RS Global Journals

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	ARTIFICIAL INTELLIGENCE AND ETHICAL IMPLICATIONS IN SOUTH AFRICAN HIGHER EDUCATION: A POLICY FRAMEWORK PERSPECTIVE
ARTICLE INFO	Elizabeth Oluwakemi Ayandibu. (2024) Artificial Intelligence and Ethical Implications in South African Higher Education: A Policy Framework Perspective. *International Journal of Innovative Technologies in Economy*. 3(47). doi: 10.31435/rsglobal_ijite/30092024/82111
DOI	https://doi.org/10.31435/rsglobal_ijite/30092024/82111
RECEIVED	07 August 2024
ACCEPTED	26 September 2024
PUBLISHED	30 September 2024
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

ARTIFICIAL INTELLIGENCE AND ETHICAL IMPLICATIONS IN SOUTH AFRICAN HIGHER EDUCATION: A POLICY FRAMEWORK PERSPECTIVE

Elizabeth Oluwakemi Ayandibu
Commerce Foundation, Faculty of Commerce, Administration and Law, University of Zululand, South Africa

ABSTRACT

As an increasing number of South African universities begin to consider and implement artificial intelligence systems, there is an accompanying concern about the ethical aspects that these innovations could have on society. Public discourse and scholarly research that raise concerns about AI's impact on important societal systems, such as political and gender biases, are numerous. Current policies on higher education in South Africa are silent when it comes to how AI ethical implications may be addressed. The paper explores higher education's current focus on AI and what external policies say about ethical AI and related technologies in the context of their applications.
Robotic process automation, as one of the earlier forms of AI, is being used in South African higher education to automate administrative operations. Through a combination of a policy analysis method and case study approach, we analyze the policy framework. The paper then shows how the policy neither explicitly addresses ethical AI nor critical ICT applications like artificial intelligence and mimics systems. The paper concludes that policy framework development for addressing ethical challenges related to AI should become an immediate priority. These findings emerge from an ongoing empirical study on the South African higher education sector regarding artificial intelligence. This study contributes to policy formulation in higher education to stimulate an ethically responsible AI environment. The study's research focus on South African higher education provides a gap in current literature that is mainly focused on AI policy developments in developed nations, which currently do not have a comparative acceleration of AI and related technologies.

KEYWORDS

Artificial Intelligence (AI), Ethical Implications, Higher Education Policy, Robotic Process Automation, Policy Analysis, South African Universities, ICT Applications

CITATION

Elizabeth Oluwakemi Ayandibu. (2024) Artificial Intelligence and Ethical Implications in South African Higher Education: A Policy Framework Perspective. *International Journal of Innovative Technologies in Economy*. 3(47). doi: 10.31435/rsglobal_ijite/30092024/82111

1. Introduction.

Ensuring the ethical use of AI technology is a major concern globally. Any discussion on the use of AI technology brings to the fore the notion that AI technology has the potential not only to change the way we live and work but also to change humanity itself (Daly et al., 2022). The higher education sector, in South Africa and globally, has embraced AI technology and is using it and employing technological advancements in an attempt to address several of the challenges students and institutions confront (Hlongwane et al.2024). These advancements can range from personalized learning experiences to the development of digital libraries and conversational AI helping students access key learning and administrative content and processes. While institutions are interested in AI from a consumer's perspective, AI is also being used by institutions to address efficiency improvement, reduction in unit costs, and to bolster the international and domestic reputation of their AI and data science departments (Olan et al.2022). These advancements, whether beneficial or not, have ethical implications that need to be addressed by institutions that supply AI-based services to students.

Tertiary institutions have to grapple with the ethics of these technological advancements. South Africa, like other jurisdictions, cannot afford to have its ethical considerations trail behind the development of these

technological advancements (Stahl & Eke, 2024). Tertiary institutions need to think well in advance about what using AI technology means for these institutions, especially in a country where institutional resources are scarce and where these institutions have to grapple with issues of social justice and transformation. We voice policy framework recommendations created from South African higher education participants, focusing on standards aligned with areas of capacity building, data governance and literacy, surveillance capitalism, transparent consumer consent, and regulation in a multistakeholder collegiate structure (Boughey & McKenna, 2021). The aim is to craft a South African-specific ethical framework that is mindful of the South African context when applying principles of ethical AI.

1.1. Background and Context.

Artificial intelligence (AI) is defined as the ability of a machine or system to simulate intellectual processes like learning, reasoning, adaptation, and creation (Ezzaim et al.2022). AI is concerned with developing computing technologies that allow machines to undertake activities that can only otherwise be performed by a human by mimicking the latter's cognitive processes (Samoili et al., 2020). These technologies have the capacity to create immense social change, particularly within a higher education sector that is fundamentally about creating knowledge of a sophisticated nature. Education provisioning with its associated scholarship is to 'develop the human mind,' and AI technologies are starting to be closely associated with the creation, procurement, and de-professionalization of these activities and scholarship (Bailey & Barley, 2020).

Within a South African university context and within many global institutions, the strategic planning and development of AI and the appropriate adjustments that will be required to address the philosophical and ethical issues that have been laid are, at best, embryonic, and, at worst, ignored due to a poor perception of risk posed by AI (Mahlomaholo2020). AI innovation leads to the industrial revolution with the focus on the advances that come from the digital age of machine learning, and excellence in these fields is thought about in terms of business, military, and possibly civil servant-related strategic issues (Mhlanga, 2022). This paper is concerned with presenting a policy framework in the South African higher education context for commentary.

1.2. Research Aim and Objectives.

The main aim of this study is to engage with existing work on the governance of artificial intelligence (AI) in South African higher education. The policy frameworks reviewed in this paper pertain to making recommendations for the governance of the growing field of AI in the context of AI teaching, research, and the self-regulation of AI developers in South African higher education. The focus of this study is on a set of ethical questions regarding AI that are increasingly applying pressure on universities, specifically about AI governance and the establishment of an AI Policy Committee.

It is necessary to distinguish the AI Policy Committee defined in what follows from the newly established national ministerial-level advisory committee on AI and the Fourth Industrial Revolution, the Presidential Commission to review and guide research and innovation in the fast-developing areas of science, digital technology, and innovation, and the High-Level Taskforce to develop AI strategies and roadmaps. Overall, this aim consists of the following three objectives:

- To define governance and ethical parameters for the AI Policy Committee in South African higher education.
- To examine recent international guidelines for the ethics and education of AI and research, as well as the potential governance frameworks and committee demands in the South African context.
- To contextualize the potential recommendations for South African universities through surveys and interviews aimed at AI stakeholders, which include experts who work in a range of important South African university contexts and faculty members in significant AI disciplines.

2. Artificial Intelligence in Higher Education.

The move towards the development of intelligent learning environments as components of computer-aided learning tools has seen both an increase in research and development in learning technologies (Mhlongo et al., 2023). In recent years, web-based collaborative learning has received a lot of attention in higher education. The increasing number of students in higher education has encouraged educators and educational researchers to consider how technology can be used to support and facilitate the learning process (Oluwajana et al., 2021). A greatly increased awareness and fear of the impact of assistive technologies has become more apparent. As far back as the use of e-learning and its tremendous potential for enhancing learning processes and improving the quality of education is undisputed.

Artificial intelligence has a long history of impacting on the higher education sector, mainly through research projects connected to teaching and learning and to a lesser extent, the management of the institutions themselves (Chen et al., 2020). Numerous applications of AI techniques target the enhancement of adaptive education and offer intelligent tutoring systems in a structured learning process. Innovative platforms that encompass AI in its fullness can create a completely new suite of tools for the digital learning environment that integrates augmented and virtual reality and can be used to enhance many forms of learning (Alam, 2021). Such systems have broader uses for an even more immense variety of other pedagogical purposes when integrated with a variety of other teaching methodologies.

2.1. Overview of AI Technologies.

This section aims to address the relationship between AI and education based on a policy framework in South Africa. The section begins with an explanation of the concepts of AI and technology and their relationship. Schools, like all other parts of society, are affected by advances in technology. This has implications for curriculum, pedagogy, and assessments. It also leads to explorations about the nature of intelligence. Historically, education has seen technology as the domain of vocational education, and educational notions have been slow to change. This is mainly due to an adherence to a particular type of 'education' and/or philosophical resistance. The role of educators in shaping society reflects the type of society that is being envisioned. As the rate of technological change accelerates, it is very important to consider thoughtful and responsible ways to use technology and what role schools and educators have in shaping the direction technology takes (Haleem et al.2022).

The concept of artificial intelligence was first introduced in 1956 at a summer workshop (Cai et al., 2021). It was stated that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it (von et al.2020) . Progress had been disappointing for early workers because they severely underestimated the depth of the task that they had undertaken and warehoused most of the important conceptual problems under the label of 'logic'. Intelligence was defined as the quality that distinguished animals and machines that were functioning in a manner considered to be of a high standard. Intelligence was also defined as the ability of an organism to adjust itself effectively in its environment. Intuitively (Mikalef & Gupta, 2021). Intelligence had also been understood as the ability of an organism to do things that were characteristically human. Intuitively, intelligent beings were capable of processing information. Intelligence was understood to have certain faculties, which included problem solving, perception, visual-spatial positioning, speech recognition, learning, action, and language abilities (Markauskaite et al.2022).

2.2. Applications of AI in Higher Education.

Whilst the terms 'Artificial Intelligence' and 'Higher Education' are distinct concepts, it is crucial to acknowledge that they are indeed intertwined. The Fourth Industrial Revolution is not just about the technological development and applications of artificial intelligence, advanced robotics, and autonomous vehicles (Oosthuizen, 2022). Simply put; to prepare a workforce for the changes happening in businesses and industries across the globe today, it is crucial to equip them with the skills they require to be successful in the 21st century. Higher education plays a significant role in this paradigm by producing graduates who have both the cognitive and critical thinking abilities to navigate and function in a world dominated by smart machines (Liu & Pásztor, 2022). This mission can significantly be enhanced with the incorporation of strong, problem-based curricular and pedagogical approaches. Artificial intelligence has transformative impacts on teaching, learning, and management in higher education which, when tapped into, can play a significant role in assisting universities to meet these goals (Kumar et al.2023).

Artificial intelligence systems have the potential to boost the activities and functionalities of most university business units and organizational processes (Haefner et al.2021). The use of these systems in academic and administrative processes can greatly enhance student services, increase the efficiency of operations, and present opportunities for a variety of personalized services. These technological applications alone are bringing the potential to streamline operations by improving responsiveness, reducing human error, and decreasing staff satisfaction times while allowing preference-based functionalities. Such systems reinforce and enhance professional and institutional efforts to better serve an increasingly diverse and mobile student population (Haefner et al.2021).

3. Ethical Implications of AI in Higher Education.

The aim of this paper is to critically reflect on the ethics and policy implications regarding the adoption and use of artificial intelligence (AI) within the realm of South African higher education. In the paper, the author critically reflect on the ethical and policy implications of the proliferation of increasingly sophisticated "intelligent" systems. Reasons include institutionalizing fair and socially desirable uses of AI, as well as guarding against an ethical erosion of essential public trust by not safeguarding against inappropriate AI applications. The increasing stakes of existing and future AI are such that educators, universities, and other "highly impactful" AI actors must also continuously evolve an ethical and policy support framework. While increasing technological sophistication and inter-empathetic capabilities are significant, in the case of future learning systems, for example, there is the concrete danger that educators and educational policymakers become more involved in aligning real learner behavior with systems than helping learners develop to best benefit their society and, by extension, also themselves. Moreover, if implemented poorly, AI could exhibit inherent bias in the data it is trained on, among a host of other socio-cultural ethical implications. Growth and its disruption have been shown to be multifaceted and complex as a result of the adjunct of AI across sectors. Several studies have suggested that such a combination could have widespread and profound consequences for employment. Although one may argue that job displacement is not an accurate measure of job loss, several studies have made long-term predictions of AI-influenced job losses. Not only are these just a few of the systemic ethical concerns that pervade AI, but they also highlight that more sophisticated and probably nuanced policies are needed. To express these concerns succinctly: What ethical policy guardrails need to be implemented and put in place to best safeguard and promote the socially responsive and ethical use of AI in South African higher education? The fundamental question guiding this paper is what ethical policy guardrails need to be implemented and put in place to best safeguard and promote the socially responsive and ethical use of AI in South African higher education.

3.1. Ethical Concerns and Challenges.

Artificial intelligence is fast gaining traction in academic circles primarily because of its key ability to automate processes relating to administrative functions and data management. However, little is known regarding the ethical implications of using this technology in a tertiary setting, particularly the extent and nature of ethical implications, as well as the level of understanding and action by the higher education sector. An important question that needs to be asked is, how are universities ethically championing the increased juggling that the acceptance of academic ethical moral norms has become where AI is involved? This paper explores hypothetical ethical problems and challenges that AI poses to the higher education sector in South Africa. It proposes a policy framework with the potential of guiding institutions in the decision to address future ethical concerns and supporting them in the humanizing endeavor of the application of or interactions of humans with machines. Given the increasing prevalence of AI at institutions of higher learning, this trend necessitates an understanding of potential shortcomings, while allowing for the mechanisms to address these ethical challenges to the adoption of AI (Schiff2022). While there is a substantial amount of international research on ethical AI in higher learning, the understanding of ethical implications of such a phenomenon is subtly different or nuanced across countries; as such, it requires specific consideration at the national or at least institutional policy level.

3.2. Existing Ethical Frameworks.

Germany is home to some of the world’s most well-respected technology and engineering universities (Schneider2024). After a public debate in 2010, the Federal Ministry of Education and Research drafted and amended the ‘Code of Conduct for Scientific Work’ with member institutions of the German Science and Humanities Council. In a similar policy perspective, Lithuania opened a public discussion on a Draft Code of Conduct for Higher Education and Science, while in the USA, a university created an ethics resource database, including documents and manuals on artificial intelligence and the ethical considerations surrounding it (Huang et al.2022), including standard setting, policy, and strategic material. It is interesting to note the similarity between some of the critical principles underpinning ethical frameworks of institutions and academia and the Cape Town Convention and the Ethical Standards subsection in Part D of the NACI Code of Conduct.

This section presents an overview of the ethical frameworks guiding artificial intelligence development worldwide, including Ethiopia and Slovenia. Although Ethiopia may be one of the last countries to set out its policy draft for public input in 2020, it is crucial to mention that in 1969, the International Committee on Science and Technology by UNESCO drafted a ‘Universal Code of Ethics for Science’ which may still guide

the Africa-led global initiative for AIIP, which in turn initiated a Call for Proposals to develop a policy draft for public input for the development of an 'Artificial Intelligence for Public Value: A Policy Framework'.

4. Policy Frameworks in South African Higher Education.

South African higher education has been through several policy frameworks. This section provides an overview of the main frameworks that are directly relevant to the broader topic of the integration of AI in higher education. Reports and studies that focus more narrowly on technologies, such as blended learning or e-learning, are not engaged in this study, as the focus of the research does not only consider AI or the technology, but rather the broader implications of integrating such technologies into higher education that include ethical, legal, and institutional implications.

Firstly, the White Paper for post-school education and training specifically mentioned the use of technology in higher education and stated that as one avenue to address the acute shortage of skilled professionals (Aluko et al., 2022). The development of technologies of teaching and learning that enable flexible learning pathways for students and the use of technology in the management and administration of technical and vocational education and training and community education would provide new opportunities for access and flexibility (Beer & Mulder, 2020). This policy, however, is very vague about how ICTs could do this and does not deeply engage the discussion regarding the types of technologies, with a reference to the ancillary development of lab sciences and technologies facilitated by the training of education and training teachers and lecturers and much original research being performed in universities.

4.1. Current Policies and Regulations.

This paper explores the implications of ethically driven decision-making in a data-driven society, focusing on educational institutions. The regulation outlines an ethical stance on the use of personal data, including a requirement for privacy by design. Recent discussions of AI and principles relating to justice, among others, bring a similar focus on ethics and quality to the discourse. This paper explores emergent policies and regulations in South African higher education data systems to consider the degree to which institutional policies and regulations already embody an ethical focus.

Considering that South Africa is a developing country with access to the best global practices and knowledge but faces many local socio-economic challenges, it is interesting to consider to what degree and where policies and regulations could benefit from ethics and AI principles. In a data-driven society (Aderibigbe et al.2023), where AI is providing insights and, sometimes, key decisions, informed by no observable, let alone ethical considerations, how can society develop an ethics-infused approach to data governance based on policy analysis of this rich data source?

4.2. Need for AI-specific Policies.

It is apparent that the responsible AI guidelines derived from South African law can be achieved through the current governing statutes and policy frameworks (Wakunuma et al.2022). The challenge is that to hold institutions accountable for their intelligent systems, the responsible use and governance of AI requires more specific AI policies contextualized within South Africa's unique moral and cultural cosmopolitan communion. General governing frameworks can only act as broad leadership outlines and incentive structures within which AI policy principles and practices can be articulated, developed, and maintained. The impediment is that these data policies, even though created for data exploitation, do not primarily focus on the risks associated with analytical accountability and control. The regular policy revision processes do not often give consideration to the ethical implications of emerging technologies such as AI.

5. Integration of AI and Ethics in Higher Education Policy.

There are only a few higher educational institutions that have policies specifically dedicated to the ethical implications of AI. Therefore, a new dedicated comprehensive AI ethical policy is needed for South African higher education. It is necessary for this policy to be accompanied by related institutional practices for the use of AI in higher education to grow while meeting constitutionally appropriate national transformative higher educational goals. It is important that the delay in creating explicit AI user policies should not hinder AI growth in higher education (Pisica et al., 2023). The emergence of AI is putting some pressure on their organizational practices in terms of inequality in education and employment.

South African society still struggles with the legacies of apartheid. The education system continues to represent an important part of societal transformation. Higher education is a particularly important element of

leadership and professional education, but it also produces people who go into a variety of societal roles, thereby continuously building society (Mishra, 2020). Technology in education can close the inequality gap that exists in the education system, but any content and design procedures that are included in South African AI used in higher education must be designed to consider South Africa's unique national security and societal needs.

5.1. Importance of Ethical Considerations.

Artificial Intelligence (AI) systems can make fast and efficient decisions on subjects such as administrative support, testing, and teaching (Ahmad et al.2022). The involvement of technology in making inevitable decisions in education raises many questions about whether decisions will maintain ethical standards in decision-making. South African higher education has a complex and dynamic relationship with AI, involving different intrusive technologies, which have practical as well as normative dimensions (Prinsloo & Kaliisa, 2023). The practical dimensions involve actual usage, including physical and computational resources as well as related infrastructure. The normative dimensions involve concerns about ethical implications, including broader ethical, social, and humanistic concerns.

Current literature in the AI arena focuses mainly on data privacy rules, with limited realization of the ethical implications exposed by some of the AI systems used in South African higher education settings (Raimundo & Rosário, 2021). The policy framework perspective claims that imposing ethical restrictions on AI would mean disrupting technical progression. Despite AI's complexities, technology ethics can help steer the development of AI in solving complex problems. Developing an AI policy framework for South African higher education requires seriousness about the role played by ethical codes and administrative law in the field of information science. This paper takes a policy framework perspective to discuss the important role of the bounded AI model. It is the AI representative of South African higher education institutions that brings advances in information science research using AI in specific South African domains.

5.2. Proposed Policy Recommendations.

The journey towards elevating the very existence of higher education in the South African context has seen considerable progress, incorporating significant investment in the latest digital infrastructure. Nonetheless, as the need arises for the proliferation of online and digitally enabled blended modes of learning and teaching, it became apparent that policy guidelines were urgently required. Of particular significance is the government's recognition that the investment in digital learning has much broader implications for the future of work and the overall citizenry of the country. We argue that these institutionalized systems cannot remain relevant in a contemporary society, predisposing the need for radical policy shifts.

While artificial intelligence plays a significant role in the proposed digital learning strategies at South African universities, in a developing country context, ethical considerations are seldom given the same thrust as that of technological advances. As machine intelligence transforms every aspect of the global economy, creating new industries and affecting the structure of automation in existing industries, the transitioning of the South African economy and society necessitates consideration of the ethical, legal, and social understanding of the impact of these technologies on higher education. With the latest national policy on higher education, science, and innovation specifically endorsing reform to promote greater equity and inclusivity in the sector, it is critical to illuminate some of these foundational considerations.

6. Conclusions.

This paper discussed the ethical implications that the advancement of AI poses to the higher education sector. South Africa faces multifaceted challenges that include funding, staff recruitment and retention, student mobility, and inclusivity. The acceptance and embedding of AI in this environment require developing and maintaining a supportive ethical environment. The paper suggested a framework to input into higher education organizational AI policies and guidelines. It is important for all stakeholders in South African universities to engage in dialogue on AI in the sector to ensure that negative ethical implications are attenuated and positive ones harnessed.

While researchers from South Africa have written about AI and education, the paper seems to be the first to address the impact of AI and its ethical implications in the South African higher education policy domain. This paper provided South African policymakers and higher education practitioners with an approach to developing and implementing AI policies and guidelines. The proposed framework focused on understanding AI technologies and emphasized the role of ethical principles as well as organizations' values and responsibilities.

6.1. Key Findings and Contributions.

The key point made is the necessity of addressing ethical implications and responsibilities of AI, machine learning, deep learning, and other AI paradigms involved in academia, particularly in South African higher education. The necessary pressures on the training and eventual accountability of AI are to strike the right balance between good and harm. Ethical and responsible policies and regulations for AI development and applications within South African higher education are critical (Kiemde & Kora, 2022). The right kinds of regulation and policy for AI in South African higher education should be based on five fundamental principles: accountability, action, global strategy, adaptability, and the collaboration of the public sector, related institutions, the private sector, and the public to support stronger AI research funding.

Furthermore, to introduce broader AI training and a generally agreed-upon structure, the Ministries of Higher Education and Research and Technology of South African universities must now invest in initiating and mandating AI programs that are both required for current employment needs and able to serve as a gateway for the new digital future of work. This may lead to potentially significant growth (Arakpogun et al.2021). Similar support and shared investment in current South African interdisciplinary research at the boundaries, characterized by an AI-driven South African approach to social, legal, and ethical research, need to be strengthened. Finally, contributions include demonstrated experience in industry-driven AI research investments and a robust network of established South African AI accelerators, innovation hubs, start-ups, and related spinoffs. Collaborations on AI, education, and e-business also emphasize the combined strategic effect of AI in a global context (Rapanyane & Sethole, 2020).

6.2. Future Research Directions.

There is an urgent need to increase theoretical and empirical research that addresses potential negative or unintended consequences of AI in higher education institutions in South Africa. Future research must not only limit itself to addressing fundamental ethical long-term challenges that might occur because of AI, but it should also investigate the economic, social, and policy implications as a result of implementing AI technologies in respective South African higher education institutions. When the research focus moves from technical to broader societal, ethical, legal, business, governmental, state, institutional, individual, and social implications of applying AI in educational settings and at university level in South Africa, it is important that South African society is not forgotten when addressing AI in higher education institutions.

Extensive empirical research will be necessary to understand, conceptualize, and analyze the issues directed by ethical theories regarding AI in higher education institutions in South Africa. For instance, using data to calculate the overall cost of AI deployment in higher education institutions by determining the economic value of the data as an intangible asset; strengthen business cases for investing in AI and to justify the ongoing costs of maintaining the data and the systems. This would also include identifying which educational structures students prefer to learn from, which would help direct future educational policy. Lastly, to highlight the resources required for maintaining and operationalizing policies, to protect students and staff from policy harm. It might then also be that recommendations to accentuate the process of generating practical ethical guidelines could be developed, focusing intensely on how AI technology can affect institutions, students, and parents for the better.

REFERENCES

1. Aderibigbe, A. O., Ohenhen, P. E., Nwaobia, N. K., Gidiagba, J. O., & Ani, E. C. (2023). Artificial intelligence in developing countries: bridging the gap between potential and implementation. Computer Science & IT Research Journal, 4(3), 185-199. fepbl.com
2. Ahmad, S. F., Alam, M. M., Rahmat, M. K., Mubarik, M. S., & Hyder, S. I. (2022). Academic and administrative role of artificial intelligence in education. Sustainability, 14(3), 1101. mdpi.com
3. Alam, A. (2021, November). Possibilities and apprehensions in the landscape of artificial intelligence in education. In 2021 International Conference on Computational Intelligence and Computing Applications (ICCICA) (pp. 1-8). IEEE. [HTML]
4. Aluko, R., Krull, G., & Mhlanga, E. (2022). Shaping open, distance and e-learning in post school education and training: A call for a revised agenda. Perspectives in Education. ufs.ac.za
5. Arakpogun, E. O., Elsahn, Z., Olan, F., & Elsahn, F. (2021). Artificial intelligence in Africa: Challenges and opportunities. The fourth industrial revolution: Implementation of artificial intelligence for growing business success, 375-388. northumbria.ac.uk

6. Beer, P. & Mulder, R. H. (2020). The effects of technological developments on work and their implications for continuous vocational education and training: A systematic review. Frontiers in psychology. frontiersin.org
7. Boughey, C. & McKenna, S. (2021). Understanding higher education: Alternative perspectives. oapen.org
8. Cai, Z., Liu, L., Chen, B., & Wang, Y. (2021). Artificial Intelligence: From Beginning to Date. worldscientific.com
9. Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. Ieee Access. ieee.org
10. Daly, A., Hagendorff, T., Hui, L., Mann, M., Marda, V., Wagner, B., & Wei Wang, W. (2022). AI, Governance and Ethics: Global Perspectives. deakin.edu.au
11. Ezzaim, A., Kharroubi, F., Dahbi, A., Aqqal, A., & Haidine, A. (2022). Artificial intelligence in education-State of the art. International Journal of Computer Engineering and Data Science (IJCEDS), 2(2). researchgate.net
12. Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021). Artificial intelligence and innovation management: A review, framework, and research agenda☆. Technological Forecasting and Social Change, 162, 120392. sciencedirect.com
13. Hlongwane, J., Shava, G. N., Mangena, A., & Muzari, T. (2024). Towards the integration of artificial intelligence in higher education, challenges and opportunities: the African context, a case of Zimbabwe. Int J Res Innov Soc Sci, 8(3S), 417-435. researchgate.net
14. Huang, C., Zhang, Z., Mao, B., & Yao, X. (2022). An overview of artificial intelligence ethics. IEEE Transactions on Artificial Intelligence, 4(4), 799-819. ieee.org
15. Kiemde, S. M. A. & Kora, A. D. (2022). Towards an ethics of AI in Africa: rule of education. AI and Ethics. springer.com
16. Kumar, D., Haque, A., Mishra, K., Islam, F., Mishra, B. K., & Ahmad, S. (2023). Exploring the transformative role of artificial intelligence and metaverse in education: A comprehensive review. Metaverse Basic and Applied Research, 2, 55-55. semanticscholar.org
17. Liu, Y. & Pásztor, A. (2022). Effects of problem-based learning instructional intervention on critical thinking in higher education: A meta-analysis. Thinking Skills and Creativity. sciencedirect.com
18. Mahlomaholo, G. S. (2020). Creating decolonial sustainable learning environments for the fourth industrial revolution in the rural and urban higher education contexts: a study of inclusive management strategies. Alternation: Interdisciplinary Journal for the Study of the Arts and Humanities in Southern Africa. ump.ac.za
19. Markauskaite, L., Marrone, R., Poquet, O., Knight, S., Martinez-Maldonado, R., Howard, S., ... & Siemens, G. (2022). Rethinking the entwinement between artificial intelligence and human learning: What capabilities do learners need for a world with AI?. Computers and Education: Artificial Intelligence, 3, 100056. sciencedirect.com
20. Mhlanga, D. (2022). Human-centered artificial intelligence: The superlative approach to achieve sustainable development goals in the fourth industrial revolution. Sustainability. mdpi.com
21. Mhlongo, S., Mbatha, K., Ramatsetse, B., & Dlamini, R. (2023). Challenges, opportunities, and prospects of adopting and using smart digital technologies in learning environments: An iterative review. Heliyon. cell.com
22. Mikalef, P. & Gupta, M. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm …. Information & management. sciencedirect.com
23. Mishra, S. (2020). Social networks, social capital, social support and academic success in higher education: A systematic review with a special focus on 'underrepresented' students. Educational Research Review. [HTML]
24. Olan, F., Arakpogun, E. O., Suklan, J., Nakpodia, F., Damij, N., & Jayawickrama, U. (2022). Artificial intelligence and knowledge sharing: Contributing factors to organizational performance. Journal of Business Research, 145, 605-615. sciencedirect.com
25. Oluwajana, D., Adeshola, I., & Clement, S. (2021). Does the use of a web-based collaborative platform reduce cognitive load and influence project-based student engagement?. Current Psychology. researchsquare.com
26. Oosthuizen, R. M. (2022). The fourth industrial revolution–Smart technology, artificial intelligence, robotics and algorithms: industrial psychologists in future workplaces. Frontiers in artificial intelligence. frontiersin.org
27. Pisica, A. I., Edu, T., Zaharia, R. M., & Zaharia, R. (2023). Implementing artificial intelligence in higher education: Pros and cons from the perspectives of academics. Societies. mdpi.com
28. Prinsloo, P. & Kaliisa, R. (2023). Dimensions of privacy and its implications for learning analytics. Preliminary insights from/for African higher education. Learning. tandfonline.com
29. Raimundo, R. & Rosário, A. (2021). The impact of artificial intelligence on data system security: A literature review. Sensors. mdpi.com
30. Rapanyane, M. B. & Sethole, F. R. (2020). The rise of artificial intelligence and robots in the 4th Industrial Revolution: implications for future South African job creation. Contemporary Social Science. [HTML]
31. Stahl, B. C. & Eke, D. (2024). The ethics of ChatGPT–Exploring the ethical issues of an emerging technology. International Journal of Information Management. sciencedirect.com
32. Samoili, S., Cobo, M. L., Gómez, E., De Prato, G., Martínez-Plumed, F., & Delipetrev, B. (2020). AI Watch. Defining Artificial Intelligence. Towards an operational definition and taxonomy of artificial intelligence. ugd.edu.mk

33. Schiff, D. (2022). Education for AI, not AI for education: The role of education and ethics in national AI policy strategies. International Journal of Artificial Intelligence in Education, 32(3), 527-563. [HTML]
34. Schneider, C. P. (2024). Innovative German technology in sub-Saharan Africa: Where is it used?. International Journal of technology management & sustainable development, 22(3), 245-273. [HTML]
35. Wakunuma, K., Ogoh, G., Eke, D. O., & Akintoye, S. (2022, May). Responsible AI, SDGS, and AI governance in Africa. In 2022 IST-Africa Conference (IST-Africa) (pp. 1-13). IEEE. researchgate.net
36. von Rueden, L., Mayer, S., Sifa, R., Bauckhage, C., & Garcke, J. (2020). Combining machine learning and simulation to a hybrid modelling approach: Current and future directions. In Advances in Intelligent Data Analysis XVIII: 18th International Symposium on Intelligent Data Analysis, IDA 2020, Konstanz, Germany, April 27–29, 2020, Proceedings 18 (pp. 548-560). Springer International Publishing. springer.com