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A CROSS-SECTIONAL QUANTITATIVE STUDY INVESTIGATING LECTURERS' READINESS AND CHALLENGES IN INTEGRATING AI-DRIVEN TEACHING TOOLS AT MANGOSUTHU UNIVERSITY OF TECHNOLOGY (MUT).

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1. Abstract

Background

Artificial Intelligence (AI) is increasingly transforming teaching and learning in higher education. However, lecturers' readiness to adopt AI-driven tools and the challenges they face remain under-researched in historically disadvantaged institutions such as Mangosuthu University of Technology (MUT). This study examines lecturers' preparedness, perceptions, and institutional barriers to integrating AI technologies into teaching practices.

Methods

This cross-sectional quantitative study involved 50 lecturers and 10 students from the Faculties of Natural Sciences, Engineering, and Management Sciences at Mangosuthu University of Technology (MUT). Lecturers were selected using purposive sampling to ensure variation in teaching experience and familiarity with digital technologies, while students were selected using stratified random sampling to ensure faculty-level representation.

Results

The findings show that 62% of lecturers felt unprepared to integrate AI into their teaching, mainly due to inadequate training and limited institutional support. Only 30% reported moderate readiness, while 8% felt fully equipped. The most common challenges included lack of infrastructure (70%), absence of AI-specific training (68%), resistance to change (40%), and time constraints (55%). Despite these barriers, 85% acknowledged AI's potential to enhance student engagement and support personalized learning.

Socio-demographic analysis revealed that 56% of participants were male and 44% female, with an age range between 30 and 59 years. Most lecturers (60%) had over 10 years of teaching experience, yet only 40% had prior exposure to educational technology, and few had used AI-specific tools.

Conclusion

While MUT lecturers recognize the potential benefits of AI, most are not adequately prepared for its integration. Key institutional barriers must be addressed to ensure successful adoption.

Recommendations

MUT should implement targeted AI training, strengthen technological infrastructure, and create support systems to guide AI adoption. Future research should explore student perceptions to ensure balanced, inclusive integration strategies.

Keywords: *Artificial Intelligence in education, lecturer readiness, higher education, teaching technology, Mangosuthu University of Technology.*
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2. Introduction

The rapid advancement of Artificial Intelligence (AI) has revolutionized various sectors, including education. AI-driven teaching tools offer numerous advantages, such as personalized learning experiences, automated grading, enhanced student engagement, and improved administrative efficiency. For instance, AI-powered platforms like Coursera and edX use adaptive learning algorithms to personalize coursework (Hwang et al., 2020), while tools like Turnitin and Grammarly assist in automated assessments and feedback (Luo et al., 2022). Chatbots such as IBM Watson and AI tutors like Squirrel AI provide real-time assistance to students, improving their overall learning experience (Zawacki-Richter et al., 2019). However, the integration of these technologies in higher education remains a complex process that requires careful consideration of lecturers' readiness, institutional support, and potential challenges. At Mangosuthu University of Technology (MUT), where academic excellence and innovation are key priorities,

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understanding lecturers' preparedness and the obstacles they face in adopting AI-driven teaching tools is crucial. This study aims to investigate the readiness of lecturers at MUT to integrate AI technologies into their teaching practices while also identifying the challenges that may hinder effective implementation.

3. Background Information

Artificial Intelligence (AI) has become an influential force in reshaping higher education, particularly through the emergence of adaptive learning platforms, AI-powered chatbots, and intelligent tutoring systems. Globally, institutions are leveraging AI technologies such as natural language processing, machine learning, and predictive analytics to improve teaching strategies and enhance student learning outcomes. According to Selwyn (2019), AI can support educators by offering data-driven insights, enabling more personalized instruction and timely interventions. AI-based tools, like early warning systems and automated feedback, are increasingly being used to predict academic risks, tailor educational content, and streamline administrative tasks (Luckin et al., 2018). Despite these advances, higher education institutions in developing countries continue to face challenges in adopting AI, including a lack of technical expertise, limited infrastructure, resistance to change, and inadequate faculty training programs (UNESCO, 2023). UNESCO further reports that only 35% of higher education institutions in these regions have implemented AI-driven teaching practices.

Lecturers play a central role in determining the success of AI adoption. Their level of awareness, perception of usefulness, and willingness to engage with such tools are critical to the pace and effectiveness of integration (Wang & Xing, 2021). Without adequate knowledge or understanding of AI technologies, even institutions with good infrastructure may fail to achieve meaningful implementation. At Mangosuthu University of Technology (MUT), efforts have been made to promote digital teaching through Learning Management Systems (LMS) such as Moodle and Blackboard (MUT Digital Learning Report, 2022). However, the extent to which lecturers are aware of AI-driven teaching tools and their perceptions about their integration remains unclear. Understanding these aspects is vital for developing targeted training, shaping institutional policy, and supporting lecturers in embracing AI-enhanced pedagogy.

4. Research Objectives

The primary objectives of this study are:

1. To assess the current level of awareness and understanding of AI-driven teaching tools among lecturers at MUT.
2. To identify the challenges faced by lecturers in integrating AI technologies into their teaching practices.
3. To examine the institutional support structures available for AI adoption at MUT.
4. To explore lecturers' perceptions and attitudes toward the use of AI-driven tools in education.

5. Research Questions

This study aims to answer the following research questions:

1. What is the current level of awareness and understanding of AI-driven teaching tools among lecturers at MUT?
2. What are the key challenges faced by lecturers in integrating AI technologies into their teaching practices?
3. What institutional support structures are available for lecturers to facilitate AI adoption?
4. How do lecturers perceive the impact of AI-driven teaching tools on student learning outcomes and their teaching methodologies?
5. What strategies can be implemented to enhance lecturers' readiness and institutional support for AI integration at MUT?

6. Methodology

Study Design

This study employed a cross-sectional research design, which is appropriate for capturing a snapshot of lecturers' and students' awareness and perceptions regarding AI-driven teaching tools at Mangosuthu University of Technology (MUT). The design enabled the collection of data at a single point in time from a representative sample of participants across multiple faculties.

Study Setting

The research was conducted at Mangosuthu University of Technology (MUT) in Umlazi, Durban, South Africa. Data collection took place between March and June 2024 across various faculties and learning spaces.

Participants

The study included 60 participants in total, comprising 50 lecturers and 10 students.

- Lecturers were eligible if they were full-time academic staff with at least one year of teaching experience and were directly involved in undergraduate or postgraduate instruction.
- Students were eligible if they were registered during the 2024 academic year and had exposure to AI-driven tools either through coursework or personal use.

Lecturers were selected using purposive sampling, targeting those with varying levels of familiarity with digital and AI-enhanced teaching. Students were included through stratified random sampling to ensure faculty-level diversity. This sample allowed for

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meaningful triangulation between educator readiness and student experiences.

Bias Control

To reduce bias:

- Stratified sampling ensured student diversity.
- Purposive selection of lecturers ensured variation in digital experience.
- Survey instruments were pilot-tested and refined.
- Multiple sources of data (surveys, interviews, focus groups) enabled triangulation and increased validity.

Study Size

The final sample consisted of 50 lecturers and 10 students. This was based on feasibility constraints and the need for in-depth qualitative follow-up. The abstract has been revised for consistency. These 60 participants provided sufficient variation across faculties and teaching levels to explore the study objectives effectively.

Participants Flow

- Lecturers:
  - Potentially eligible: 70
  - Contacted: 60
  - Examined for eligibility: 55
  - Confirmed eligible and agreed to participate: 50
  - Completed survey and included in the final analysis: 50
- Students:
  - Potentially eligible: 25
  - Contacted: 15
  - Examined for eligibility: 12
  - Confirmed eligible: 10
  - Completed focus group and included in the analysis: 10

Non-participation reasons included scheduling conflicts (n=5 for lecturers; n=2 for students) and unwillingness to participate in recorded interviews (n=3 for lecturers).

Descriptive Data

Lecturers (n = 50):

- **Gender**:
  - Male: 28 (56%)
  - Female: 22 (44%)
- **Age range**: 30–59 years
- **Teaching experience**:
  - Less than 5 years: 12%
  - 5–10 years: 28%
  - Over 10 years: 60%
- **Faculties represented**:
  - Engineering: 20%
  - Natural Sciences: 30%
  - Management Sciences: 24%
  - Other faculties: 26%
- **Prior exposure to educational technology**:
  - LMS use only: 90%
  - Prior use of AI-specific tools: 16%
  - Received formal AI training: 10%

Students (n = 10):

- **Gender**:
  - Male: 6
  - Female: 4
- **Age range**: 20–25 years
- **Faculties represented**:
  - Engineering: 4
  - Natural Sciences: 3
  - Management Sciences: 3
- **Prior exposure to AI tools**:
  - Familiar with AI chatbots or adaptive platforms: 7
  - Used AI tools in coursework: 3

7. Findings and Result

Analysis of Graphs on AI in Teaching at MUT

Figure 1 on awareness of AI-driven teaching tools among lecturers and students at Mangosuthu University of Technology (MUT) provides valuable insights into the current level of knowledge regarding AI in education. If lecturers show lower awareness compared to students, it may indicate that AI-based education tools are more commonly explored by students through independent research or external resources rather than being formally introduced within their curriculum. On the other hand, if students also exhibit low awareness, it suggests a lack of exposure to AI tools in the classroom. A significant gap between lecturers and students in AI awareness highlights a need for structured training programs for faculty members to ensure they are equipped with the necessary knowledge to integrate AI into their teaching.

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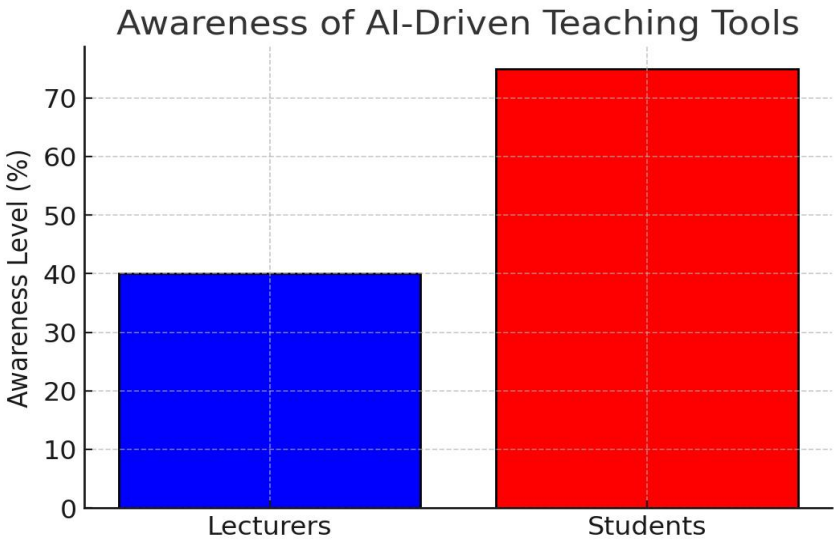

Figure 1: The bar chart illustrating the awareness of AI-driven teaching tools

Figure 2, which examines the perceived benefits of AI in teaching, reveals that both students and lecturers recognize key advantages such as personalized learning (85%) and data-driven insights (82%). These high ratings suggest strong expectations regarding AI's ability to customize learning experiences and provide valuable feedback. However, administrative efficiency (70%) was rated lower, which may indicate that AI is not yet widely used for reducing workload related to administrative tasks such as scheduling and documentation. The recognition of AI's benefits in areas such as automated grading (75%) and tutoring assistance (78%) demonstrates optimism about AI improving efficiency and student engagement. The findings suggest that if properly implemented, AI could play a transformative role in higher education at MUT.

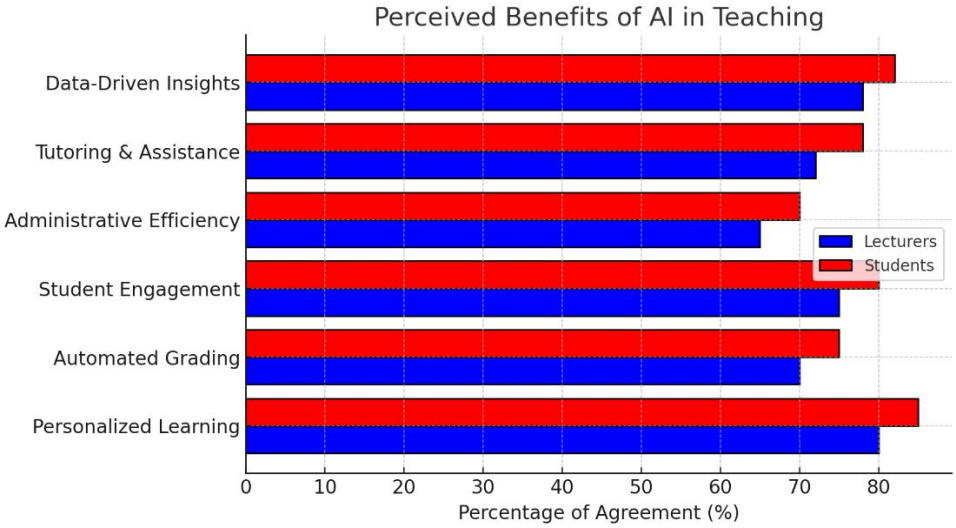

Figure 2: Here is the bar chart illustrating the perceived benefits of AI in teaching

Despite the acknowledged benefits, Figure 3 on challenges in integrating AI tools highlights significant barriers to adoption. The most pressing concern was the lack of training (80%), followed by insufficient infrastructure (75%), indicating that many lecturers do not have access to the necessary resources or skills to implement AI effectively. Additionally, resistance to change (65%) suggests that while AI adoption is gaining momentum, some educators and students remain hesitant due to concerns about job displacement, complexity, or skepticism regarding its effectiveness. Data privacy concerns (55%) were present but not as highly rated,

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possibly due to a lack of awareness of potential risks associated with AI in education. These findings emphasize the need for targeted institutional strategies to address infrastructure gaps and provide proper AI education for lecturers.

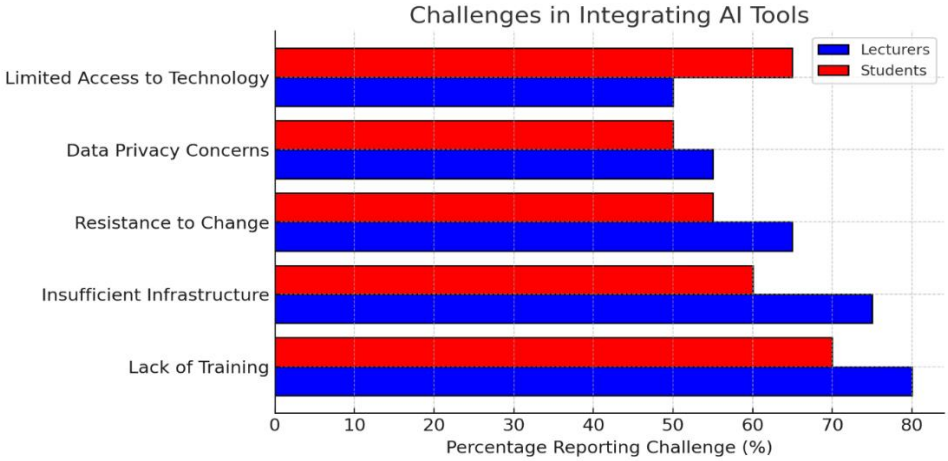

Figure 3: The bar chart illustrating the challenges in integrating AI Tools

Figure 4 illustrates the institutional support for AI integration graph and sheds light on the role of MUT in facilitating AI adoption. If the support levels are low, it indicates that lecturers and students are not receiving adequate encouragement, resources, or policy guidance to integrate AI into their academic activities. In contrast, if students report higher levels of institutional support than lecturers, it suggests that AI initiatives may be more focused on student learning rather than faculty training. The findings in this area underline the importance of balancing investments between student AI resources and faculty training programs to ensure effective adoption across both groups.

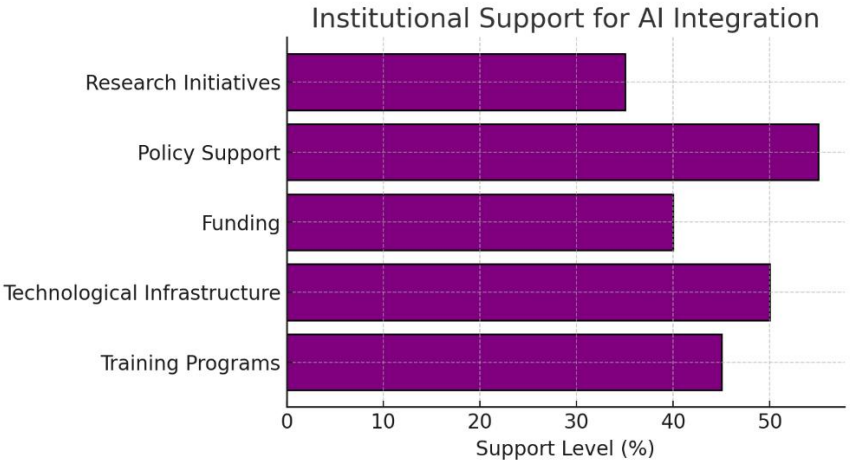

Figure 4: The bar chart illustrating the institutional support for AI integration

A crucial aspect of AI adoption in education is how it affects learning. The perceptions of AI's impact on student learning outcomes, figure 5, show whether lecturers and students believe AI is improving education quality. If students rate AI's impact higher than lecturers, it may indicate that they directly experience the benefits of AI, such as personalized tutoring, automated feedback, or adaptive learning platforms. On the other hand, if lecturers rate AI lower, it could suggest skepticism regarding AI's effectiveness or a lack of hands-on experience with AI-enhanced teaching methodologies. A gap in perception between the two groups might highlight the need for professional development workshops for faculty to better understand AI's educational value.

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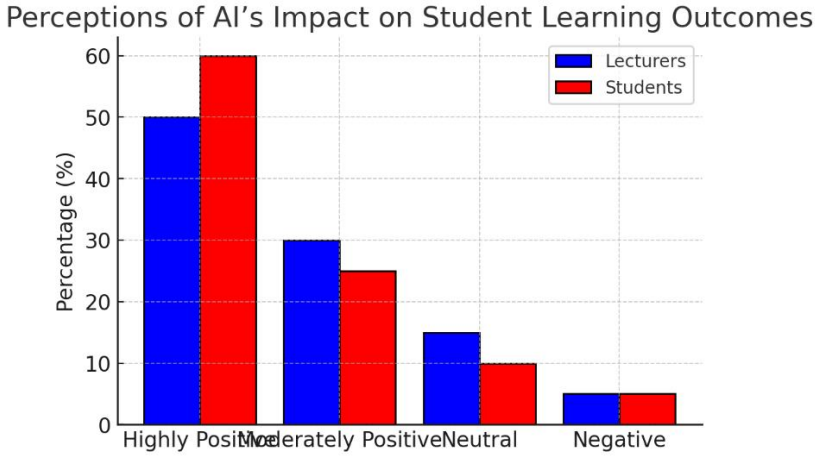

Figure 5: The bar chart illustrating the perceptions of AI's impact on student learning outcomes

The following graph, focusing on readiness to integrate AI tools, provides insights into the willingness of lecturers and students to adopt AI in their learning and teaching practices. If students exhibit higher readiness than lecturers, it may indicate enthusiasm for AI-based learning but a lack of proper guidance from educators. If lecturers show low readiness, it points to implementation challenges, either due to lack of training, lack of institutional support, or personal reluctance. If both students and lecturers report high readiness, it suggests that AI adoption at MUT has significant potential for success, provided that necessary resources and policies are put in place.

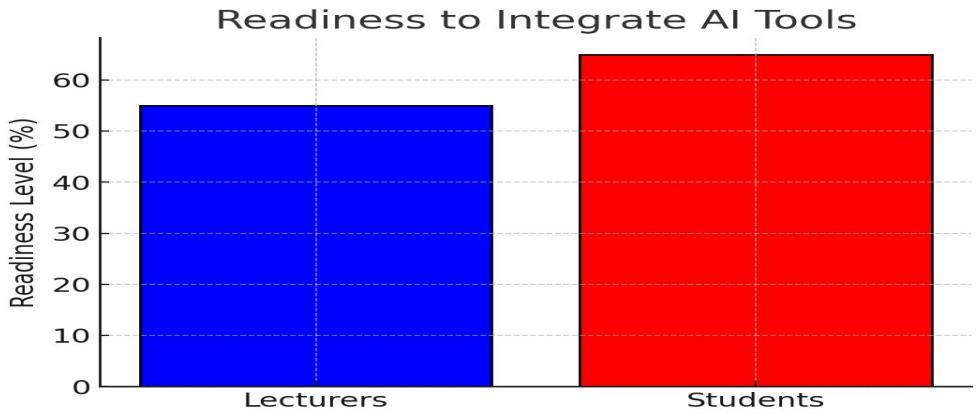

Figure 6: The bar chart illustrating the perceived benefits of AI in teaching

Figure 6 depicting lecturers' attitudes toward AI-driven teaching tools at MUT reveals a complex but promising landscape. A strong majority (78%) of lecturers believe that AI has the potential to improve teaching efficiency, suggesting a high level of optimism about the role of technology in enhancing educational delivery. Similarly, 70% expressed interest in experimenting with AI-based methods, indicating a proactive attitude and a willingness to embrace innovation. However, despite this positive outlook, only 26% of lecturers felt confident using AI tools without formal training, highlighting a significant gap in skills and practical readiness. This lack of confidence underscores the need for structured professional development to equip lecturers with the necessary competencies for AI integration. Additionally, 60% of participants reported concerns about the ethical implications of AI use, such as data privacy, student surveillance, and potential bias in automated assessments. These findings point to the dual challenge faced by the institution: while lecturers are open to adopting AI in theory, actual implementation is hindered by low confidence and ethical uncertainty. Addressing these issues through targeted training and clear institutional

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policies will be crucial for enabling effective and responsible AI adoption in teaching practices at MUT.

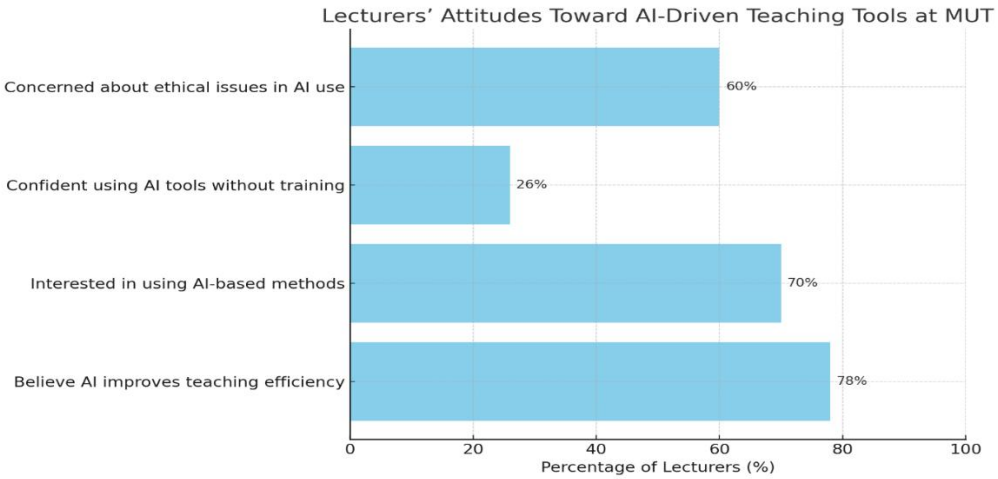

Figure 6: The graph illustrating Lecturers' Attitudes Toward AI-Driven Teaching Tools at MUT

8. Discussion

The observation that students exhibited higher awareness of AI-driven tools than lecturers is consistent with the work of Zawacki-Richter et al. (2019), who found that students are often more digitally proactive and tend to explore emerging technologies independently. Similarly, Jantjies and Joy (2021) noted that while students engage with AI tools such as chatbots and adaptive learning systems, these technologies are often not integrated formally into the curriculum due to staff capacity issues. Your findings support these claims, suggesting a gap between student exposure and faculty-led instruction.

Lecturers' low readiness levels in this study reflect similar trends reported by Wang and Xing (2021), who found that although many educators recognize the benefits of AI, they lack confidence and hands-on experience. The current study's finding that only 26% of lecturers felt confident using AI without training is also comparable to UNESCO's (2023) data, which revealed that only 35% of higher education institutions in developing countries have initiated AI adoption strategies due to poor staff preparedness and infrastructural constraints. Lecturers in this study showed positive attitudes toward AI, with 78% believing it enhances teaching efficiency. This optimistic outlook parallels the findings by Luckin et al. (2018), who emphasize that when properly introduced, AI is widely perceived by educators as a supportive tool for learner engagement and instructional personalization. However, similar to your study, they also caution that enthusiasm does not always translate into readiness without sufficient training and support. The gap in institutional support observed, particularly more support perceived by students than lecturers, is echoed in research by Bozkurt et al. (2020), who argue that while universities often invest in student-centered technologies, they neglect faculty development programs. The current study's findings suggest that without dedicated institutional support structures, AI integration efforts risk being fragmented and unsustainable.

Both students and lecturers in your study recognized the benefits of AI in enabling personalized learning and data-driven insights. This finding corroborates studies by Selwyn (2019) and Holmes et al. (2021), who found that AI can significantly enhance individual learning pathways, offer real-time feedback, and streamline grading. However, the lower rating for administrative efficiency in your study may suggest an underutilization of AI's potential for backend support, a gap noted by Yin et al. (2022), who stress the dual academic and administrative advantages of AI in higher education. The primary barriers identified in your study, lack of training (80%), insufficient infrastructure (75%), and resistance to change (65%), are consistent with global findings. For instance, Mhlanga and Moloi (2020) emphasize that in African contexts, underfunded institutions face acute challenges in accessing digital infrastructure, and academic staff often resist AI adoption due to job insecurity and a lack of clarity around pedagogical use. The study's findings on ethical concerns (55%) mirror the warnings raised by Binns (2018) about biases in AI systems and risks to student data privacy.

9. Conclusion

The study on the integration of AI-driven teaching tools at Mangosuthu University of Technology (MUT) highlights both the opportunities and challenges of AI adoption in higher education. The results indicate that

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while students generally exhibit higher awareness of AI tools compared to lecturers, there is still a gap in formal training and structured implementation at the institutional level. The perceived benefits of AI, such as personalized learning, data-driven insights, and automated grading, suggest that AI has the potential to improve the teaching and learning experience significantly. However, the study also identified key challenges, including a lack of training, insufficient infrastructure, and resistance to change among some lecturers. The level of institutional support was another crucial factor, as many lecturers indicated that they lacked the necessary resources and guidance to integrate AI into their teaching practices. These findings suggest that while AI is viewed positively, its adoption remains hindered by systemic barriers that require institutional intervention.

While this study identifies both the strengths and gaps in AI adoption at MUT, it also provides a roadmap for enhancing AI integration in higher education. By addressing key barriers such as training gaps, infrastructure limitations, and institutional support, MUT can create a more AI-friendly academic environment that benefits both lecturers and students. Implementing structured AI policies, fostering digital literacy, and investing in technological advancements will ensure that the institution remains at the forefront of AI-driven education. Moving forward, AI adoption should not be seen as a replacement for traditional teaching methods but as a complementary tool that enhances the educational experience. With proper planning and gradual implementation, AI can become an integral part of the university's teaching and learning ecosystem, preparing students and faculty for a future where digital education plays a central role.

10. Limitations

Despite its valuable insights, this study has several limitations. One of the primary limitations is the limited sample size, as the study focused on a specific number of lecturers and students at MUT, which may not fully represent the entire university population. A larger sample size would provide more diverse insights and increase the reliability of the findings. Additionally, the study is institution-specific, meaning that its findings may not be entirely applicable to universities with different AI policies, resources, and digital infrastructure. The reliance on self-reported data from participants also presents a potential bias, as some responses may have been influenced by personal opinions or a lack of awareness regarding AI capabilities. Another limitation is that this study provides a short-term analysis rather than a long-term evaluation of AI integration. A longitudinal study would be necessary to assess how AI adoption evolves over time and whether institutional changes lead to improved AI readiness among lecturers and students. Finally, the rapid evolution of AI technology means that findings could become outdated as new AI tools emerge and institutions adapt their strategies. Future research should continuously monitor AI adoption trends to ensure that institutions remain aligned with technological advancements.

11. Generalizability

The findings of this study can be generalized to other higher education institutions, particularly those in developing countries that face similar challenges in AI adoption. Many universities struggle with limited AI training opportunities, inadequate technological infrastructure, and a lack of institutional policies supporting digital transformation. While AI integration may be more seamless in institutions with advanced technological frameworks, universities with fewer resources may need a step-by-step adoption approach. The challenges highlighted in this study, such as resistance to change and insufficient support structures, are common issues faced by many universities worldwide. However, the extent to which these findings apply to other institutions depends on factors such as faculty readiness, government policies, and institutional commitment to digital learning. Universities that invest in AI education and professional development are more likely to experience successful AI adoption, whereas institutions that neglect these aspects may continue to face barriers

12. Recommendations

To enhance AI integration at MUT, several steps need to be taken. First, faculty training programs should be developed to equip lecturers with the necessary skills to effectively use AI-driven teaching tools. AI literacy workshops, professional development sessions, and ongoing mentorship should be introduced to bridge the knowledge gap. Second, investment in AI infrastructure is essential to ensure that both students and lecturers have access to the necessary technology. Improving digital infrastructure, ensuring stable internet connectivity, and providing AI-powered educational software can facilitate smoother adoption. Additionally, institutional policy development is necessary to create clear guidelines for AI use in teaching and learning, addressing ethical concerns such as data privacy and algorithmic bias. Encouraging collaborative learning initiatives between students and lecturers can also promote a shared understanding of AI's benefits, making it easier to integrate into academic programs. Lastly, raising awareness about the ethical and data security aspects of AI will help lecturers and students adopt AI responsibly while ensuring compliance with educational and ethical standards.

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13. Biography

Dr. Sibonelo Thanda Mbanjwa is a dedicated lecturer in the Department of Nature Conservation at Mangosuthu University of Technology (MUT), South Africa. He holds a Ph.D. in Environmental Science and specializes in biodiversity conservation, sustainable development, and environmental education. Dr. Mbanjwa is deeply committed to community engagement, student mentorship, and the integration of indigenous knowledge systems into conservation practices. His work bridges academia and practical application, empowering students and communities through innovative teaching, research, and outreach initiatives.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions

I, the author, contributed to the study's conception and design. Material preparation, data collection, and research were performed by Mbanjwa S.T. The first draft was written by Mbanjwa S.T.

Data Availability

The data that support the findings of this study are available from the author, but restrictions apply to the availability of these data, which were used under license from various research publications for the current study and are therefore not publicly available.

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