E-Journal of Humanities, Arts and Social Sciences (EHASS)
ISSN – Online 2720-7722 | Print 2821-8949
Volume 6 Issue 12 2025 pp 3257 - 3270
Available online at: https://noyam.org/journals/ehass/
DOI: https://doi.org/10.38159/ehass.202561227

The Impact of Artificial Intelligence on Academic Performance and Learning Strategies among 21st-Century South African University Students

Billy James Chavalala [1]

[1] University of Limpopo, Private Bag X1106, Sovenga, 0727, School of Education, Department of Language Education.

ABSTRACT

This study examined the impact of artificial intelligence (AI) on academic performance and learning strategies among university students in the 21st century. The purpose was to explore how AI tools influenced students' study habits, engagement, and overall academic outcomes. A mixed-methods approach was employed, involving quantitative surveys distributed to 300 students across South African Universities and qualitative interviews with 30 participants to gain deeper insights into their experiences with AI-assisted learning. Findings revealed that AI integration significantly improved academic performance by providing personalized learning experiences, instant feedback, and adaptive study plans. Students reported increased motivation and efficiency, often utilizing AI-driven platforms for time management, problem-solving, and knowledge retention. However, challenges such as overreliance on AI and reduced critical thinking were also noted. The study recommended balanced AI usage alongside traditional learning methods to maximize benefits while minimizing dependency. In conclusion, AI emerged as a transformative tool shaping learning strategies and enhancing academic success among university students, though it necessitated careful implementation to foster critical cognitive skills. The study contributes to scholarship by bridging gaps in understanding AI's practical effects on higher education learners, offering empirical evidence to guide educators, policymakers, and technology developers in designing effective AI-based educational interventions.

Keywords: Artificial Intelligence, Academic Performance, Learning Strategies, University Students.

Correspondence
Billy James Chavalala
Email:
billy.chavalala@ul.ac.za

Publication History
Received: 16th May, 2025
Accepted: 15th October, 2025
Published online:
28th November, 2025

To Cite this Article:
Chavalala, Billy James. "The Impact of Artificial Intelligence on Academic Performance and Learning Strategies among 21st-Century South African University Students." *E-Journal of Humanities, Arts and Social Sciences* 6, no. 12 (2025): 3257 - 3270, https://doi.org/10.38159/ehass.202561227.

INTRODUCTION

Artificial Intelligence (AI) has emerged as a pivotal force in reshaping contemporary higher education, significantly affecting how university students learn and perform academically in the 21st century. Its integration into academic institutions has fostered more personalized, engaging, and flexible learning environments while challenging conventional teaching models. This introduction aims to examine the diverse influence AI has on university students' educational experiences. AI-powered systems have transformed the way learning is personalized by adapting educational content to suit individual learners' needs. Adaptive technologies use sophisticated algorithms to identify students' areas of strength and difficulty, enabling dynamic modifications to learning materials. For example, platforms like Carnegie Learning leverage AI to tailor instruction, thereby improving students' understanding and information retention. Sajja et al. introduced the Artificial Intelligence-Enabled Intelligent Assistant (AIIA), a tool designed to support students by responding to questions, generating practice quizzes, and crafting

individualized learning routes.[1] These innovations have been linked to academic gains by addressing unique learning challenges and encouraging independent study habits. AI also enhances interactivity and student engagement through technologies like gamification and immersive simulations. Such tools provide hands-on experiences, allowing learners to apply theoretical concepts in practical contexts. For instance, AI-based simulations offer medical students virtual surgery practice in a safe setting, improving both knowledge application and skill development.

Intelligent Tutoring Systems (ITS) represent another important application of AI in education. These systems mimic the support of human tutors by adjusting to student progress, supplying personalized feedback, and offering real-time guidance. Research shows that students using ITS often perform better than those in traditional classroom environments, especially in disciplines like science and mathematics, where tailored feedback and problem-solving practice are critical. Despite these advantages, the use of AI in academia raises several concerns, particularly regarding ethical and pedagogical implications. Issues such as data privacy, algorithmic bias, and dependency on AI tools have been widely discussed. Wecks et al. found that students who relied on generative AI tools like ChatGPT performed on average 6.71 points lower than their peers, suggesting potential drawbacks from improper or excessive use.[2] Moreover, the widespread use of AI in student work has compelled universities to revise their assessment practices to uphold academic integrity. In the UK, over 90% of students reportedly use AI in their studies, prompting institutions to implement policies governing its use. Globally, universities are increasingly embedding AI into their curricula to prepare learners for an AI-integrated future. Chinese institutions have introduced AI-focused courses to cultivate innovation and technical proficiency, while universities in the United States have adopted tools like ChatGPT across campuses, influencing the educational experiences of more than 460,000 students and 63,000 faculty members. These developments indicate a broader educational shift towards embracing AI as a catalyst for improved learning outcomes and career readiness. In summary, the influence of AI on university students' academic achievements and learning strategies is extensive and complex. While it offers opportunities for customized learning and increased engagement, it also introduces ethical concerns and practical challenges that must be addressed. As AI continues to evolve, its role in shaping higher education will likely grow, requiring careful evaluation and strategic policy development to ensure it supports, not supplants, critical learning processes. Although AI technologies have modernized the learning landscape by offering tools such as intelligent tutoring systems, adaptive learning platforms, and generative models like ChatGPT, their impact on educational quality remains contested. Some researchers highlight benefits like increased efficiency, immediate feedback, and automation of routine academic tasks. Others caution that reliance on AI may erode essential cognitive skills, compromise independent problem-solving, and encourage unethical academic behaviour.

Thus, evaluating AI's long-term implications on student engagement, comprehension, and achievement is crucial. Furthermore, concerns about digital inequality, algorithmic fairness, and data protection complicate AI's integration into education. Institutions are tasked with creating equitable access and safeguarding academic standards while maximizing the benefits AI can offer. Although AI claims to deepen learning by customizing instruction, critics argue it may foster superficial knowledge rather than meaningful understanding. Disparities in access to AI tools also risk widening educational gaps, particularly among socioeconomically disadvantaged students. Therefore, this study seeks to explore the extent to which AI influences student performance and learning approaches in university settings, examining both its potential and limitations. A nuanced understanding of these dynamics will help shape effective educational practices and inform responsible AI policy implementation in higher education.

LITERATURE REVIEW

The incorporation of AI into higher education has progressed notably, significantly shaping how 21st-century university students perform academically and develop learning strategies. This shift is largely attributed to the emergence of AI-powered tools that support individualized learning, deliver instant feedback, and streamline academic administration. As these technologies advance, their impact on

[1] Ramteja Sajja et al., "Artificial Intelligence-Enabled Intelligent Assistant for Personalized and Adaptive Learning in Higher Education," *Information* 15, no. 10 (2024): 596.

[2] Janik Ole Wecks et al., "Generative AI Usage and Exam Performance," *ArXiv Preprint ArXiv:2404.19699*, 2024.

transforming conventional educational models becomes more apparent. Early implementations of AI in tertiary education primarily focused on intelligent tutoring systems (ITS), which deliver tailored instruction without requiring direct teacher involvement. By leveraging algorithms to match instructional content to individual learning preferences, these systems have demonstrated notable improvements in academic outcomes.[3] The success of ITS laid the foundation for the expansion of more complex AI applications in education. Over time, adaptive learning technologies have emerged, analysing student data to forecast academic progress and identify learners who may need additional support. This predictive capacity enables institutions to offer timely interventions and enhance learner achievement.[4] Additionally, AI-based chatbots now provide immediate academic assistance, which has been linked to greater student motivation and improved performance.[5]

The integration of AI within digital learning platforms also supports ongoing assessment methods, moving away from conventional final exams to more dynamic, formative evaluations.[6] Recognizing AI's transformative potential, many universities have integrated AI-related studies into their academic offerings. For example, institutions in China have developed specialized AI courses aimed at equipping students with the skills necessary for innovation and technological advancement.[7] This evolution calls for a pedagogical shift, where instructors adapt their teaching practices to better utilize AI tools in enriching student experiences. Furthermore, AI supports personalized and self-paced learning, making it compatible with competency-based education models.[8] Nevertheless, the adoption of AI in academia is not without its complications. Concerns about academic honesty have risen due to the accessibility of generative AI tools that produce text indistinguishable from human writing. Evidence suggests that students who over-rely on tools such as ChatGPT may experience a decline in performance, with one study reporting an average score drop of 6.71 points among users.[9] Additional concerns regarding privacy, algorithmic fairness, and equal access underscore the need for robust frameworks to guide ethical AI use in education. As AI continues to develop, its influence on higher education is expected to broaden further. Future innovations hold potential for enhancing personalized instruction, streamlining institutional processes, and advancing research capabilities. However, achieving these goals depends on collaborative efforts among educators, policymakers, and developers to ensure that AI technologies are implemented ethically and inclusively to support meaningful and equitable educational outcomes.

AI-Powered Learning Tools and Their Influence on Academic Performance

AI has become a transformative force in higher education, introducing a range of AI-powered learning tools designed to enhance academic performance among university students. These tools, including intelligent tutoring systems, personalized learning platforms, and generative AI applications, have been integrated into educational settings with the aim of improving learning outcomes. AI-powered learning tools have been developed to provide personalized educational experiences, adapting to individual student needs and promoting active engagement. A study by Baillifard et al. explored the integration of AI tutors to complement learning programs in accordance with learning sciences.[10] The results indicated that students who actively engaged with the AI tutor achieved significantly higher grades, with an average

[3] Olaf Zawacki-Richter et al., "Systematic Review of Research on Artificial Intelligence Applications in Higher Education – Where Are the Educators?," *International Journal of Educational Technology in Higher Education* 16, no. 1 (December 28, 2019): 39, https://doi.org/10.1186/s41239-019-0171-0.

[4] American College of Education, " How Artificial Intelligence Is Transforming Higher Education," 2025, https://ace.edu/news/how-artificial-intelligence-is-transforming-higher-education/.

[5] J. Chukwuere and E. Handoko, "The Impact of Generative AI Educational Chatbots on the Academic Support Experiences of Students in U.S. Research Universities," NASPA, 2024, https://naspa.org/blog/the-impact-of-generative-ai-educational-chatbots-on-the-academic-support-experiences-of-students-in-u-s-research-universities.

[6] Rutgers University, " How Is Artificial Intelligence Impacting Higher Education? ," 2024, https://comminfo.rutgers.edu/news/how-artificial-intelligence-impacting-higher-education.

[7] Reuters, "Chinese Universities Launch DeepSeek Courses to Capitalise on AI Boom," 2025, https://www.reuters.com/technology/artificial-intelligence/chinese-universities-launch-deepseek-courses-capitalise-ai-boom-2025-02-21/.

[8] EDUCAUSE, " How AI Could Impact Student Success in Higher Ed.," EDTECH Magazine, 2023, https://edtechmagazine.com/higher/article/2023/10/educause-2023-how-ai-could-impact-student-success-higher-ed.

[9] Wecks et al., "Generative AI Usage and Exam Performance."

[10] Ambroise Baillifard et al., "Implementing Learning Principles with a Personal AI Tutor: A Case Study," *ArXiv Preprint ArXiv:2309.13060*, 2023.

improvement of up to 15 percentile points compared to a parallel course without the AI tutor. This suggests that AI tutors can effectively enhance academic performance by modelling human learning processes and providing personalized support. Similarly, research conducted by Wecks et al. evaluated the impact of students' usage of generative AI tools, such as ChatGPT, on their academic performance.[11]

The study found that students using these tools scored, on average, 6.71 points lower than non-users, indicating that while AI tools may offer benefits for learning and engagement, their actual usage correlated with diminished academic outcomes. This highlights the necessity for educators and policymakers to carefully consider the implications of AI tool usage in educational settings. The integration of AI-powered learning tools into higher education presents several challenges and ethical considerations. Concerns have been raised regarding academic integrity, as the ease of access to AI-generated content may lead to increased instances of plagiarism and reduced development of critical thinking skills. A study highlighted those students using generative AI tools like ChatGPT scored, on average, 6.71 points lower than non-users, suggesting that improper use of AI may hinder learning.[12] Additionally, issues related to data privacy, algorithmic bias, and the digital divide necessitate the development of comprehensive policies to ensure equitable and responsible use of AI in education. The rapid adoption of AI tools has outpaced the establishment of clear guidelines and training for both students and educators. Reports indicate that while a significant percentage of students are incorporating AI into their studies, many institutions have yet to provide formal training or develop policies regarding its use, leading to confusion and potential misuse.[13] This underscores the need for educational institutions to proactively address the integration of AI technologies, ensuring that they enhance rather than undermine the learning experience. AI-powered learning tools hold substantial potential to transform higher education by providing personalized learning experiences and enhancing academic performance. However, their effective implementation requires careful consideration of ethical implications, comprehensive training for users, and the development of clear institutional policies. As AI continues to evolve, ongoing research and dialogue among educators, policymakers, and technologists will be essential to harness its benefits while mitigating associated challenges.

The Role of AI in Enhancing Student Engagement and Motivation

Artificial Intelligence (AI) has become a pivotal innovation in higher education, playing a major role in enhancing student motivation and participation. The adoption of AI-based platforms and technologies has transformed conventional educational settings by offering tailored and interactive learning experiences that respond to individual student needs. Through AI, personalized education has reached new levels, with adaptive learning systems using data-driven algorithms to evaluate learners' strengths and weaknesses, thereby modifying content delivery to suit each learner. This personalized approach supports autonomy and competence—key elements of intrinsic motivation. Tools like intelligent tutoring systems and learning analytics have contributed to heightened student involvement and better problem-solving skills by offering customized feedback and flexible assessments.[14] Likewise, Kim et al. reported a 25% increase in learner engagement through AI-enhanced interface designs in tutoring systems, demonstrating the effectiveness of personalized AI applications in academic settings.[15]

The integration of AI-driven chatbots and virtual assistants has added new dimensions to the learning experience. These technologies provide real-time answers to student questions, promoting continuous learning while minimizing the sense of isolation common in remote education. In a study by Cao et al., AI chatbots deployed in computer science courses functioned in multiple roles: teacher, peer, career guide, and emotional supporter, contributing to a more engaging and emotionally supportive environment.[16] This multifaceted support fulfilled learners' psychological needs, thus boosting motivation

[11] Wecks et al., "Generative AI Usage and Exam Performance."
[12] Wecks et al., "Generative AI Usage and Exam Performance."
[13] The Guardian, "UK Universities Warned to 'stress-Test' Assessments as 92% of Students Use AI," February 26, 2025.
[14] Zohaib Hassan Sain et al., "Exploring the Role of Artificial Intelligence in Enhancing Student Motivation and Cognitive Development in Higher Education," *TechComp Innovations: Journal of Computer Science and Technology* 1, no. 2 (2024): 59–67.
[15] Byungchan Kim et al., "AI-Driven Interface Design for Intelligent Tutoring Systems Improves Student Engagement," *ArXiv Preprint* , 2020.
[16] Cassie Chen Cao et al., "AI Chatbots as Multi-Role Pedagogical Agents: Transforming Engagement in CS Education," *ArXiv Preprint ArXiv:2308.03992*, 2023.

and interaction. AI has also played a central role in introducing gamified elements into the curriculum, enriching the learning experience. By employing algorithms to create challenges and deliver immediate feedback, AI facilitates active and immersive learning environments. Kim et al. emphasized that these AI-supported designs not only increased learner participation but also made lessons more enjoyable.[17] This aligns with the Self-Determination Theory, which suggests that intrinsic motivation can be nurtured by meeting learners' psychological needs through gamification, ultimately enhancing academic achievement. However, the integration of AI into educational environments is not without concerns. Issues such as data security, algorithmic fairness, and an over-reliance on automated tools are significant. Sain et al. cautioned that while AI enhances engagement, excessive dependence on these tools could limit students' creative and critical thinking abilities.[18]

Furthermore, unequal access to advanced technologies may deepen educational disparities. Therefore, AI should be implemented thoughtfully, with regular assessment to ensure it enhances rather than undermines core educational principles. Looking ahead, AI technologies are expected to evolve further, with innovations like AI-enabled virtual and augmented reality offering more immersive educational experiences. These tools could make complex concepts easier to understand and more engaging. Nonetheless, the effective adoption of these emerging technologies will require addressing existing challenges and ensuring that AI complements traditional teaching methods rather than replacing them. In conclusion, AI has made a significant impact on student motivation and participation in higher education through its ability to deliver personalized, responsive, and engaging learning experiences. While its benefits are clear, a balanced and ethically informed approach to its use is essential. Continued research and strategic application will be vital for leveraging AI's potential to improve learning outcomes for university students in the digital age.

Gamification and adaptive learning technologies

Gamification involves incorporating game-like elements into educational contexts to motivate and engage students. AI enhances gamification by personalizing challenges and feedback based on individual student performance. For instance, AI tools can adjust the difficulty level of tasks in real-time, ensuring that students remain challenged yet not overwhelmed, thereby maintaining optimal engagement levels. A study by Faulkner University highlights that AI can modify gamified experiences to align with each student's progress, preventing frustration and promoting sustained motivation.[19] Similarly, research indicates that the adoption of gamification positively impacts students' academic performance, as it fosters a more interactive and enjoyable learning environment.[20] Adaptive learning technologies utilize AI to customize educational content, addressing the unique needs of each student. These systems analyse learners' interactions and adjust instructional materials accordingly, facilitating a personalized learning journey.

A study published in Teaching in the AI Era found that adaptive learning technologies, combined with personalized feedback and interactive AI tools, significantly improved student engagement. The research also emphasized that students with higher digital literacy levels benefited more from these technologies, suggesting that digital proficiency moderates the effectiveness of adaptive learning tools.[21] Further supporting this, a case study conducted at UniDistance Suisse demonstrated that students who actively engaged with an AI tutor achieved significantly higher grades. The AI tutor provided personalized microlearning questions generated from course materials, leading to an average improvement of up to 15 percentile points compared to a parallel course without the AI tutor.[22] This underscores the potential of AI-driven adaptive learning systems to enhance academic performance by offering tailored educational experiences. The convergence of gamification and adaptive learning technologies creates a dynamic

[17] Kim et al., "AI-Driven Interface Design for Intelligent Tutoring Systems Improves Student Engagement."
[18] Sain et al., "Exploring the Role of Artificial Intelligence in Enhancing Student Motivation and Cognitive Development in Higher Education."
[19] Faulkner University, "AI and College: The Impact on Online Learning," 2024, https://www.faulkner.edu/news/the-role-of-artificial-intelligence-in-online-learning/.
[20] Tandfonline, " The Adoption of Gamification in Higher Education and Its Impact on Students' Academic Performance," 2024, https://www.tandfonline.com/doi/full/10.1080/2331186X.2024.2428907.
[21] Husam Yaseen et al., "The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement: The Moderating Role of Digital Literacy," *Sustainability* 17, no. 3 (2025): 1133.
[22] Baillifard et al., "Implementing Learning Principles with a Personal AI Tutor: A Case Study."

educational environment where AI personalizes both the content and the delivery method. For example, AI can design gamified learning modules that adapt in complexity based on the learner's progress, ensuring that students remain engaged and challenged appropriately. Research indicates that combining gamification with intelligent tutoring systems in serious games for engineering education not only enhances student engagement but also improves educational efficacy. The system adaptively provides support based on data collected from students' in-game actions, leading to better learning outcomes.[23] Despite the benefits, integrating AI-driven gamification and adaptive learning technologies into higher education presents challenges. One concern is the potential for over-reliance on AI tools, which may impede the development of critical thinking and problem-solving skills.

A study evaluating the impact of generative AI tools, such as ChatGPT, found that students using these tools scored, on average, 6.71 points lower than non-users, suggesting that improper use of AI may hinder learning.[24] Additionally, issues related to data privacy, algorithmic bias, and ensuring equitable access to technology must be addressed to maximize the benefits of AI in education. AI-driven gamification and adaptive learning technologies have the potential to significantly enhance academic performance and transform learning strategies among university students. By personalizing educational experiences and fostering increased engagement, these tools can address individual learning needs effectively. However, careful implementation, continuous evaluation, and addressing ethical considerations are essential to ensure that the integration of AI in education supports the development of critical skills and promotes equitable learning opportunities.

Academic integrity and the risk of AI-assisted plagiarism

AI-driven writing assistants, like OpenAI's ChatGPT, are increasingly used by university students to help with tasks such as essay composition and academic assignments. A recent study indicated that more than 90% of undergraduate students in the UK have integrated AI tools into their learning routines—an increase from roughly 66% the year before. These tools support activities like brainstorming and summarizing content; however, they also introduce risks related to academic misconduct. The ability of these systems to produce fluent, natural-sounding text makes it easier for students to submit AI-generated material as if it were their own, which can compromise academic integrity and diminish meaningful learning. Identifying the use of AI-generated content is proving difficult for educators. Conventional plagiarism detectors often fail to flag such work because it is typically original and not copied from other sources. Although newer AI detection technologies have emerged, doubts about their accuracy persist. For instance, Turnitin rolled out an AI detection tool in early 2023, but concerns about incorrect flagging led several institutions to deactivate it. False accusations, especially when human-written work is misidentified as AI-produced, can result in unjust consequences for students. Moreover, some detection systems have shown bias, particularly against students who are non-native English speakers, raising equity concerns. As AI tools continue to evolve and produce more human-like outputs, detection becomes even more complex. In response, many universities are reconsidering their evaluation strategies and policies on academic honesty. Some institutions have returned to in-person assessments to prevent misuse of AI tools. Still, such strategies may not align with today's collaborative and digitally integrated educational landscape.

A growing number of academic leaders advocate for embedding AI literacy into the curriculum. This involves teaching students how to engage with AI ethically and critically, emphasizing responsible usage over prohibition. For example, Trinity College Dublin has issued a policy permitting the use of AI in academic work if it is appropriately acknowledged. This balanced approach allows students to benefit from technological advances while reinforcing ethical standards. The widespread use of AI in education has sparked important ethical debates. Students often struggle to determine what constitutes acceptable AI use, sometimes inadvertently breaching academic conduct rules. Research into student attitudes toward "AI-giarism" revealed general disapproval of using AI for full content generation, though opinions were more mixed when it came to partial or indirect use. This highlights the need for clear institutional guidelines and educational initiatives that clarify expectations around AI. Furthermore, excessive

[23] Ying Tang and Ryan Hare, "Combining Gamification and Intelligent Tutoring Systems in a Serious Game for Engineering Education," *ArXiv Preprint ArXiv:2305.16568*, 2023.
[24] Wecks et al., "Generative AI Usage and Exam Performance."

dependence on AI tools may hinder skill development in areas such as analytical thinking and effective writing. While AI can serve as a supportive tool in the early stages of the writing process, educators are urged to design assignments that foster original thought and encourage learners to express their individual understanding. Such practices reduce the temptation to rely heavily on AI-generated responses. The integration of AI in higher education brings both promising opportunities and serious challenges. While these technologies can enhance the learning experience, they also pose threats to academic integrity if misused. Addressing these challenges calls for a comprehensive strategy that includes reliable detection systems, transparent policies, and ethical education around AI. By promoting responsible use and maintaining high academic standards, institutions can take full advantage of AI's capabilities while preserving the integrity of student learning and assessment.

The shift from traditional study methods to AI-assisted approaches

Traditional study methods often rely on passive learning techniques, such as rote memorization and solitary study sessions. While these approaches have been foundational in education, they may not fully address the diverse learning needs of students in the digital age. The limitations of traditional methods include a lack of personalized learning experiences, limited access to immediate feedback, and challenges in maintaining student engagement over extended periods. The advent of AI technologies has introduced personalized learning experiences that adapt to individual student needs. AI-powered tools, such as intelligent tutoring systems and adaptive learning platforms, analyse student performance data to tailor educational content and pacing. This personalization fosters a more engaging and effective learning environment. A study by Eltahir and Babiker demonstrated that integrating AI-powered personalized learning tools into educational settings significantly improved academic performance and student engagement. [25] The shift to AI-assisted learning approaches has been associated with notable improvements in academic performance. Research indicates that students utilizing AI tools exhibit enhanced critical thinking skills, better knowledge retention, and higher levels of motivation. For instance, a study by Micabalo et al. found that the use of AI-powered study tools, such as ChatGPT and Grammarly, positively influenced academic outcomes and student motivation among higher education students.[26] AI-assisted learning encourages active learning strategies, such as problem-solving, collaborative learning, and real-time feedback. These strategies promote deeper understanding and critical thinking. A study by Eltahir and Babiker highlighted that AI tools facilitate personalized instruction, intelligent tutoring, and automated assessments, leading to improved learning outcomes.[27]

Despite the benefits, the integration of AI into education presents challenges, including concerns about data privacy, algorithmic bias, and the potential for over-reliance on technology. A study by Eltahir and Babiker noted that while AI tools can enhance engagement, there is a risk of reduced creativity and critical thinking if students become too dependent on technology.[28] The transition from traditional study methods to AI-assisted learning approaches represents a significant advancement in higher education. AI technologies offer personalized, engaging, and effective learning experiences that address the diverse needs of students. However, it is essential to address the challenges and ethical considerations associated with AI integration to ensure that these technologies enhance rather than hinder the learning process.

Future Prospects of AI in University Education

The incorporation of AI into higher education is reshaping academic performance and learning methodologies. As AI technologies advance, they offer opportunities to enhance education through individualized learning, predictive analytics, and immersive experiences. This evolution is particularly pertinent as universities address challenges related to student retention, engagement, and achievement. AI facilitates the customization of educational content to align with each student's unique needs, abilities, and learning preferences. Adaptive learning platforms employ algorithms to analyse students' learning

[25] Mohd Elmagzoub Eltahir and Frdose Mohd Elmagzoub Babiker, "The Influence of Artificial Intelligence Tools on Student Performance in E-Learning Environments: Case Study," *Electronic Journal of E-Learning* 22, no. 9 (2024): 91–110.
[26] Anicco Dionne Cajigas Micabalo et al., "The Impact of AI-Powered Study Tools on the Academic Performance and Motivation of Higher Education Students," 2024.
[27] Eltahir and Babiker, "The Influence of Artificial Intelligence Tools on Student Performance in E-Learning Environments: Case Study."
[28] Eltahir and Babiker, "The Influence of Artificial Intelligence Tools on Student Performance in E-Learning Environments: Case Study."

patterns, adjusting content to match their pace and style. Research indicates that such personalization can improve information retention and engagement, leading to better academic outcomes. As AI continues to evolve, it is anticipated to provide more nuanced personalization, ensuring tailored support for all learners. AI's capability to monitor and assess student progress in real-time offers significant advantages in identifying and addressing learning gaps. Tools like intelligent tutoring systems and real-time feedback applications analyze performance data to pinpoint areas where students struggle, recommending targeted interventions. These continuous feedback loops foster a dynamic and interactive learning environment, encouraging students to reflect on their progress and adjust their study strategies accordingly. Predictive analytics powered by AI holds promise for enhancing student retention and academic success.

By analysing historical data—such as academic performance, attendance, and engagement levels—AI algorithms can predict which students are at risk of underperforming or dropping out. This enables universities to take timely actions, like providing additional resources or personalized support, to improve retention rates and academic outcomes. Advancements in AI are expected to integrate immersive technologies, such as virtual and augmented reality (VR/AR), into university education. These technologies offer interactive learning experiences that are challenging to replicate in traditional classrooms. For instance, medical students can practice surgeries, and engineering students can experiment with designs in virtual environments. The integration of AI-powered chatbots can also provide students with 24/7 assistance, enhancing the flexibility and responsiveness of the learning environment. AI can enhance collaboration among students by forming groups with complementary skill sets, maximizing learning opportunities. In large-scale online courses, AI-powered platforms can facilitate peer-to-peer learning by matching students who excel in certain areas with those needing assistance.

Future AI-driven platforms may include sophisticated peer-assessment tools, enabling students to review each other's work and provide constructive feedback, thereby improving individual and collective learning outcomes. As AI becomes more integrated into higher education, ethical considerations must be addressed. Concerns regarding data privacy, algorithmic bias, and the impact on the student-teacher relationship are central to the responsible use of AI. Universities must establish clear policies on data collection, algorithm transparency, and student involvement in decision-making processes. Additionally, the potential for AI-assisted cheating or plagiarism necessitates the development of sophisticated detection tools to uphold academic integrity. The future of AI in university education is poised to transform learning experiences through personalization, predictive analytics, immersive technologies, and enhanced collaboration. However, it is crucial for universities to address the ethical challenges associated with AI integration. By fostering collaboration among educators, policymakers, and students, institutions can ensure that AI enriches the educational experience and supports student success in the 21st century.

THEORETICAL FRAMEWORK

This study was anchored in Constructivist Learning Theory, which posits that learners actively construct knowledge through experiences rather than passively receiving information.[29] AI-powered educational tools facilitate this process by providing interactive and adaptive learning environments that cater to individual student needs.[30] These tools support scaffolding, allowing students to develop higher-order thinking skills through guided learning experiences.[31] Cognitive Load Theory suggests that the human brain has a limited working memory capacity, and effective learning occurs when instructional methods optimize cognitive resources.[32] AI-driven learning platforms, such as intelligent tutoring systems, assist students in managing cognitive load by personalizing content delivery and reducing extraneous cognitive demands.[33] These adaptive systems enhance learning efficiency and academic performance by tailoring instruction to individual cognitive needs. Self-Regulated Learning (SRL) Theory emphasizes the importance of students taking control of their learning through goal-setting, self-monitoring, and strategic resource use. [34] AI-enhanced learning strategies support SRL by providing real-time feedback,

[29] J. Piaget, *The Construction of Reality in the Child* (Routledge, 2019).
[30] L. S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes* (Harvard University Press, 2021).
[31] J. Bruner, *Toward a Theory of Instruction* (Harvard University Press, 2020).
[32] J. Sweller, *Cognitive Load Theory and Educational Design* (London: Routledge, 2020).
[33] P. A. Kirschner, P. Ayres, and P. Chandler, *Cognitive Load Theory in Action: Educational Applications* (Springer, 2022).
[34] B. J. Zimmerman and D. H. Schunk, *Self-Regulated Learning: From Teaching to Self-Reflective Practice* (Guilford Press, 2019).

personalized study recommendations, and tracking student progress.[35] Through these mechanisms, students develop autonomy and metacognitive skills that improve academic outcomes. Technological Determinism Theory argues that technological advancements shape human behaviour and societal structures.[36] The integration of AI in education influences teaching methodologies, learning strategies, and assessment practices, altering the traditional academic landscape.[37]AI-powered educational tools redefine knowledge acquisition and skill development, necessitating the adaptation of university curricula and pedagogical approaches.

METHODOLOGY

The study was carried out at South African Universities. This study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to analyse the impact of AI on academic performance and learning strategies among university students. The quantitative aspect utilized a survey-based method to collect numerical data on students' engagement with AI-powered tools, while the qualitative aspect incorporated semi-structured interviews to gain deeper insights into students' experiences and perceptions.[38] The target population comprised undergraduate and postgraduate students from various disciplines at three universities.

A stratified random sampling technique was used to ensure representation from different academic backgrounds. The final sample consisted of 400 students, with 300 participants completing the survey and 30 engaging in interviews.[39] Data collection occurred over three months, from January to March 2024. The survey, administered through Google Forms, included both closed-ended and Likert-scale questions assessing students' use of AI tools, their academic performance, and the effectiveness of AI-based learning strategies. The interview sessions were conducted via Zoom and lasted approximately 30 minutes per participant.[40] Quantitative data were analysed using SPSS software, employing descriptive statistics, regression analysis, and t-tests to identify patterns and correlations between AI utilization and academic performance. The qualitative data from interviews were transcribed and thematically analysed to extract key themes related to students' attitudes, challenges, and perceived benefits of AI integration in their learning processes.[41] (Ethical approval was obtained from the university's Institutional Review Board prior to data collection. Participants provided informed consent, and anonymity was ensured by coding responses and securely storing data. Additionally, participants had the right to withdraw at any stage of the study.[42] This study acknowledged several limitations, including the potential for self-reporting bias in survey responses and the limited generalizability of findings beyond the selected universities. Additionally, technological access disparities among students may have influenced their engagement with AI tools.[43]

PRESENTATION OF FINDINGS AND DISCUSSION

Recent findings suggest that AI is significantly influencing how university students in the 21st century approach their studies and improve academic outcomes. Most respondents acknowledged that digital tools powered by AI—such as automated assistants, virtual academic support systems, writing enhancers, and adaptive learning platforms- contributed to a clearer grasp of challenging material and more effective handling of their academic responsibilities. Quantitative analysis indicated a strong link between consistent use of AI technologies and elevated academic performance, particularly in areas heavily reliant on research and written communication. In addition to numerical data, qualitative feedback revealed that students were modifying their learning habits in response to AI integration. These adaptations included increased reliance on self-guided learning, the incorporation of immediate AI-generated feedback, and

[35] P. H. Winne and A. F. Hadwin, *Self-Regulated Learning and Academic Achievement: Theoretical Perspectives* (London: Routledge, 2021).
[36] Marshall McLuhan, *Understanding Media: The Extensions of Man* (MIT press, 1994).
[37] N. Selwyn, *Education and Technology: Key Issues and Debates* , 3rd ed. (Bloomsbury Publishing, 2023).
[38] John Ward Creswell and John David Creswell, *Research Design Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. (Thousand Oaks, California: SAGE Publications Ltd, 2018).
[39] Mark N. K Saunders, Philip Lewis, and Adrian Thornhill, *Research Methods for Business Students*, 8th ed. (New York: Pearson, 2019).
[40] A. Bryman, *Social Research Methods*, 5th ed. (Oxford University Press, 2021).
[41] M. B. Miles, A. M. Huberman, and J. Saldaña, *Qualitative Data Analysis: A Methods Sourcebook*, 4th ed. (Sage Publications, 2020).
[42] Emma Bell, Bill Harley, and Alan Bryman, *Business Research Methods*, 6th ed. (Oxford university press, 2022).
[43] M. Denscombe, *Good Research Guide: Research Methods for Small-Scale Social Research*, 7th ed. (Open Univ. Press., 2021).

more efficient time planning based on personalized learning cues. Nevertheless, certain participants voiced apprehension about the risk of becoming too reliant on AI tools, which they feared might compromise their capacity for critical analysis and independent thought. The broader interpretation of these results indicates that AI has the potential to serve as a powerful aid in academic development when embedded thoughtfully into educational practices. Rather than replacing human reasoning and scholarly effort, AI is best positioned as a complementary resource. These conclusions echo prevailing academic discussions that call for a stronger emphasis on digital literacy and mindful use of technology within higher education.

Quantitative Findings

Survey data from South African university students revealed the following key statistics:

- 78% of respondents reported that AI-powered tools contributed positively to their academic results.
- Improvements most frequently mentioned included assignment quality (65%), time management (54%), and understanding complex concepts (49%).
- The most used AI applications were grammar checkers (72%), plagiarism detection tools (68%), intelligent tutoring systems (60%), research assistants (58%), and personalized learning platforms (56%).
- 22% of participants expressed concerns about overreliance on AI, reporting reduced critical thinking and creativity.

17% of respondents mentioned ethical concerns, including academic dishonesty and misuse of AI-generated

Qualitative Findings

Thematic analysis of semi-structured interviews with 30 participants yielded three key themes:

Theme 1: Enhanced Learning Autonomy

Students described gaining greater control over their learning pace and strategies due to AI support.

> *"With AI, I can learn at my own speed. If I don't understand something, I just ask the tool to explain it again until I get it."* (Participant 4)
>
> *"The instant feedback I get from AI helps me fix my mistakes immediately without waiting for the lecturer's comments."* (Participant 9)

Theme 2: Active Engagement Through Digital Tools

AI integration encouraged the adoption of interactive and reflective learning strategies.

> *"Before, I never used digital note-taking, but now I have everything organized and searchable, which saves me hours."* (Participant 2)
>
> *"Self-assessment quizzes on the AI platform push me to test my understanding after each topic."* (Participant 11)

Theme 3: Risks of Overdependence and Ethical Concerns

While beneficial, some students warned against excessive reliance on AI tools.

> *"Sometimes I feel like I'm not thinking for myself — the AI just gives me the answer, and I accept it."* (Participant 6)
>
> *"I've seen classmates misuse AI to complete assignments they didn't even read. That's not learning."* (Participant 14)

DISCUSSION

The incorporation of AI into higher education has notably transformed the academic landscape for university students in the 21st century. The outcomes of this study underscore the substantial influence of AI technologies on learners' academic achievement and study methods. While AI opens new avenues for academic improvement, it also presents challenges that warrant careful attention. This paper analyses the

implications of these findings and places them within the wider academic conversation on the use of AI in educational contexts. The research data indicated that AI tools including intelligent tutoring systems, automated writing assistants, personalized feedback platforms, and adaptive learning technologies, contributed to enhanced academic results. Students reported advantages such as quick access to information, improved revision capabilities, and organized learning structures. These tools supported more precise and efficient assignment completion, contributing to higher grades and increased self-assurance in their academic abilities. These results are consistent with findings from Holmes et al., who identified the capacity of AI-driven environments to customize learning and improve student outcomes.[44]

Participants in this study highlighted that AI enabled them to grasp complex topics at a pace suited to their individual needs, a significant benefit in large lecture-based courses where personalized support is often limited. One of the key observations was the noticeable change in learning behaviours. Many students moved away from traditional methods like reading hardcopy textbooks and participating in physical study groups, opting instead for AI-enhanced alternatives such as digital simulations, self-directed tutorials, and AI-created learning aids. This shift allowed for more adaptable and personalized study habits. Luckin et al. emphasize that AI fosters learner independence and reflective practices critical elements for cultivating lifelong learning abilities.[45] Additionally, the study showed that AI's ability to deliver real-time feedback and performance tracking empowered students to identify weaknesses and target areas needing improvement more effectively than traditional approaches. However, the research also drew attention to certain limitations. One recurring concern was an increasing dependence on AI applications, which some students admitted reduced their capacity for independent problem-solving and critical analysis. These concerns echo Selwyn's caution that overreliance on AI can dampen students' intellectual engagement and slow their cognitive development.[46] Participants expressed that although AI provided convenient answers and helpful suggestions, it often did so at the expense of deeper analytical thinking, which is essential for meaningful comprehension. The ease of obtaining AI-generated material also raised ethical concerns regarding academic honesty. A number of students acknowledged using these tools in ways that lacked critical input or genuine understanding, prompting concerns about potential misuse. Another issue identified was the digital divide: not all students had equal access to advanced technology or stable internet, limiting their ability to benefit fully from AI-based resources. This disparity underscores broader socio-economic gaps and highlights the importance of institutional measures to ensure fair access to digital learning tools.

In view of these challenges, the educator's role becomes vital. Teachers must help students use AI ethically and effectively, reinforcing the importance of creativity, critical thinking, and moral decision-making alongside technical competence. Embedding AI literacy into educational programs could promote a more balanced use of technology, encouraging students to actively engage in their learning while making the most of AI's advantages. In conclusion, while the research confirmed that AI holds promise for enhancing academic performance and reshaping study habits, it must be implemented thoughtfully and continuously assessed. The most beneficial use of AI in academia involves maintaining equilibrium using its capabilities to improve and personalize learning while preserving the human interaction and critical engagement that drive true intellectual development.

Discussion Summary

The study explored the impact of AI on academic performance and learning strategies among 21st-century university students, revealing both positive outcomes and critical concerns. The findings showed that AI technologies significantly enhanced students' academic performance by providing personalized learning experiences, instant feedback, and efficient time management tools. Additionally, students adopted new, more autonomous learning strategies facilitated by AI-driven platforms. However, the study also highlighted issues such as overreliance on AI, diminished critical thinking, and concerns about academic

[44] Wayne Holmes, Maya Bialik, and Charles Fadel, *Artificial Intelligence in Education Promises and Implications for Teaching and Learning* (Center for Curriculum Redesign, 2019).

[45] Rosemary Luckin et al., "Empowering Educators to Be AI-Ready," *Computers and Education: Artificial Intelligence* 3 (2022): 100076, https://doi.org/10.1016/j.caeai.2022.100076.

[46] N. Selwyn, " Digital Inequality: Understanding Technology's Impact on Social Equity," *Educational Technology Research and Development* 68, no. 1 (2020): 107–13.

integrity. While AI emerged as a powerful educational tool, the study emphasized the need for balanced and ethical integration to support cognitive development and long-term academic growth.

RECOMMENDATIONS

Based on the findings of this study on the impact of AI on academic performance and learning strategies among 21st-century university students, several key recommendations are proposed to enhance the effective and ethical integration of AI in higher education. Firstly, universities should incorporate AI literacy into the curriculum across all faculties. This includes educating students on how to use AI tools responsibly, evaluate AI-generated content critically, and understand the ethical implications of AI use in academic work. AI literacy can empower students to maximize the benefits of these tools while avoiding misuse or overdependence. Secondly, academic institutions should provide equal access to AI technologies by ensuring that all students have the necessary devices, internet connectivity, and training. Bridging the digital divide is essential to promote inclusive education and prevent technological disadvantages from hindering academic success. Thirdly, lecturers and academic advisors should guide students in balancing AI-assisted learning with traditional methods that encourage deep thinking and creativity. Workshops and training sessions for educators can help them integrate AI in ways that enhance pedagogy without diminishing the role of human instruction and mentorship. Fourthly, universities should develop clear policies on AI usage in academic contexts, addressing issues such as plagiarism, authorship, and originality. These policies must be communicated clearly to students to maintain academic integrity. Finally, further research should be encouraged to monitor the long-term effects of AI on learning behaviours and academic performance, allowing institutions to adapt their strategies in line with technological advancements and student needs.

CONCLUSION

The integration of AI into higher education has marked a significant shift in how 21st-century university students engage with learning and achieve academic success. This study concluded that AI tools have had a largely positive impact on academic performance by enhancing students' ability to access information, receive immediate feedback, and manage their studies more efficiently. Moreover, AI has influenced a transformation in learning strategies, promoting greater autonomy, personalization, and engagement in academic tasks. Students are increasingly adopting AI-powered platforms to support their studies, which has improved their confidence and performance in various disciplines. The study also uncovered important concerns, including the risk of overreliance on AI technologies, which may hinder the development of critical thinking and problem-solving skills. Issues of academic integrity and unequal access to AI resources were also highlighted, pointing to the need for institutions to implement clear guidelines and inclusive strategies. While AI offers substantial opportunities for improving higher education outcomes, it must be used as a complementary tool rather than a substitute for human reasoning and traditional academic practices. In conclusion, the impact of AI on university students is multifaceted, offering both benefits and challenges. For AI to be a sustainable force for academic enhancement, it must be integrated thoughtfully, ethically, and equitably. This study contributes to the growing body of scholarship on digital learning by providing empirical insights and practical recommendations, encouraging ongoing dialogue and innovation in the responsible use of AI in education.

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ABOUT AUTHORS

Dr. BJ Chavalala is a Senior Lecturer at the University of Limpopo, specializing in Language Methodology. Dr BJ Chavalala has made significant contributions to the development of DLE modules, supervision and projects. He has worked with different stakeholders like PenSalb, DBE Exam committee as a researcher and Language Laboratory researcher to mention a few. In addition to his professional work, Dr BJ Chavalala is passionate about the less privileged and always ready to make them future leaders. He has also written books, book chapters and lot of articles.