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Strategic leadership for responsible artificial intelligence adoption in higher education

Kudzayi S. Tarisayi

Stellenbosch University, Ryneveld Street, Stellenbosch, 7599, South Africa

Abstract. Artificial intelligence (AI) has the potential to transform higher education through its potential to improve learning, research, and leadership in colleges and universities. This study aims to identify key themes, challenges, and recommendations related to AI implementation in higher education and leadership. A literature review was supported by 2 LLMs. The results show that AI is being used to personalize teaching, provide formative feedback, identify at-risk students, accelerate research discovery, streamline administrative processes through chatbots, and optimize resource utilization. However, the findings also highlight significant technical, ethical, cultural and resource challenges that institutions must overcome in order to successfully harness AI's enormous potential while mitigating risks. Empowering management through knowledge, funding, and support structures that promote good governance and responsible AI adoption is fundamental to successfully harnessing the enormous but still largely untapped potential of AI.

Keywords: artificial intelligence, higher education, leadership, strategic planning, responsible AI adoption

1. Introduction

Artificial intelligence (AI) promises to transform higher education through its potential to improve learning, research and leadership in colleges and universities. Machine learning and deep learning techniques applied to large data sets enable AI functions such as automated essay grading, personalized adaptive learning, intelligent tutoring systems, and interactive chatbots to support administrative functions [16, 20]. However, to fully realize the benefits of artificial intelligence in higher education, social, cultural, and ethical issues related to bias, fairness, privacy, transparency, fairness, and security must be overcome [11, 24]. Without careful consideration of these issues and proactive oversight, AI could exacerbate inequality, undermine trust in institutions, and perpetuate bias against marginalized groups [12].

In addition, the resource requirements associated with the responsible implementation of artificial intelligence, including technical staff, data infrastructure, management systems, and ongoing funding, pose challenges for some institutions [33]. Faculty, staff, and students may also resist artificial intelligence because of concerns that automation will threaten jobs, dehumanize education, and lack transparency in how algorithms generate recommendations [36]. All of these challenges suggest that AI initiatives can only be implemented after careful research and testing, and in a way that is consistent with educational priorities, ethical principles, and societal

kudzayit@gmail.com (K. S. Tarisayi)
0000-0003-0086-2420 (K. S. Tarisayi)

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values. These challenges and the search for solutions reinforce the rationale for strengthening university management to promote the spread of artificial intelligence in higher education. As such, university strategic leadership plays a critical role in guiding appropriate AI adoption and innovation to balance benefits and risks. Examples of strategic actions leaders can take include articulating an AI vision within the context of broader institutional goals, fostering a campus climate that embraces experimentation and thoughtful adoption of AI tools, ensuring transparency and oversight of AI initiatives, and allocating resources to support ethics and ethics [2, 19, 35]. Crucially, leaders themselves need a deep understanding of AI opportunities, trends, challenges, and applications tailored to higher education to distinguish hype from reality, critically evaluate vendor offerings, and formulate AI investment strategies to maximize benefits while minimizing potential harm. The author uses the next section to unravel the theoretical framework guiding this study.

2. Theoretical framework

The author triangulates Roger's diffusion of innovations theory and technology leadership as a theoretical framework to guide this study of how university leadership facilitates the adoption and integration of AI on campus. Rogers' [28] diffusion of innovations theory outlines the spread of new ideas and technologies in the organization over time, passing through the stages of awareness, interest, evaluation, experimentation, and permanent implementation. Leadership plays a key role in all stages of this process to facilitate the spread of success. In the understanding phase, managers communicate the potential benefits of artificial intelligence to generate interest among stakeholders. As interest grows, leaders are critically evaluating the "fit" of AI solutions to learning priorities, values, and needs. Once a solution is chosen, managers strategically test and experiment with small AI applications to prove their value. If the pilot is successful, managers measure AI initiatives and deploy them sustainably over time.

However, as an innovation, many managers lack a deep understanding of AI's capabilities, limitations, trends, and applications, which hinders progress in the diffusion phase. Adequate AI expertise enables managers to distinguish hype from reality, determine the benefits of AI in the context of the agency's strategic priorities, and critically evaluate vendor offerings. Resources for controlled experiments also allow managers to effectively pilot AI applications before wider adoption. Technology leadership provides an additional lens to examine the role of university administrators in implementing AI. Technical management involves the creative application of technology to achieve learning objectives and the mobilization of financial and human resources necessary for effective technology integration [15]. Key responsibilities include fostering a shared vision of how technology aligns with institutional priorities, modelling effective technology use, providing professional development and integration support, and strategic management of technology resources [3, 32].

Therefore, equipping university administrators with specific AI knowledge and technical management skills is critical to ensure appropriate and sustainable implementation of AI on campus. This includes articulating an ambitious but down-to-earth vision for the role of AI in fulfilling the institutional mission, providing targeted professional development and support, opportunities for faculty and students to learn about AI, and judicious allocation of resources

for strategic AI initiatives, as well as establishing a role for AI. management system to ensure transparency, fairness and oversight. Through these efforts, empowered university leadership can navigate the complex socio-technical environment surrounding AI in higher education, maximizing benefits while avoiding harm. The next section discusses the research methodology used in this study.

3. Research methodology

This review used a qualitative approach. The purpose of qualitative research is to understand meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of phenomena [6]. It occurs naturally, rather than being rigidly preset, and allows data to be collected early in the study to be reviewed and refined as additional data is collected [10]. Qualitative methods are appropriate for this review given its exploratory aim, focus on describing AI implementations, and identification of broader challenges and themes.

A literature review was conducted to identify key themes, challenges, and recommendations related to AI implementation in higher education and leadership. The following databases were searched: ERIC, Education Research Complete, Google Scholar, and IEEE Xplore. Search terms included "artificial intelligence" and "higher education" or "university" and "management". In addition to the literature review, examples of AI implementations were collected using LLMs GPT 3.5 and Bard from a variety of sources, including vendors, university websites, and media reports. These examples illustrate specific AI tools used in higher education and the extent of current implementation. Obtaining data from multiple sources allows for data triangulation, which increases the validity and reliability of research findings [9]. Analysing the data, five main themes emerged regarding AI implementation: technologies used, applications, challenges, management considerations and recommendations. Within each topic, sub-codes were developed to further categorize the data (e.g., specific AI techniques, potential applications in functional areas, etc). The findings provide insight into the current state of AI implementation in higher education, highlighting both opportunities and challenges for institutions and management. While AI tools promise to transform higher education, their full potential requires careful planning, strategic management, and a human-centred approach that leverages human knowledge and judgment [1, 4]. In the next section, we present the results of this study.

4. Findings

4.1. The transformative potential of AI in higher education

AI consists of machines and systems that can perceive, understand, act, and learn independently using techniques such as machine learning applied to big data [21]. The adoption of artificial intelligence in many industries has recently accelerated due to expanded datasets, improved algorithms, and increased computing power. In higher education, AI has broad applications to improve learning, research, and administration.

In education, AI can enable personalized and adaptive learning systems that tailor content, activities and feedback to students' needs and interests, improving engagement and outcomes.

For example, Carnegie Mellon University has developed an AI chemistry tutor that can improve test scores and course pass rates [30]. In terms of grading, artificial intelligence can use natural language processing to grade written assignments, reducing the grading burden on teachers. The University of L'Aquila tested a text analyser that provided students with formative feedback on their scientific writing [34]. By analysing university records and learning from analytics, AI can identify at-risk students in time for targeted intervention. Georgia State University is using AI-powered chatbots and predictive data analytics to create a new student advising system that has significantly increased graduation rates [26]. In research, AI can mine scientific literature, discover patterns in large data sets, formulate hypotheses, and automate experiments. Applications are developed across disciplines; for example, MIT researchers used artificial intelligence to identify new antibiotics [31]. On the administrative side, AI can help with admissions, admissions, financial aid, advising, and course selection through chatbots. An AI virtual assistant at the University of Georgia answered more than 5,000 admissions questions, saving staff time [25]. Operationally, AI can predict student attrition, pattern enrolment, improve building efficiency, and improve campus security through pattern recognition in security footage [29]. The benefits of AI are presented as a table 1.

Table 1
Benefits of AI.

Benefit	Description
Personalized and adaptive learning experiences	AI can be used to personalize and adaptive learning experiences for each student. This can be done by tailoring content, activities, and feedback to the individual needs and interests of each student.
Graded written assignments	AI can be used to grade written assignments, which can free up faculty time to focus on other tasks. AI can also be used to provide feedback on written assignments, which can help students improve their writing skills.
Identification of at-risk students	AI can be used to identify at-risk students early on, so that they can receive the support they need to succeed. AI can do this by analysing student data and identifying patterns that suggest that a student is at risk of failing or dropping out.
Mining scientific literature	AI can be used to mine scientific literature, which can help researchers find new insights and discoveries. AI can do this by analysing large amounts of data and identifying patterns that would be difficult for humans to find.
Discovering patterns in large data sets	AI can be used to discover patterns in large data sets. This can be helpful for researchers who are trying to understand complex phenomena. AI can also be used to identify trends and patterns in student data, which can help institutions improve their educational programs.
Automating experiments	AI can be used to automate experiments. This can free up researchers' time to focus on other tasks, and it can also improve the accuracy and efficiency of experiments.

While artificial intelligence promises to transform higher education, its benefits must be weighed against potential risks. AI systems can amplify bias in training datasets, compromising the goals of fairness and justice that should guide the ethical design and implementation of AI [14]. In addition, the widespread adoption of artificial intelligence may displace certain

leadership and mentoring roles that require human judgment that AI is currently unequalled [8]. Careful planning, ethical assurance, "enhanced" human-AI collaboration, and retraining of displaced workers will become critical as agencies consider the benefits and costs of AI in advancing their strategic missions [18, 23]. However, with the right framework, AI can transform higher education in a positive way, improving learning outcomes, research findings, and operational efficiency while driving the adaptations necessary to remain relevant in a technology-driven future [5].

Despite its great promise, thoughtful implementation of artificial intelligence involves overcoming technical, ethical, cultural, and resource barriers. Technically, today's AI systems still have several limitations that make successful implementation in higher education difficult. Compared to humans, many AI systems, for example, are reasonable in context, universality, and their decisions in explaining lower abilities. This is obvious in the dialog agent because students cannot chat with them using a complex dialogue [22]. Many researchers believe that today's artificial intelligence lacks the common-sense skills of humans.

Ethically, the "black box" nature of some AI algorithms and the reliance on big data increases the risk of bias and unfairness in the long run. The potential for bias and inequality in artificial intelligence algorithms underscores the need for ethical frameworks to guide system design and use. In addition, artificial intelligence systems collect large amounts of student data for training and use, raising privacy concerns and questions about data ownership, management, and security.

From a cultural perspective, organizations face significant challenges in getting stakeholders to accept the rise of artificial intelligence. Many students, teachers, and staff fear that AI will dehumanize education and replace valuable human roles and expertise, leading to reluctance to adopt AI [36]. Changing the teaching practices of faculty and the workflow of administrative staff to accommodate AI also requires adapting established work culture and practices. From a resource perspective, the adequate implementation and management of AI in higher education requires access to data infrastructure, technical staff, governance mechanisms, and ongoing investment and funding, which some institutions currently lack. Collecting, annotating, and maintaining student data for AI models is expensive, and not all colleges and universities can afford it. Overall, to effectively harness the potential of AI while mitigating risk, educational institutions need to develop specific strategic plans, robust governance structures, codes of ethics, professional development, and targeted funding to support AI's long-term impact. If the technical, ethical, cultural, and resource challenges associated with AI adoption are not addressed, institutions may be at risk of harming disadvantaged students and potentially increasing educational inequity.

4.2. Key leadership roles in AI adoption

University leadership has a critical role to play in addressing the technical, ethical, cultural, and resource challenges associated with appropriate AI implementation that aligns with educational values and goals. The key leadership roles in AI adoption are presented in table 2.

As revealed in table 2, the first major responsibility is to articulate a strategic vision for AI adoption that aligns with broader institutional priorities and initiatives. Leaders must communicate the benefits of AI in a transparent and responsible manner to gain buy-in from stakeholders

Table 2
Key leadership roles.

Finding	Responsibility of university leadership
Articulate a strategic vision	University leaders must articulate a strategic vision for AI adoption that aligns with broader institutional priorities and initiatives. They must also communicate the benefits of AI in a responsible and transparent manner to gain buy-in from campus stakeholders.
Foster an institutional culture	University leaders must foster an institutional culture that is open to experimentation and evaluation of new AI tools. They can do this by providing training programs to improve the AI skills of faculty and students, and by offering incentives and support for faculty and staff to participate in AI pilots and experiments.
Gather and allocate resources	University leaders must gather and allocate the necessary financial, staffing, infrastructure, privacy, governance, and administrative resources to ensure the sustainable implementation of AI solutions on campus. This may include establishing a dedicated oversight committee or panel to formally review AI initiativzes to ensure adherence to institutional values and policies.
Seek external partnerships	University leaders should actively seek external partnerships with peer institutions and the broader higher education community to identify, share, and expand best practices for ethical and sustainable AI implementation. This may involve establishing research collaborations between institutions focusing on the governance, regulation and implementation of AI.

across campus [37]. Developing a coherent strategic plan can help drive ethical and sustainable AI implementation. Second, leaders must foster an institutional culture open to experimenting with and evaluating new AI tools. As discussed by Zheng and Webber [37], initiatives like training programs to build AI skills and incentives for participating in pilots can promote openness to change. Leaders also play a crucial role in ensuring diversity in AI design teams to mitigate algorithmic bias. Formal reviews of AI systems are needed to assess potential disparate impacts on marginalized groups [27]. Third, leaders must allocate necessary resources for AI adoption including finances, staffing, infrastructure, and governance mechanisms. Berkman Klein Center [7] highlights the value of a dedicated AI oversight committee to ensure alignment with institutional values. Finally, leaders should seek partnerships with peer institutions to share best practices around ethical AI adoption in higher education. Overall, visionary leadership is key to charting a responsible course for AI that advances education while upholding human values.

4.3. AI technology management

University leaders face a complex responsibility for the effective use of artificial intelligence in higher education institutions. To fully realize the potential benefits of artificial intelligence while mitigating risks, technical leadership skills are needed to foster shared vision, role models for innovative use, capacity building, and resource management [3, 15, 37]. Technical leadership skills enable technology experts to drive innovation and business value. Key skills include

deep technical expertise, strategic thinking, communication across domains, team building, project management, and the agility to adapt to a changing technology landscape through continuous learning. Technical leaders blend technical depth with business acumen to leverage technology to meet organizational goals. A shared vision for AI implementation is critical to gaining buy-in and aligning initiatives with institutional goals. Effectively communicating how AI can define and drive the university's mission is critical to fostering buy-in from a variety of campus stakeholders. Managers must not only articulate the goals and expected outcomes of AI projects, but also lead by example in the use of AI. For example, leaders can demonstrate AI applications in presentations and forums to introduce to the campus community.

Capacity building through user-centred professional development and technical support is critical to equipping workers and students with the AI knowledge and skills they need to reap the benefits. Unlike traditional technologies, the implementation of artificial intelligence requires greater facilitation, oversight, and ethical safeguards due to its complexity [17]. Therefore, leaders must lay the foundation for an environment that encourages experimentation, equitable access, and ethical use. Resource management roles are critical to carefully acquiring and scaling AI infrastructure, tools, and expertise based on learning needs, financial constraints, and ethical guidelines. From the point of view of technology management, the implementation of AI should be critically evaluated in terms of educational utility and fiscal responsibility. Managers must avoid the tendency to pursue new technologies solely for the sake of novelty. Instead, they must make prudent investments based on solid research and evidence of the value of new technologies. To be successful, university leaders aiming to harness the innovative and transformative potential of AI must employ technical leadership skills that match AI's disruption. This includes effectively communicating the value of AI, modelling the intended use of the technology, promoting equitable access and ethical adoption, and judiciously allocating scarce resources to responsibly promote innovation. Technology leaders can pave the way for artificial intelligence to augment, not replace, the ability of humans to serve educational and social purposes.

From the foregoing, it can be noted that technological leadership refers to a university's ability to pioneer new technologies through research and innovation. MIT developing robotic technologies is an example. Technological management refers to a university's ability to effectively adopt and implement technology. UC Berkeley using learning management systems and digitizing libraries demonstrates technological management. Thus, technological leadership is about pioneering innovation and disruption while technological management is about the prudent adoption and governance of technology for business benefit. Leading universities need to balance both leadership and management of technology.

4.4. Providing leadership to succeed in AI

Equipping university leaders with the expertise, funding and support needed to actively manage the implementation of AI on campus is critical to fully realizing AI's potential benefits while mitigating ethical and cultural challenges. As Gandomi and Haider [16] argue, for managers to make sound strategic, operational and investment decisions related to AI implementation, they need to be fluent in the capabilities, limitations, and nuances of different AI solutions. Continuing education initiatives that include providing higher education leaders with the latest knowledge

of AI trends, technologies, applications, risks, and potential to improve learning and performance can thus increase strategic leadership capabilities. With a deep understanding of AI's capabilities and limitations in an educational context, leaders will be better equipped to critically evaluate AI solutions and separate hype from reality. This informed understanding allows leaders to focus investments on AI applications that closely align with specific institutional needs, learning goals, and values [13]. Once the strategic AI knowledge is in place, managers can move to trial selected AI tools and build momentum for wider adoption. Investing in clear budget allocations and ensuring buy-in from key stakeholders such as teacher leaders are important initial steps. This helps organizations move through Rogers' [28] innovation phase, building trust and comfort with AI, as initial trials generate actionable insights that inform subsequent stages of implementation. Strengthening governance requires, in addition to expertise and funding, oversight structures and support mechanisms that institutionalize effective and ethical governance of AI. This includes establishing advisory boards, developing clear policies and frameworks for ethical and fair AI, developing the technical infrastructure to handle rapidly growing volumes of student data, and establishing professional development programs for faculty and staff to continuously increase the capacity of AI users.

Providing leadership with the necessary expertise, financial resources, oversight structures, policy frameworks, technological infrastructure, professional networks, and change management capabilities is critical to successfully harnessing the enormous but untapped potential of AI to transform higher education while maintaining institutional values and operating with integrity and transparency to the campus community. With empowered leadership, universities can better develop sustainable and humane curricula for the responsible adoption and implementation of AI based on ethics, equity, evidence, and educational excellence.

5. Conclusion

The findings reveal that while AI holds enormous potential to transform functions like teaching, research, and administration, major technical, ethical, cultural and resource barriers must still be addressed. Key opportunities include personalized and adaptive learning, automated grading, identifying at-risk students, accelerating research, and streamlining operations via chatbots. However, limitations around bias, transparency, and explainability pose risks, along with potential resistance from faculty fearing job loss. Sustainable implementation also requires substantial investments in staff, data infrastructure, and governance mechanisms.

Empowered leadership is critical to advance responsible AI adoption. University administrators need strategic plans aligning AI with institutional goals, oversight structures to ensure accountability, policies and codes of ethics, targeted resources and staffing, and collaboration with other institutions to share best practices. With expertise, funding and support, leadership can foster a culture embracing thoughtful AI experimentation. They can also demonstrate AI's value, promote equitable access, and manage resources judiciously. Overall, while AI holds transformative potential, realizing the full benefits requires strong governance, strategic investment, and a human-centric approach leveraging AI to augment human capabilities and educational excellence. Further research should continue exploring implementation challenges and solutions across institutional contexts.

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