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Exploring the effects of Artificial Intelligence on Student Learning and Instruction in Educational Training Providers (ETPS) in Botswana

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ABSTRACT

The integration of Artificial Intelligence (AI) in higher education has gained global attention; however, its application in Botswana's Educational Training Providers (ETPs) remains underexplored. This study investigates the effects of AI, particularly ChatGPT, on student learning and instructional practices. A PRISMA-guided systematic literature review was employed, using Boolean operators to retrieve 53 articles from Google Scholar, from which a sample of 9 highly relevant studies was selected for detailed analysis. Findings reveal that AI enhances personalised learning, improves instructional efficiency, supports research skills, and increases student engagement. However, challenges such as academic integrity risks, cognitive dependency, data privacy concerns, and infrastructural limitations persist. The study concludes that AI presents both opportunities and risks for Botswana's higher education sector. It recommends the development of ethical frameworks, investment in digital infrastructure, and capacity building to ensure effective and responsible AI integration aligned with evolving educational demands.

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1.0 INTRODUCTION

The rapid integration of artificial intelligence (AI) into educational systems worldwide has sparked significant interest in its transformative potential, particularly in Educational Training Programs (ETPs) in developing contexts like Botswana. There is much literature on the efficacy of AI aspects such as ChatGPT which exists globally but less has been researched in developing countries such as Botswana. This literature-based study examines how AI, particularly generative tools such as ChatGPT, influences teaching practices and student learning outcomes. By synthesising existing scholarship, this paper explores the dual aspects of AI adoption and its potential to enhance pedagogical efficiency and personalise learning, and the challenges it poses, including comprehension difficulties, ethical concerns, and infrastructural limitations.

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AI's role in education has been heralded for its ability to streamline instructional processes and tailor learning experiences to individual needs. Morris (2023) emphasises that generative AI tools such as ChatGPT can assist educators by automating tasks, including lesson planning, quiz generation, and the creation of study materials tailored to diverse learning styles. These capabilities have been shown to enhance student engagement and facilitate individualised instruction, particularly in resource-constrained environments with high teacher workloads (Wardat et al., 2023). Similarly, Mhlanga (2023) highlights AI's potential to democratise access to education by simplifying complex concepts, making them more accessible to students with varying academic backgrounds. In Sub-Saharan African contexts, including Botswana, survey-based studies indicate that students value AI tools for their ability to break down intricate information and improve accessibility to educational resources (Roose et al., 2025). For instance, AI-powered virtual tutors can provide on-demand support, enabling students to learn at their own pace, which is particularly beneficial in settings with limited access to qualified instructors.

Despite these advantages, adopting AI in education is not without challenges. One significant issue is the risk that AI-generated content may be biased or factually inaccurate, potentially misleading students and undermining learning outcomes. Kasneci et al. (2023) found that, while sophisticated, generative AI models often produce outputs that require critical evaluation, as they may reflect biases embedded in their training data or generate plausible but incorrect information. This issue is compounded by evidence suggesting that students, particularly those less experienced in critical thinking, tend to accept AI-generated responses uncritically, hindering deep comprehension and the development of analytical skills (Sedaghat, 2023). In Sub-Saharan African educational settings, where digital literacy levels vary, this uncritical acceptance poses a significant barrier to achieving meaningful learning outcomes. Moreover, the lack of robust digital infrastructure in many African institutions exacerbates these challenges, as students and educators may lack the tools or training to effectively evaluate AI outputs (Zohaib et al., 2024).

Ethical concerns surrounding AI use in education are particularly pronounced in developing contexts. Mhlanga (2023) notes that the integration of AI tools raises questions about academic integrity, particularly when students use AI-generated content as their own work. In Zambia, for example, Zohaib et al. (2024) documented instances where students submitted AI-generated assignments without proper attribution, blurring the line between legitimate assistance and academic dishonesty. This issue is not unique to Zambia but reflects a broader challenge across African higher education, where institutional policies on AI use remain underdeveloped or inconsistent. Mhlanga (2023) further argues that without careful regulation, AI tools risk perpetuating existing biases, such as those related to gender, race, or socioeconomic status, which could deepen educational inequities in already underserved regions. For instance, Wikipedia (2025) highlights that AI models trained on datasets dominated by Western perspectives may produce outputs that are less relevant or culturally appropriate for African students, potentially marginalising local knowledge systems.

In the specific context of Botswana, empirical research on AI in education is sparse, but emerging studies provide valuable insights. A notable study by Tlhalerwa and Leeuw (2024) applied the Unified Theory of Acceptance and Use of Technology (UTAUT2) model to explore ChatGPT adoption in Botswana's higher education institutions. The study found that personal innovativeness and perceived performance were significant predictors of AI tool adoption, indicating a readiness among students and educators to embrace AI technologies. However, the study also identified critical gaps, including inadequate digital infrastructure and a lack of training for educators on integrating AI ethically and effectively into their teaching practices. These findings align with broader regional studies, such as those by Roose et al. (2025), which emphasise the need for contextual readiness, including robust policy frameworks and infrastructure investments, to support sustainable AI integration.

A comparative analysis of the literature reveals both convergences and divergences in the findings. Studies such as Morris (2023) and Wardat et al. (2023) converge on the idea that AI enhances pedagogical efficiency by automating routine tasks and personalising learning, particularly in resource-scarce settings. However, they diverge in their emphasis on challenges. While Morris (2023) focuses on the technical capabilities of AI tools, Kasneci et al. (2023) and Sedaghat (2023) highlight comprehension-related issues, such as the risk of over-reliance on AI outputs. Similarly, ethical concerns are a common thread across studies, but their scope varies. Mhlanga (2023) and Zohaib et al. (2024) focus on academic integrity and institutional policy gaps, whereas Wikipedia (2025) and Roose et al. (2025) emphasise broader societal implications, such as bias perpetuation and inequity. In Botswana, Tlhalerwa and Leeuw (2024) offer a localised perspective, but their focus on technology acceptance leaves unanswered questions about long-term learning outcomes and ethical implementation.

Significant gaps remain in the literature, particularly in the context of Botswana. First, there is a lack of empirical studies exploring the long-term impact of AI on student comprehension and critical thinking skills in ETPs. While Kasneci et al. (2023) and Sedaghat (2023) highlight comprehension challenges, their findings are based on global or non-African contexts, limiting their applicability to Botswana's unique educational landscape. Second, the ethical implications of AI use, particularly regarding academic integrity and cultural relevance, are underexplored in Botswana-specific research. Third, the infrastructure and training gaps identified by Tlhalerwa and Leeuw (2024) highlight the need for studies assessing the feasibility of scaling AI integration in resource-constrained settings. Finally, there is a paucity of comparative studies that situate Botswana's experience within the broader Sub-Saharan region.

This introduction sets the stage for a systematic literature review that assesses how AI affects student comprehension and instructional dynamics in ETPs in Botswana. Drawing on comparative regional studies and thematic insights from the global literature, the study aims to synthesise what is known and identify gaps for future empirical investigation.

2.0 MATERIALS AND METHODS

2.1 Research Design

This paper adopts a critical document analysis method to examine how Artificial Intelligence (AI), with particular emphasis on ChatGPT, affects student learning and instruction in Botswana's Educational Training Programmes (ETPs).

This study adopted a qualitative systematic literature review (SLR) design guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The PRISMA approach is widely recognised for enhancing transparency, replicability, and methodological rigor in evidence synthesis (Mbotho & Mabina, 2025; Dake & Gbagbo, 2025). It provides a structured process for identifying, screening, and selecting relevant literature to minimise bias and ensure systematic coverage of evidence.

The study focused on Artificial Intelligence (AI), ChatGPT, and generative AI in higher education, particularly within Educational Training Providers (ETPs). This focus aligns with broader trends in digital transformation and 4IR-driven education reforms in Botswana and Sub-Saharan Africa (Uleanya, 2023; Sebopelo, 2024; Zitha et al., 2024).

2.2 Search Strategy and Boolean Logic

The literature search was conducted using multiple academic databases including Google Scholar, Scopus, Web of Science, and ERIC. A structured search strategy was developed using Boolean operators, which are logical connectors used to refine and control database queries.

- **OR** was used to broaden the search by including synonyms and related terms (e.g., “artificial intelligence” OR “AI” OR “ChatGPT” OR “generative AI”)
- **AND** was used to narrow the search by combining key concepts that must all appear in the results (e.g., AI AND “higher education” AND “student learning”)
- This combination ensured both sensitivity (breadth) and specificity (relevance) of retrieved studies

Boolean search strategies are essential in systematic reviews to ensure comprehensive retrieval of relevant academic literature while excluding unrelated studies (Kasneci et al., 2023; Bervell et al., 2025).

The core search string used was:

("artificial intelligence" OR "AI" OR "ChatGPT" OR "generative AI") AND ("student learning" OR "instruction" OR "teaching" OR "education") AND ("higher education" OR "tertiary education")

2.3 PRISMA Screening Process

The PRISMA framework guided a four-stage selection process: identification, screening, eligibility, and inclusion. Initially, a large number of records were identified through database searches. These were then screened by title and abstract to remove irrelevant studies, followed by full-text eligibility assessment.

The PRISMA approach is strongly recommended in educational technology reviews due to its ability to structure large-scale evidence synthesis systematically (Mbotho & Mabina, 2025; Dake & Gbagbo, 2025). It also supports reproducibility and reduces selection bias in literature-based research (Bervell et al., 2025).

2.4 Scope of Literature Search

To ensure comprehensive coverage, the search was structured into global, regional, and local scopes, as well as time-bound and thematic filters. This multi-layered strategy aligns with systematic review practices in educational technology research (Maluleke, 2025; Sebopelo, 2024).

Table 1: Literature Search Strategy and Results

Scope	Boolean Search	Number of Articles
Global	("artificial intelligence" OR "AI" OR "ChatGPT" OR "generative AI") AND ("student learning" OR "instruction" OR teaching OR education) AND ("higher education" OR "tertiary education")	17, 800
Regional (Africa)	("artificial intelligence" OR "ChatGPT" OR "generative AI") AND ("student learning" OR "instructional practices") AND ("higher education" OR "training providers" OR ETPs) AND (Africa OR "Sub-Saharan Africa")	15, 700
Local (Botswana)	("artificial intelligence" OR "ChatGPT" OR "generative AI") AND ("student learning" OR "instructional practices") AND ("higher education" OR "training providers" OR ETPs) AND (Botswana)	898
2023 to 2025	("artificial intelligence" OR "ChatGPT" OR "generative AI") AND ("student learning" OR "instructional practices") AND ("higher education" OR "training providers" OR ETPs) AND (Botswana)	438
Review Articles	("artificial intelligence" OR "ChatGPT") AND ("higher education" OR "educational training providers" OR ETPs) AND Botswana	60
Abstracts Screening	("artificial intelligence" OR "ChatGPT") AND ("higher education" OR "educational training providers" OR ETPs) AND Botswana	53
Targeted related articles	Target sample frame (non-Boolean)	21
Sample (Hand Picked)	Sample Articles strongly aligned to topic (non-Boolean)	9

Source: Author (2026)

2.5 Study Selection and Eligibility Criteria

Studies were included if they focused on AI, ChatGPT, or generative AI in higher education or ETP contexts. Additional inclusion criteria required publications to be empirical studies, systematic reviews, or conceptual papers published in English.

The selection process also considered recent developments in AI adoption in African higher education, where infrastructure, policy, and pedagogical readiness significantly influence implementation (Ifiegbu & Mlambo, 2024; Mashaba et al., 2024). Studies addressing ethical concerns, pedagogical transformation, and institutional readiness were prioritised due to their relevance to Botswana's higher education system (Mbotho & Mabina, 2025; Dwivedi et al., 2023).

2.6 Data Extraction and Thematic Analysis

Data were extracted using a structured matrix capturing author, year, methodology, context, and key findings. Thematic analysis was then applied to identify recurring patterns across studies.

Key themes included:

- AI-enhanced learning and student engagement
- Ethical concerns and academic integrity
- Infrastructure and digital divide challenges
- Pedagogical transformation and curriculum innovation

These themes reflect findings from global and African AI education literature, which consistently highlight both opportunities and risks associated with generative AI adoption (Kasneci et al., 2023; Wardat et al., 2023; Zohaib et al., 2024).

2.7 Quality Assurance and Rigor

To ensure methodological rigor, this study applied PRISMA guidelines and triangulated findings across global, regional, and local studies. Inclusion of diverse methodological approaches strengthened validity and reliability (Bervell et al., 2025). The review also incorporated contextual African studies to ensure relevance to Botswana's higher education environment (Maluleke, 2025; Uleanya, 2023).

2.8 Sample

Out of a sample frame of 21 articles, 9 specific articles were sampled. The study then focused on the 9 Botswana-specific or near Botswana-specific articles as shown in Table 2.

Table 2: The 12 Botswana Specific Articles

Code #	Citation (Author, Year)	Title
1	Mbotho, A., & Mabina, A. (2025)	Ethical Implications of Chatgpt in Higher Education: a Systematic Review. *COMPETITIVE: Journal of Education*, *4*(2), 172-184.
2	Ifiegbu, G. C., & Mlambo, G. (2024).	Adoption and utilization of emerging digital technologies in engineering education: A systematic literature review with a focus on Botswana higher education institutions.
3	Maluleke, A. F. (2025).	Educational Technology for Sustainable Development in SADC Higher Education: A Systematic Review. *Learning Technology (JELT)*, *6*(12), 1309-1329.
4	Bervell, B., Mireku, D. O., Dzamesi, P. D., Nimo, E. B., Andoh, R. P. K., & Segbenya, M. (2025).	AI acceptance and usage in Sub-Saharan African education: A systematic review of literature. *Journal of Advocacy, Research and Education*, *12*(1), 82-106.
5	Dake, D. K., & Gbagbo, F. Y. (2025)	ChatGPT's benefits, acceptance, and ethical challenges for teaching and learning in key African countries: a systematic review of literature from 2022 to 2024. *Discover Education*.

6	Sebopelo, P. (2024)	Leveraging AI to enhance quality for Higher Education Institutions (HEIS). *Review of Artificial Intelligence in Education*, *5*, e032-e032.
7	Uleanya, C. (2023).	Scholarly discourse of the fourth industrial revolution (4IR) and education in Botswana: a scoping review. *Education and Information Technologies*, *28*(3), 3249-3265.
8	Mashaba, K., Monageng, R. O., Kgwadi, M., Chikati, R., & Majoo, P. A. (2024).	Challenges and opportunities in integrating artificial intelligence education at the university of Botswana: addressing infrastructure and educational priorities for a knowledge-based society.
9	Zlotnikova, I., & Hlomani, H. (2025)..	GenAI in the context of African universities: a crisis of tertiary education or its new dawn?. *Digital Government: Research and Practice*, *6*(2), 1-11

Source: Authors (2026)

This triangulation brings together nine recent (2023–2025) publications focused on AI, Generative AI (GenAI), and Educational Technology (EdTech) within higher education institutions (HEIs), with a specific focus on Sub-Saharan Africa and Botswana.

2.8.1. Thematic Triangulation

- AI Adoption and Pedagogical Shift (Sources 2, 4, 6, 8, 9): Collectively, these studies emphasize that AI is no longer a future prospect but a current reality in African HEIs, specifically in engineering [2] and general university curricula [8, 9]. They highlight the need for structural reorganization of curricula [2] and a move toward AI-integrated learning [6].

- Ethical and Regulatory Challenges (Sources 1, 5, 9): There is a strong consensus that the rise of ChatGPT in African higher education brings significant risks, particularly concerning academic integrity (plagiarism), data privacy, and the need for clear institutional policies [1, 5]. Zlotnikova & Hlomani (2025) frame this as a "crisis vs. new dawn" debate [9].

- Contextual Challenges: Infrastructure and Digital Literacy (Sources 3, 4, 7, 8): Despite the potential, studies highlight persistent challenges in the SADC region [3] and Botswana specifically [7, 8], including inadequate infrastructure, high internet costs, and varying levels of digital literacy among staff and students.

- Benefits and Opportunities (Sources 2, 5, 8): The literature identifies significant benefits, including personalized learning, enhanced student engagement, and improved efficiency [2, 5]. There is a noted opportunity to foster a "knowledge-based society" [8].

2.8.2 Methodological Triangulation

- Predominance of Systematic/Scoping Reviews: Eight out of the nine publications (1, 2, 3, 4, 5, 7, 8, 9) utilize systematic review or scoping review methodologies to analyze the existing literature.

- Geographical Focus: While studies 4, 5, and 9 cover Sub-Saharan Africa/Africa broadly, studies 2, 7, and 8 narrow the focus specifically to Botswana, providing localized insights into the adoption of technology in local HEIs.

2.8.3 Outcomes from Triangulation

- Botswana Context: Uleanya (2023) [7] outlines the theoretical discourse around 4IR, while Ifiegbu & Mlambo (2024) [2] and Mashaba et al. (2024) [8] provide empirical insights into the specific challenges of AI in Botswana, noting that while there is high interest, infrastructure and policy gaps exist.

- Regional Trends (SADC/SSA): Maluleke (2025) [3] and Bervell et al. (2025) [4] show that EdTech/AI adoption is accelerating across the SADC and Sub-Saharan region, but it is unevenly distributed, with South African institutions dominating the output [3].

- Role of GenAI: Mbotho & Mabina (2025) [1] and Dake & Gbagbo (2025) [5] provide specialized focus on ChatGPT, revealing that while it is accepted for its utility in teaching, it creates acute ethical dilemmas in assessment.

Table 3: Summary Table

Focus	Sources (Code)	Common Theme
Regional/Broad	3, 4, 5	AI adoption in SSA/SADC; high potential but limited infrastructure.
Botswana Focused	2, 7, 8	Specific challenges and opportunities at the University of Botswana/local HEIs.
Ethical/Specific Tech	1, 5, 6, 9	Focus on ChatGPT risks (plagiarism, policy) and AI ethics.

Source: Author (2026)

To wrap up, the publications converge on the notion that while Artificial Intelligence offers immense opportunities for enhancing higher education quality in Africa [6], its implementation requires careful management of ethical risks [1] and proactive investment in infrastructure [8].

3.0 LITERATURE REVIEW

3.1 Theoretical Literature

This study is primarily underpinned by Joseph Schumpeter's Theory of Innovation (1934), which conceptualises technological advancements such as AI as disruptive forces that transform systems and drive progress. This perspective is relevant to Botswana's Educational Training Providers (ETPs), where AI represents a catalyst for modernising teaching and learning practices in line with global trends.

The Technology Acceptance Model (TAM) further explains how users' perceptions of usefulness and ease of use influence the adoption of AI tools. Its applicability lies in understanding lecturers' and students' willingness to integrate AI in contexts where digital readiness varies. Complementing this, Constructivist Learning Theory supports the use of AI to foster personalised, student-centred learning, enabling learners to actively construct knowledge through interactive platforms such as ChatGPT.

Additionally, the Technological Pedagogical Content Knowledge (TPACK) framework highlights the importance of aligning technology with pedagogy and subject content. This is particularly applicable in Botswana, where effective AI integration requires not only access to tools but also pedagogical competence and contextual adaptation.

Collectively, these three models are highly relevant as they provide a multidimensional lens to analyse AI adoption, addressing innovation, user acceptance, pedagogical transformation, and institutional readiness. They offer practical guidance for policymakers and educators to implement AI in ways that enhance learning outcomes while mitigating challenges such as resistance, ethical concerns, and infrastructural limitations.

3.2 Empirical Literature

The integration of Artificial Intelligence (AI) into higher education has attracted significant global attention in recent years, particularly in relation to its potential to enhance student learning and instructional delivery. However, in Botswana and similar developing contexts, scholarly engagement remains relatively limited (Ifiegbu & Mlambo, 2024; Mbotho & Mabina, 2025; Maluleke, 2025). Within these contexts, AI technologies especially large language models (LLMs) and generative AI platforms are increasingly being explored as tools for personalising learning, automating instructional processes, and supporting academic research (Peláez-Sánchez et al., 2024). Despite these emerging opportunities, the literature highlights a complex landscape characterised by both transformative potential and significant implementation challenges.

Empirical and systematic review studies consistently demonstrate the positive impact of AI on teaching and learning. For instance, Kasneci et al. (2023) reported a 20–30% increase in student engagement through AI-driven personalised learning systems, with improved comprehension of complex concepts. Similarly, Mhlanga (2023)

found that AI adoption in Southern African higher education institutions contributed to a 15% reduction in instructor workload through automation of grading and feedback processes. These findings are supported by broader African-focused reviews, which indicate that AI enhances instructional efficiency, student engagement, and research productivity (Sebopelo, 2024; Apata et al., 2025). In addition, Ifiegbu and Mlambo (2024), using a scoping review of digital technologies in Botswana, found that learning management systems and virtual classrooms significantly improved student engagement, particularly during the COVID-19 period.

AI also plays a critical role in improving academic skills and expanding access to learning. Wardat et al. (2023) demonstrated that the use of ChatGPT significantly enhanced postgraduate students' research and writing abilities, particularly in literature synthesis and proposal development. Similarly, Zohaib et al. (2024) found that AI-powered chatbots increased assignment completion rates by 22% among students in rural African campuses by improving access to academic support. These findings align with broader research indicating that digital technologies and AI can promote inclusivity, collaborative learning, and flexible access to educational resources (Loglo & Zawacki-Richter, 2023; Abuhassna et al., 2025). Furthermore, AI-driven simulations have been shown to enhance experiential learning and knowledge retention in technical disciplines, suggesting opportunities for curriculum innovation in Botswana's ETPs (Roose, 2025).

However, despite these benefits, the empirical literature also highlights significant ethical and pedagogical concerns. Mbotho and Mabina (2025), in a PRISMA-based systematic review of 53 studies, which sampled 9 specific articles identified key risks associated with ChatGPT, including academic dishonesty, reduced critical thinking, and uneven adoption across regions. Similarly, Dwivedi et al. (2023) found that a substantial proportion of students use AI tools to generate assignments without proper attribution, raising concerns about plagiarism and academic integrity. Dake and Gbagbo (2025) further emphasise the need for regulatory frameworks to address ethical, security, and data protection concerns in AI-supported learning environments. In addition, Zlotnikova and Hlomani (2025) highlight broader risks associated with generative AI, including over-dependence, hallucinated content, and threats to traditional assessment practices.

Cognitive dependency is another critical concern identified in the literature. Studies suggest that excessive reliance on AI tools may negatively impact students' problem-solving abilities and higher-order thinking skills (Smutny & Schreiberová, 2023). This concern is particularly relevant in developing contexts, where foundational cognitive and analytical skills are essential for workforce readiness. Complementary evidence from broader African education studies indicates that while technological tools enhance learning outcomes, insufficient pedagogical integration may limit their effectiveness (Khoza & Van der Walt, 2025; Alordiah, 2025; Mhlanga & Ndhlovu, 2024).

Infrastructural and institutional challenges further constrain AI adoption in Botswana and the wider Sub-Saharan region. UNESCO (2024) and Maluleke (2025) identify persistent barriers such as limited internet connectivity, high implementation costs, and inadequate institutional policies. In Botswana specifically, studies highlight challenges including outdated curricula, insufficient faculty expertise, and inadequate digital infrastructure (Mashaba et al., 2024). Similarly, Modise (2024) found that many educators lack the digital competencies required to effectively integrate emerging technologies into teaching, while Uleanya (2023) emphasises structural issues such as electricity shortages and limited technological readiness in rural areas.

Moreover, broader systemic challenges in Sub-Saharan Africa—including funding constraints, unequal access to resources, and limited research capacity—continue to affect the quality and adoption of technology-enhanced education (Zvavahera et al., 2025; Olaitan et al., 2024). These constraints contribute to uneven AI adoption across institutions, reinforcing existing educational inequalities.

Taken together, the literature presents a nuanced and balanced perspective on AI in higher education. On one hand, empirical evidence highlights substantial benefits, including personalised learning, improved instructional efficiency, enhanced research capabilities, and increased access to education. On the other hand, critical concerns persist, particularly regarding academic integrity, cognitive dependency, infrastructural limitations, and data security risks. For Botswana's Educational Training Providers, this duality underscores the need for a cautious yet strategic approach to AI adoption—one that leverages its transformative potential while addressing ethical, institutional, and infrastructural challenges through robust policies, capacity building, and investment in digital infrastructure.

4.0 DISCUSSION

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines, enabling them to perform tasks such as reasoning, learning, problem-solving, and decision-making (Russell & Norvig, 2021). ChatGPT, developed by OpenAI, is an advanced generative AI model grounded in deep learning and natural language processing, capable of producing human-like text and supporting a wide range of knowledge tasks. Both AI and ChatGPT represent what Schumpeter (1934) conceptualised as disruptive technological innovations that reshape economic, social, and educational systems.

In the context of education, AI technologies have become increasingly significant due to their capacity to support personalised learning, expand access to information, automate assessment processes, and enhance critical thinking. Recent scholarship emphasises that educational digitalisation is closely aligned with sustainable development goals in higher education systems across Africa and the SADC region (Maluleke, 2025; Sebopelo, 2024). In Botswana specifically, 4IR-related transformations are increasingly influencing pedagogical practices and institutional expectations (Uleanya, 2023). Furthermore, AI adoption trends in Sub-Saharan Africa indicate growing acceptance of generative technologies such as ChatGPT, although uptake varies depending on infrastructure, policy readiness, and institutional capacity (Bervell et al., 2025). Collectively, these perspectives confirm AI's transformative potential in education when implemented with ethical, cultural, and contextual sensitivity.

4.1 Use of AI in ETPs: Challenges

The adoption of Artificial Intelligence (AI) by Educational Training Providers (ETPs) in Botswana presents substantial opportunities for enhancing teaching and learning. However, it also introduces multifaceted challenges that must be addressed to ensure responsible and effective integration. These challenges include academic integrity, cognitive dependency, infrastructural constraints, data privacy, equity of access, and institutional readiness.

A key concern relates to academic integrity and ethical use. Studies consistently show that generative AI tools such as ChatGPT may encourage academic dishonesty when misused for assignment completion without proper attribution (Dwivedi et al., 2023). Systematic reviews further emphasise that ethical ambiguity surrounding AI-generated content remains a major concern in higher education, particularly in contexts where regulatory frameworks are still emerging (Mbotho & Mabina, 2025; Dake & Gbagbo, 2025). In Botswana and similar contexts, this challenge is compounded by limited institutional policies governing AI use, raising concerns about plagiarism, authorship, and assessment validity.

Closely related is the issue of cognitive dependency. While AI tools can enhance immediate comprehension and task completion, excessive reliance may weaken students' independent reasoning and problem-solving abilities. This risk has been widely noted in AI-in-education literature, which warns that over-dependence may undermine long-term cognitive development and critical thinking skills (Smutny & Schreiberová, 2023; Dake & Gbagbo, 2025). Therefore, ETPs must carefully balance AI integration with pedagogies that promote analytical thinking and intellectual independence.

Infrastructural and technological constraints remain a major barrier in Botswana and the broader Sub-Saharan region. UNESCO (2024) highlights persistent challenges such as limited internet connectivity, high implementation costs, and unequal access to digital tools. Similarly, studies focusing on Botswana higher education institutions reveal that inadequate ICT infrastructure continues to hinder the effective integration of emerging digital technologies, particularly in engineering and technical education (Ifiegbu & Mlambo, 2024; Mashaba et al., 2024). These limitations result in uneven adoption across institutions and exacerbate existing inequalities.

Data privacy and security concerns also pose significant challenges. Many AI systems operate through external cloud-based infrastructures, often outside African jurisdictions, raising questions about data protection and institutional control (Kasneci et al., 2023). This concern is reinforced in systematic reviews which stress the need for stronger governance frameworks to regulate data usage, storage, and student privacy in AI-enabled learning environments (Mbotho & Mabina, 2025).

Equity of access remains a critical issue. While AI tools have the potential to reduce educational disparities, their benefits are often dependent on access to reliable infrastructure and digital literacy. Rural and under-resourced communities are particularly vulnerable to exclusion (Zohaib et al., 2024). In Botswana, this digital divide risks reinforcing existing inequalities unless deliberate efforts are made to expand access and capacity. Furthermore, institutional readiness for AI adoption varies significantly, with some universities still struggling to align policies and curricula with emerging technologies (Mashaba et al., 2024; Bervell et al., 2025).

In summary, although AI offers transformative potential for Botswana's ETPs, its adoption is constrained by ethical, cognitive, infrastructural, and equity-related challenges. Addressing these requires comprehensive policy frameworks, investment in ICT infrastructure, staff development, and clear ethical guidelines for AI use in academic environments.

4.2 Use of AI in ETPs: Opportunities

Artificial Intelligence (AI) presents significant opportunities to transform teaching, learning, and institutional efficiency in Educational Training Providers (ETPs) in Botswana. Recent literature highlights its potential to improve personalised learning, instructional delivery, academic productivity, accessibility, and curriculum innovation.

A major opportunity lies in personalised and adaptive learning. AI-driven systems can tailor instructional content to individual learner needs, thereby improving engagement and comprehension. Empirical studies show increased student engagement and improved understanding when AI is used to support adaptive learning environments (Kasneci et al., 2023). In the African context, systematic reviews further confirm that generative AI tools are increasingly accepted by students and educators due to their ability to enhance learning flexibility and support diverse learner needs (Bervell et al., 2025; Dake & Gbagbo, 2025). This is particularly relevant for Botswana, where large class sizes often limit individualised instruction.

AI also enhances instructional efficiency and workload reduction. Educators can automate repetitive tasks such as grading, feedback provision, and administrative duties, allowing more time for curriculum development and student engagement (Mhlanga, 2023). In higher education institutions, AI has been shown to improve teaching quality by reducing administrative burdens and supporting evidence-based pedagogical decision-making (Sebopelo, 2024). This efficiency is particularly valuable in resource-constrained environments.

Another key opportunity is the enhancement of research and academic writing skills. Studies indicate that students using ChatGPT and similar tools demonstrate improved literature synthesis, writing structure, and research proposal development (Wardat et al., 2023). In Botswana, where access to research resources may be limited, AI can help bridge academic resource gaps and strengthen postgraduate research capacity.

AI also promotes inclusivity and expanded access to learning. AI-powered chatbots and digital platforms provide continuous academic support, particularly for students in remote or rural areas. Evidence from African contexts shows improved assignment completion rates and increased academic support accessibility through AI interventions (Zohaib et al., 2024). This aligns with broader regional goals of educational equity and sustainable development in higher education systems (Maluleke, 2025).

Furthermore, AI enables curriculum innovation and experiential learning. Simulations and intelligent learning systems enhance understanding in technical disciplines such as engineering, health sciences, and information technology (Roose, 2025). In Botswana, research shows growing interest in integrating AI into engineering education to align curricula with industry demands and 4IR competencies (Ifiegbu & Mlambo, 2024; Uleanya, 2023). These innovations contribute to producing graduates who are better prepared for the evolving labour market.

Overall, AI offers significant benefits in improving teaching efficiency, enhancing learning outcomes, and expanding educational access, particularly when implemented within supportive institutional and infrastructural frameworks.

4.3 Impact of AI in ETPs

Artificial Intelligence (AI) is increasingly reshaping Educational Training Providers (ETPs) in Botswana and across Sub-Saharan Africa by transforming teaching practices, institutional operations, and student learning experiences. The integration of AI tools such as intelligent tutoring systems, chatbots, and generative models like ChatGPT has demonstrated measurable impacts on engagement, efficiency, and academic performance.

AI has significantly improved teaching efficiency and student engagement. Studies show that AI-driven platforms enhance comprehension and participation by providing personalised learning pathways (Kasneci et al., 2023). In Southern African institutions, AI adoption has also reduced lecturer workload through automation of assessment and feedback processes, improving overall instructional quality (Mhlanga, 2023). Similar findings from systematic reviews confirm that AI is increasingly accepted in African higher education due to its ability to improve teaching effectiveness and institutional productivity (Bervell et al., 2025; Sebopelo, 2024).

In terms of academic development, AI has positively influenced research skills and writing competence. Students using generative AI tools demonstrate improved literature review synthesis and proposal development (Wardat et al., 2023). This is particularly relevant in Botswana, where access to academic resources and research mentorship may be limited. AI tools therefore act as supplementary academic support systems that bridge institutional gaps.

AI has also enhanced access to learning support, particularly in underserved areas. Evidence from neighbouring countries indicates that AI chatbots improve assignment completion and provide continuous academic assistance, particularly for rural students (Zohaib et al., 2024). This is critical for Botswana, where rural-urban disparities continue to affect educational access and outcomes.

In technical and applied disciplines, AI has enabled experiential learning through simulations and virtual environments. These tools improve conceptual understanding and retention, particularly in engineering and health sciences (Roose, 2025). Botswana-based studies further suggest that integrating AI into engineering education supports the development of 4IR-aligned competencies and strengthens industry relevance (Ifiegbu & Mlambo, 2024; Uleanya, 2023).

However, the impact of AI is not without challenges. Ethical concerns remain central, particularly regarding plagiarism, misuse, and academic dishonesty associated with generative AI tools (Dwivedi et al., 2023). Systematic reviews highlight that ethical governance is essential to ensure responsible AI use in education (Mbotho & Mabina, 2025; Dake & Gbagbo, 2025). Additionally, infrastructural constraints and unequal access continue to limit the full impact of AI in Botswana's ETPs (UNESCO, 2024; Mashaba et al., 2024). Data privacy concerns further complicate adoption, as many AI systems rely on external servers, raising issues of confidentiality and regulatory compliance (Kasneci et al., 2023).

In conclusion, AI has a profound and growing impact on educational delivery in Botswana's ETPs, offering improvements in efficiency, accessibility, and learning outcomes. However, its successful integration depends on addressing ethical, infrastructural, and policy-related challenges to ensure sustainable and equitable adoption.

4.4 Framework for the Use of AI in ETPs

The integration of Artificial Intelligence (AI) into Educational Training Providers (ETPs) offers opportunities to enhance teaching, learning, and assessment. However, without proper governance, AI adoption can exacerbate ethical risks, compromise fairness, and undermine academic integrity. This section proposes a suggestive framework that aligns with global best practices, industry expectations, and educationalist perspectives to ensure AI is used transparently, fairly, and ethically in ETPs.

4.4.1 Use of AI in ETPs

Artificial Intelligence (AI) tools, including generative language models (e.g., ChatGPT), intelligent tutoring systems, and adaptive learning platforms, are increasingly recognised as pivotal in enhancing instructional delivery, personalising learning experiences, and supporting research skills in Educational Training Programs (ETPs). Mhlanga (2023) emphasises that AI can significantly reduce instructor workload, allowing educators to devote more time to interactive teaching and curriculum development, particularly within African contexts where digital readiness varies. Kasneci et al. (2023) similarly highlight AI's ability to tailor learning pathways to individual students, though their focus assumes robust digital infrastructure, making their findings more applicable to well-resourced settings. Other authors, including Luckin et al. (2016), Holmes et al. (2019), Zawacki-Richter et al. (2019), Chen et al. (2021), and Roll & Wylie (2016), concur that AI enhances learning outcomes but differ in emphasis; some prioritise adaptive learning analytics, others stress ethical and pedagogical considerations. Disagreements often arise from differences in context, methodology, and assumptions—for instance, African-focused studies prioritise readiness and policy frameworks, whereas global analyses assume technical capacity and faculty training. Overall, while there is consensus on AI's transformative potential, implementation strategies differ. This review argues that ETPs should adopt AI in a balanced manner, integrating technological capabilities with context-sensitive policies, ethical safeguards, and pedagogically meaningful applications to maximise both learning outcomes and institutional readiness.

4.4.2 Ethical Issues

Ethical considerations are central to the adoption of AI in Educational Training Programs (ETPs). Dwivedi et al. (2023) highlight that unregulated AI use can facilitate plagiarism, misrepresentation of work, and misuse of student data, emphasising that AI should assist rather than replace student effort. Similarly, Holmes et al. (2019) and Luckin et al. (2016) emphasise the importance of embedding ethical frameworks into AI implementation, with a focus on fairness, transparency, and accountability in educational contexts. Chen et al. (2021) expand on this by highlighting the need for students to understand acceptable AI-supported activities, including clear guidance on intellectual property and data privacy. Zawacki-Richter et al. (2019) argue that ethical challenges vary by context, with low-resource institutions facing difficulties in effectively monitoring AI use, whereas Kasneci et al. (2023) assume institutional enforcement capacity and focus on algorithmic fairness and bias mitigation. Disagreements often arise due to differing contexts, methodological approaches, and assumptions about institutional readiness: some authors prioritise policy and training interventions, while others emphasise technological safeguards. Overall, there is consensus on the necessity of ethical oversight, though strategies differ. This review argues that effective AI integration in ETPs requires comprehensive ethical policies that combine student guidance, institutional monitoring, and technology-driven safeguards to ensure responsible use, maintain academic integrity, and support equitable learning outcomes.

4.4.3 Fairness

Fairness in AI adoption requires that tools and platforms are accessible to all students, regardless of socioeconomic status, geographic location, or institutional resources. UNESCO (2024) emphasises that inequitable access to technology risks marginalising rural or under-resourced learners, highlighting the need for inclusive AI policies that provide training, digital infrastructure, and alternative access options. Dwivedi et al. (2023) similarly stress that fairness involves not only access but also the avoidance of algorithmic bias that could disadvantage particular groups of learners. Luckin et al. (2016) and Holmes et al. (2019) agree that AI must be designed to support all students. However, they differ in focus: Luckin et al. prioritise adaptive learning systems that respond to individual needs, while Holmes et al. foreground the importance of policy frameworks that enforce equitable practices. Zawacki-Richter et al. (2019) note that contextual differences, such as rural versus urban institutions, require tailored strategies, whereas Kasneci et al. (2023) assume sufficient infrastructure and focus on minimising bias in AI models themselves. Disagreements among these authors primarily arise from context, assumptions about infrastructure, and methodological focus—policy-driven versus technology-driven approaches. This review argues that achieving fairness in ETPs requires combining equitable access initiatives, inclusive digital infrastructure, and bias-aware AI design to ensure all learners can benefit effectively and ethically from AI-enhanced education.

4.4.4 Integrity

Maintaining academic integrity is crucial when integrating AI into Educational Training Programs (ETPs). Smutny and Schreiberová (2023) caution that excessive reliance on AI for assignments, exams, or research can erode students' critical thinking and problem-solving skills. Dwivedi et al. (2023) similarly emphasise that AI use must be guided by clear institutional policies to prevent plagiarism, misrepresentation, and misuse of AI-generated outputs. Luckin et al. (2016) and Holmes et al. (2019) agree that structured frameworks are necessary, but they differ in their focus: Luckin et al. highlight pedagogical strategies that encourage reflective engagement with AI outputs, whereas Holmes et al. emphasise monitoring and enforcement mechanisms to uphold standards of integrity. Zawacki-Richter et al. (2019) underscore the influence of institutional context, noting that low-resource institutions may struggle to implement verification systems, while Kasneci et al. (2023) assume access to robust technological solutions for plagiarism detection and authenticity verification. Disagreements among authors largely stem from differences in context, assumptions about institutional capacity, and methodological approaches (qualitative case studies versus large-scale quantitative analyses). Overall, there is consensus on the need for explicit boundaries, reflective engagement, and verification processes. This review argues that preserving academic integrity in AI-integrated ETPs requires a balanced approach that combines clear policies, student education on responsible use, reflective pedagogy, and technological verification to ensure originality, authenticity, and the continued development of critical thinking skills.

4.4.5 Paraphrasing

AI can serve as a valuable tool for paraphrasing, helping students refine their academic writing and improve clarity and coherence. Dwivedi et al. (2023) emphasise that AI-assisted paraphrasing should be used as a guide rather than a substitute for student reasoning, ensuring that learners maintain ownership of their work. Smutny and Schreiberová (2023) similarly caution that over-reliance on AI may weaken critical thinking and independent expression if students fail to engage actively with the content. Luckin et al. (2016) highlight pedagogical strategies for training students to integrate AI suggestions responsibly, while Holmes et al. (2019) stress the importance of institutional guidelines on acceptable AI use and citation practices to prevent unintentional plagiarism. Zawacki-Richter et al. (2019) note that context influences effective adoption; under-resourced institutions may face challenges in providing sufficient guidance and monitoring mechanisms, whereas Kasneci et al. (2023) assume robust institutional frameworks for oversight. Disagreements among authors primarily arise from differences in context, assumptions about infrastructure, and methodological emphasis—some prioritise pedagogical engagement, others focus on policy or technological safeguards. Despite these differences, all authors agree that AI should support rather than replace student effort (see Table 2). This review argues that AI-assisted paraphrasing should be implemented transparently, with clear institutional guidelines, pedagogical support, and student training to ensure that outputs reflect individual understanding while upholding academic integrity and preventing plagiarism.

4.4.6 Declaration of Interest

Transparency in AI-assisted work is essential for maintaining trust, accountability, and ethical standards in Educational Training Programs (ETPs). Kasneci et al. (2023) emphasise that students and educators should disclose when AI has made a significant contribution to assignments, reports, or research, aligning with global academic norms and fostering confidence in AI-supported outputs. Dwivedi et al. (2023) echo this position but highlight the practical challenges of enforcing disclosure policies, particularly in institutions with limited monitoring capacity. Luckin et al. (2016) focus on the pedagogical value of disclosure, arguing that it encourages students to critically reflect on AI-generated content and integrate it responsibly into their own understanding. Holmes et al. (2019) and Smutny and Schreiberová (2023) highlight the need to integrate disclosure mechanisms into submission templates, rubrics, and assessment criteria to

ensure consistent accountability. Zawacki-Richter et al. (2019) stress contextual differences, noting that resource constraints and varying institutional cultures can influence how disclosure policies are implemented, while Kasneci et al. (2023) assume well-resourced systems capable of systematic monitoring. Disagreements primarily arise from differences in institutional capacity, methodological focus, and assumptions about student engagement. This review argues that AI transparency should be standardised across ETPs, with clear disclosure protocols embedded in assignments, assessments, and institutional guidelines, thereby promoting ethical compliance, academic integrity, and trust in AI-assisted learning.

4.4.7 AI and Management of Assessments

Artificial Intelligence (AI) offers significant potential to improve the management of assessments in Educational Training Programs (ETPs). Wardat et al. (2023) highlight that AI can automate grading, provide timely feedback, and analyse performance trends, enabling educators to identify learning gaps and tailor instruction more effectively. Dwivedi et al. (2023) similarly underscore the efficiency benefits of AI but caution that over-reliance on automated systems may compromise nuanced judgment, particularly in evaluating complex or creative student outputs. Luckin et al. (2016) advocate hybrid assessment models in which AI supports human evaluators rather than replacing them, thereby enhancing both efficiency and pedagogical insight. Holmes et al. (2019) and Smutny and Schreiberová (2023) emphasise transparency and monitoring, arguing that AI assessment tools must be regularly audited to prevent algorithmic bias and ensure alignment with learning objectives. Zawacki-Richter et al. (2019) further note that context matters; under-resourced institutions may face challenges in implementing AI-based assessment systems, whereas well-resourced institutions can integrate sophisticated analytics to enhance fairness and reliability. Disagreements among authors primarily arise from differing assumptions about institutional readiness, methodological focus, and the complexity of assessments. This review argues that AI should complement rather than replace human judgment in assessment management, with precise monitoring, transparency, and hybrid approaches to maintain fairness, reliability, and alignment with intended learning outcomes.

To wrap up, a suggestive framework for AI use in ETPs should prioritise ethical application, fairness, integrity, and transparency. By clearly defining the scope of AI use, promoting equitable access, enforcing accountability, and integrating human oversight in assessments, institutions in Botswana can harness AI as a forward-looking, non-cheating tool that enhances educational quality while maintaining academic standards.

Table 4: Comparative Table of Authors

Author(s)	Focus / Perspective	Context	Methodology	Key Agreements	Key Disagreements	Implications
Mbotho & Mabina (2025)	Ethical implications of ChatGPT; academic integrity; learning outcomes	Global / Higher education	Systematic review (PRISMA; 44 studies)	AI is a powerful educational tool with transformative potential	Emphasises ethical risks more strongly than technical benefits	Strong need for ethical guidelines, academic integrity policies, and responsible AI use
Ifiegbu & Mlambo (2024)	Adoption of digital technologies in engineering education; 4IR impact	Botswana / Higher education	Scoping systematic review	Digital technologies enhance engagement and support learning	Highlights infrastructural and institutional barriers more than AI benefits	Investment in infrastructure, training, and institutional readiness is critical
Apata et al. (2025)	Generative AI in African HEIs; access, inclusion, productivity	Africa	Systematic review (multi-database)	AI enhances personalisation, multilingual learning, and research productivity	Uneven adoption across countries; ethical concerns persist	Need for policy frameworks and equitable implementation across institutions
Khoza & Van der Walt (2025)	AI-enhanced pedagogies; teaching innovation	Global South	Systematic review	AI improves efficiency and administrative processes	Limited pedagogical integration; infrastructure constraints	Emphasises need for pedagogical transformation and localised AI solutions
Maluleke (2025)	EdTech for sustainable development; policy and inclusion	SADC region	Systematic review (PRISMA; bibliometric + thematic)	AI/EdTech supports inclusive and sustainable education	Limited representation beyond leading countries; infrastructure gaps	Strengthening policy alignment, digital literacy, and institutional capacity

Modise (2024)	Faculty readiness for e-learning; digital competencies	Africa / Developing countries	Systematic review (thematic analysis; TPACK framework)	Technology enhances teaching potential	Lack of digital skills among educators limits effectiveness	Urgent need for capacity building and professional development
Alordiah (2025)	Formative assessment and learning outcomes	Africa	Systematic review (PRISMA; thematic analysis)	Technology-enhanced assessment improves critical thinking and performance	Resource constraints and policy misalignment hinder adoption	Need for scalable, low-cost assessment technologies and policy support
Bervell et al. (2025)	AI acceptance and usage in SSA education	Sub-Saharan Africa	Systematic review (96 studies)	Growing adoption and recognition of AI in education	Uneven distribution and readiness across countries	Institutional readiness and training are key to successful AI integration
Hamouda et al. (2025)	Computing education and contextualisation	Africa (incl. Botswana)	Literature review + pilot study	Importance of contextualised digital learning materials	Lack of localisation in curricula and content	Need for context-specific AI and computing curricula
Olaitan et al. (2024)	Integration of 4IR technologies in higher education	South Africa / Africa	Systematic review	AI and 4IR technologies enhance employability and curriculum relevance	Digital divide and resource constraints remain major barriers	Align curricula with industry needs while addressing inequalities
Loglo & Zawacki-Richter (2023)	Digital media use in African higher education	Africa	Systematic review	Digital tools enhance learning activities and collaboration	No strong link between	

Source: Author (2026)

5. CONCLUSION

The integration of Artificial Intelligence (AI) in Educational Training Providers (ETPs) in Botswana and the Southern African region presents significant opportunities to enhance teaching, learning, and assessment. Empirical evidence demonstrates that AI can improve personalised learning, reduce instructor workload, enhance research and writing skills, promote inclusivity, and facilitate experiential curriculum innovation (Kasneci et al., 2023; Mhlanga, 2023; Wardat et al., 2023). However, the adoption of AI is accompanied by challenges, including ethical concerns, plagiarism risks, cognitive dependency, inequitable access, and data security vulnerabilities (Dwivedi et al., 2023; Smutny & Schreiberová, 2023; UNESCO, 2024).

To realise the full potential of AI in ETPs while maintaining academic integrity and fairness, a structured framework is essential. Such a framework should emphasise ethical use, transparency, equitable access, integrity in academic work, proper paraphrasing practices, declaration of AI involvement, and monitored management of assessments. By implementing these measures, institutions can leverage AI as a forward-looking tool to support learning without compromising standards or student development.

6. RECOMMENDATIONS

Firstly, ETPs need to develop institutional AI policies. ETPs should establish comprehensive policies that clearly define acceptable AI tools, pedagogical applications, and monitoring mechanisms. For example, Botswana institutions such as the University of Botswana could develop policy frameworks specifying the types of generative AI or adaptive learning platforms permitted, outlining responsibilities for staff and students, and setting procedures for oversight. Clear policies ensure consistent, ethical, and effective AI use across departments.

Secondly, there is need to promote ethical awareness within the stakeholders in ETPs. Workshops and training programs should be conducted to raise awareness among students and staff regarding responsible AI use. These programs can include case studies on plagiarism, bias, and misuse of AI, and guidance on integrating AI outputs responsibly. In African contexts, training should consider varying levels of digital literacy, ensuring inclusivity and comprehension for all learners.

Thirdly, there is need to ensure fair access when using AI. Institutions must invest in digital infrastructure such as reliable internet, access to devices, and cloud-based AI platforms to provide equitable opportunities for all students. For rural or under-resourced campuses in Botswana, alternative access points—such as computer labs or mobile learning units—can mitigate digital divides.

Additionally, it is of paramount importance to maintain academic integrity. Clear guidelines should be implemented to prevent plagiarism and over-reliance on AI. These may include limits on AI-assisted submissions, reflective assignments requiring personal insights, and the use of verification tools to ensure originality.

Fifthly, encourage transparency when stakeholders in ETPs such as students are using AI. Students and educators should disclose AI contributions in assignments, reports, and research. This can be embedded into submission templates and assessment rubrics, promoting accountability, trust, and alignment with global academic norms.

Furthermore, there it is important to integrate AI in Assessment Policies and spell out how it is managed. AI should support assessment processes, including automated grading, feedback provision, and performance analytics, while human oversight ensures fairness, reliability, and alignment with learning outcomes. Hybrid approaches balance efficiency with pedagogical judgment, as demonstrated in pilot programs at institutions leveraging AI-assisted formative assessment tools.

Lastly, the seventh on the framework is need for monitoring and review the implementation of AI in ETPs. ETPs should establish ongoing evaluation mechanisms to assess AI adoption, effectiveness, and ethical compliance. Feedback from students and staff should guide iterative improvements, ensuring that AI integration remains contextually relevant and sustainable.

Declarations

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Competing Interests
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Ethical Approval
Ethical standards were strictly observed throughout the mixed-methods research to preserve rights of all participants. Before collecting data, the school principal, research adviser, and concerned teachers gave permission to conduct the study. The researchers provided explicit information about the study's objective, methodology, and scope, and participants were told that their participation was fully voluntary. All respondents provided informed consent, and they were advised that they could decline or withdraw from the study at any moment with no consequences. To protect confidentiality and anonymity, personal identifiers were not collected, and data was recorded and reported using codes rather than names. All survey results and interview transcripts were strictly confidential and used only for academic purposes. The researchers ensured that questions asked in both the survey and interviews were respectful, non-intrusive, and age-appropriate, especially since students discussed their gaming habits and academic challenges.

Author's Contribution
Author[1]: Formal analysis, Investigation, Visualization, Writing – original draft, Writing – review & editing
Author[2]: Conceptualization, Software, Data curation
Author[3]: Methodology, Writing – review & editing

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