

Harnessing Artificial Intelligence to Transform Education in South Africa

Introduction

Artificial Intelligence (AI) has emerged as a significant force in education worldwide. In South Africa, a nation characterised by deep historical inequities and a pronounced digital divide, the potential for AI to reshape teaching and learning is particularly compelling. Facing challenges such as overcrowded classrooms, a shortage of well-trained educators and a mismatch between education outcomes and the demands of the future job market, South Africa is under increasing pressure to innovate. AI-driven solutions, from adaptive learning systems to data-enhanced teacher support, promise to improve the quality of education and provide critical upskilling opportunities for learners facing an uncertain economic future.

AI should be harnessed as an assistive tool to augment human capacity in South African education, empowering teachers, bridging inequities in access, enriching curriculum delivery and boosting learners' employability, provided that its deployment is accompanied by investments in infrastructure, teacher training and ethical safeguards to ensure no one is left behind.

Teacher Training and Support

AI has the potential to improve teacher training and classroom support. Several studies (Ayanwale et al., 2024; Mbambo and Du Plessis, 2024) have demonstrated that AI can automate routine tasks, such as grading, attendance tracking and administrative reporting, thereby freeing educators to focus on more nuanced pedagogical interactions. AI-powered analytics have also proven beneficial in identifying learning gaps, enabling a more tailored instructional approach (Ayanwale et al., 2024). Despite these opportunities, research from South Africa indicates that many teachers are not adequately prepared to integrate AI into their teaching practices. Surveys and qualitative studies reveal that insufficient pre-service and in-service training leave educators feeling overwhelmed by the technical and pedagogical demands of AI technologies (Ayanwale et al., 2024; Ntsobi and Mwale, 2024). These studies underscore the urgent need for robust professional development initiatives that not only introduce AI tools but also cultivate a broader understanding of digital pedagogy.

The Digital Divide

The digital divide remains a persistent issue in South Africa, with stark contrasts in technology access between urban and rural areas (Moloi and Mhlanga, 2021). While AI-driven learning systems offer the promise of individualised educational support, their successful deployment hinges on reliable ICT infrastructure. Evidence suggests that many under-resourced schools lack the basic connectivity and hardware required to support such technologies (Moloi and Mhlanga, 2021; Dalberg, 2024). However,

targeted AI applications, such as mobile learning apps designed for low-bandwidth environments, have demonstrated potential to reach remote learners effectively (Dalberg, 2024). AI tools that support multilingual education or provide offline functionalities can help mitigate the risk of further marginalising disadvantaged communities (UNESCO, 2019). Therefore, while AI has the potential to narrow the digital divide, its benefits can only be realised through concurrent investments in technology infrastructure and inclusive policy frameworks.

Curriculum Development

Curriculum development is undergoing significant transformation in the wake of the Fourth Industrial Revolution (4IR). In South Africa, the integration of coding, robotics and other digital skills into the formal curriculum is a notable step towards equipping learners for an AI-driven future (Ntsobi and Mwale, 2024). Research indicates that AI can play a dual role in this domain. On one hand, it can serve as a subject matter in itself, fostering digital literacy, computational thinking and ethical reasoning; on the other, AI can act as a tool to refine curriculum delivery. For instance, adaptive learning systems provide real-time feedback that can inform curriculum adjustments, ensuring that educational content remains responsive to learner needs (UNESCO, 2019). However, to avoid misalignment with local educational standards such as the Curriculum and Assessment Policy Statement (CAPS), any integration of AI must be carefully calibrated to the South African context. This calls for ongoing collaboration between curriculum developers, educational technologists and industry experts.

Employability Skills Development

A growing body of literature emphasises the role of AI in developing employability skills among young South Africans. The nation faces a severe youth unemployment crisis, and skills mismatches in the labour market further compound the problem (Borgen Project, 2023). AI-focused initiatives, such as the Intel® AI for Youth programme and the Microsoft–Youth Employment Service (YES) partnership, have been lauded for providing learners with hands-on experience in digital technologies (Borgen Project, 2023; Nyakundi). These programmes typically combine technical training with soft skills development, such as problem-solving and critical thinking, which are essential in a rapidly evolving economic landscape. However, while such initiatives have achieved initial success, scaling them to reach a broader segment of the population remains a significant challenge. There is need for a more integrated approach that aligns formal education with industry needs, thereby ensuring that AI-driven upskilling initiatives contribute effectively to national economic development (National Department of Communications & Digital Technologies, 2023).

Recommendations

The following recommendations are proposed to harness AI's full potential in transforming education and upskilling in South Africa:

- 1. Invest in Comprehensive Teacher Training**

- Develop robust in-service and pre-service professional development programmes focused on AI literacy and digital pedagogy.
- Establish partnerships between teacher-training institutions and technology providers to offer hands-on, AI-focused workshops.
- Create communities of practice and continuous support networks for teachers to share best practices and troubleshoot challenges.

2. Strengthen ICT Infrastructure in Under-Resourced Schools

- Prioritise funding for extending high-quality internet connectivity, reliable electricity, and modern digital devices to rural and township schools.
- Support the development and deployment of low-bandwidth and offline-capable AI learning tools that can operate in challenging environments.
- Engage in public-private partnerships to leverage technological expertise and capital for infrastructure improvements.

3. Integrate AI and Digital Skills into National Curricula

- Revise curriculum frameworks to include digital literacy, computational thinking and basic AI competencies from early schooling onwards.
- Encourage adaptive learning systems that provide real-time feedback to educators and inform continuous curriculum refinement.
- Ensure that AI-related content aligns with local educational standards while remaining flexible to incorporate emerging technologies and methodologies.

4. Scale Up AI-Driven Upskilling Initiatives:

- Integrate successful AI training programmes (e.g. Intel® AI for Youth, Microsoft–YES) into the formal education system and TVET colleges.
- Develop apprenticeship and internship programmes in collaboration with industry partners to provide real-world AI training.
- Promote lifelong learning initiatives, including short courses and micro-credentials in AI and digital skills, to ensure that both students and mid-career professionals remain competitive.

5. Adopt Ethical and Responsible AI Frameworks

- Formulate and implement national guidelines for the ethical use of AI in education, addressing issues such as data privacy, algorithmic transparency, and bias mitigation.

- Involve educators, parents, students, and industry stakeholders in the development of oversight committees to monitor AI deployments.
- Ensure that AI is positioned as a tool to support, rather than replace, human educators, thereby preserving the central role of teachers in the learning process.

Conclusion

Artificial Intelligence holds transformative potential for South Africa's education system. As evidenced by empirical studies and pioneering initiatives, AI can significantly augment teacher capacity, personalise learning, and prepare students for a competitive, digital economy. However, the successful integration of AI in education requires more than the mere adoption of new technologies. It necessitates strategic investments in teacher training, infrastructural improvements, curriculum reform, and robust ethical frameworks.

This paper contends that by harnessing AI as an assistive tool, rather than a replacement for human educators, South Africa can create a more inclusive, dynamic, and future-ready educational ecosystem. Policymakers must seize the opportunity to implement targeted measures that ensure equitable access and practical upskilling. Through concerted collaboration between government, industry, and the education community, AI can become a catalyst for sustainable development, ensuring that no teacher is left unsupported and no learner is left behind in the digital era.

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