

| IDEATE TECH POLICY AFRICA

The Role of Artificial Intelligence in African Education Systems Case Study: The Use of Automated Decision-Making in Form One Placements in Kenya

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Acronyms & Abbreviations

AI	Artificial Intelligence
AIED	Artificial Intelligence in Education
EdTech	Education Technology
ICT	Information and Communications Technology
SSA	Sub-Saharan Africa
UIS	UNESCO Institute for Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organization

Glossary

Algorithm – Instructions or rules to be followed by a computer during problem-solving or data-processing.

Automated Decision-Making – The process of making decisions largely without human involvement, instead relying on machines, algorithms and data.

Chatbot – A computer application designed to simulate human text or speech during a conversation with a user, typically with the intention of providing answers to user queries.

Predictive Model – A system that uses data to predict a future outcome.

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Background

The integration of artificial intelligence (AI) tools in education emerges as a pivotal focal point in reshaping education systems. Despite the diverse range of uses of AI technologies, the use of AI in education to enhance learning, to foster skills for jobs and the adaptation of life in the age of AI has not been as prevalent. Since Aiken & Epstein published their ethical guidelines two decades ago (Aiken & Epstein, 2000), there has been limited published work that explicitly focuses on ethics and the potential impact of AIED designs and deployment methods. Relatively few initiatives, particularly in Africa, focus on AI in education, leading to a recent recommendation that policymakers should “provide an enabling policy environment and curricular spaces for exploring AI” (UNESCO Releases Report on the Mapping of K-12 Artificial Intelligence Curricula | UNESCO, n.d.).

The uptake of this new technology in education demands an essential equilibrium between improving learning outcomes for all, fostering technological advancements, mitigating and addressing issues concerning privacy and other rights of participants, the need to ensure that consent is genuinely informed and given by learners, the balance between surveillance by teachers, and autonomy of learners, gaps in datasets, and the prevention of bias based on gender, race, social status, income inequality, religion, and family status among others.

Delving into the specific context of Kenya, the use of AI within the education system remains relatively limited. The most notable application has been the utilisation of automated decision-making in the process of Form One or junior secondary school selection. However, this approach has been met with scrutiny and critique. Critics argue that the current student selection criteria for entry into secondary school is in need of a comprehensive overhaul. Proponents advocate for a collective effort from all relevant stakeholders to meticulously scrutinise and revamp the existing selection criteria, aiming to eliminate biases and rectify any anomalies present in the system.¹

¹ John Mwangi Marubu and Ruth W. Thinguri, ‘A Critique Analysis of the Effect of Form One Selection Criteria on the Provision of Quality Education in Secondary Schools in Kenya’ (2015) *Researchjournal’s Journal of Education*, Vol. 3, No. 5.

Ideate Tech Policy Africa is an organisation based in Nairobi, Kenya, that seeks to advance policy discourse, and debates and address emerging issues at the intersection of law, tech, policy and society in Africa.² The primary objective of this report is to conduct a comprehensive assessment and provide guidance for the ethical design and implementation of AI systems within the African educational landscape. The report starts by giving a brief overview of the education sector in Africa, recognising the dynamic challenges faced across the continent and the place of AI in potentially reshaping these narratives. The report then delves into some of the use cases of AI in education as well as some of the ethical considerations of these cases.

As the report seeks to provide policy recommendations for AI in education through an African perspective, it assesses some of the existing policy initiatives and zooms into African ICT policies related to the education sector. The report then narrows its lens to scrutinise the application of automated decision-making, particularly in the context of Form One or junior secondary school selection in Kenya. To achieve this, the research engaged with a diverse group of over 30 participants representing various stakeholders in the education sector. This inclusive group included parents, teachers, Ministry of Education officials, and other relevant parties. The study utilised a combination of survey questionnaires and interviews to gather insights and perspectives from these participants, aiming to foster a comprehensive understanding of the ethical considerations surrounding AI implementation in the education sector within the Kenyan context.

Building on this analysis, the report provides policy priorities and recommendations important for creating an enabling environment for AI's development, and governance in Africa's education sector.

² 'Ideate Tech Policy Africa' (*ITPA*) <<https://itpa.africa/>> accessed 10 January 2024.

Introduction

Contextualised AI Systems for Advancing Education in Africa

Sub-Saharan Africa (SSA) emerges as the region with the most pronounced rates of education exclusion. Notably, over one-fifth of children aged approximately 6 to 11 years are currently not enrolled in any educational program, followed by one-third of youth aged around 12 to 14. According to data from the UIS (UNESCO Institute for Statistics), nearly 60% of youth in the age bracket of about 15 to 17 years are also outside the school system.

A critical emphasis is placed on advancing girls' education across the region. According to UIS data, an alarming 9 million girls between the ages of approximately 6 and 11 are projected to miss out on any form of schooling, surpassing the corresponding figure for boys, which stands at 6 million. The gender disparity starts early, with 23% of girls compared to 19% of boys being out of primary school. As they progress into adolescence, the exclusion rate for girls further rises to 36%, contrasting with 32% for boys. Addressing this gender gap remains a pivotal aspect to be addressed in the efforts to enhance education in the region.

Insecurity has compelled the closure of schools in various parts of Africa. The Central Sahel, for example, faces a critical situation, witnessing a sixfold increase in closed schools from 1,700 to almost 9,000 between 2019 and 2023. Burkina Faso alone contributes to half of the school closures in Central and West Africa, with over 6,100 closed schools as of July 2023. Some schools are direct targets of attacks by non-state armed groups, with 147 incidents reported between January and August 2023. Conflicts prompt families and teachers to flee, abruptly interrupting schooling for both displaced and host community children, leading to overcrowded schools in the latter.³

In the face of these multifaceted challenges across Africa, the question arises: Where does Artificial Intelligence (AI) fit into the equation to provide viable solutions? A growing body of literature on AI in Africa,⁴ coupled with advocacy from AI policy enthusiasts within the continent, underscores the demand for AI tailored to Africa's context. The collective call for "AI

³ 'Education Under Attack in West and Central Africa - 2023 Update - Burkina Faso | ReliefWeb' (13 September 2023) <<https://reliefweb.int/report/burkina-faso/education-under-attack-west-and-central-africa-2023-update>> accessed 2 January 2024.

⁴ Rachel Adams and others, 'A New Research Agenda for African Generative AI' (2023) 7 *Nature Human Behaviour* 1839 <<https://www.nature.com/articles/s41562-023-01735-1>> accessed 2 January 2024.

for Africa" suggests that the development of AI solutions within the continent is not just a preference but a necessity.

This demand aligns with the principle of 'African solutions to African problems,' advocating for the creation of AI strategies rooted in the unique challenges and nuances of the African landscape. The central question becomes whether AI can be leveraged as a transformative force, moving beyond the habit of seeking external solutions and fostering a homegrown approach.⁵

As African nations grapple with infrastructural, cultural, and societal obstacles facing the education landscape, the exploration of AI's role becomes crucial. Can AI be harnessed to revolutionise education access, mitigate infrastructural inadequacies, and navigate cultural complexities such as differing attitudes towards formal education and early marriages? The discourse on AI in Africa reflects not just a desire for technological advancement but a strategic imperative to use AI as a tool for indigenous innovation, solving Africa's problems with African ingenuity.

AI in Education

AI stands at the forefront of revolutionising personalised learning, offering tailored educational experiences based on individual students' unique needs, strengths, and weaknesses. Beyond its student-centric advantages, AI is empowering teachers by optimising their time through AI-powered grading systems, enabling a greater focus on personalised instruction and immediate feedback. Additionally, AI-driven tools analyse teaching practices, providing tailored professional development programs that enhance teachers' skills and effectiveness in the classroom. AI-driven algorithms further scrutinise student performance patterns and behaviours, facilitating early detection of potential learning disabilities. This proactive intervention ensures that educators and parents can provide timely support, maximising academic success for all learners.

Chatbots have been implemented in classrooms and online learning environments. Chatbots, in this sense, can serve as valuable classroom aides, responding to discussion board posts and

⁵ 'AI for Africa: Artificial Intelligence for Africa's Socio-Economic Development | AUDA-NEPAD' <<https://www.nepad.org/publication/ai-africa-artificial-intelligence-africas-socio-economic-development>> accessed 2 January 2024.

emails regardless of the availability of a human representative and encouraging exploratory learning.⁶

Artificial intelligence can also augment teachers' ability to monitor and support their students. The heightened analysis of student data enables teachers and administrators to identify instances where students may require additional assistance. Predictive analytics, as reported by software, empower educators to easily recognize at-risk students and intervene promptly to ensure they receive the necessary support. Moreover, AI can measure learner skills, behaviours, and attitudes, offering insights for optimised engagement and outcomes. This facilitates early detection of various issues related to student behaviour in the learning environment, going beyond basic monitoring for compliance and retention.⁷ These systems also hold promise in identifying students displaying characteristics of undiagnosed learning, developmental, or mental health disorders.

AI's data analysis capabilities also extend to informing education policymakers about students' needs, aiding in the design of curricula that align with real-world demands. By incorporating AI insights into curriculum development, African educational systems can equip learners with relevant skills for the job market, fostering a generation of workforce-ready graduates. The role of AI in supporting and empowering teachers in Africa is pivotal. AI-based professional development tools offer personalised training, resources, and feedback, while intelligent grading and feedback systems alleviate the burden of manual assessment, allowing teachers to focus on instructional support. Data-driven insights assist teachers in identifying areas of improvement and tailoring their teaching strategies accordingly.

In the dynamic landscape of African education, the integration of Artificial Intelligence (AI) emerges as a pivotal factor, particularly in the domain of language education. The continent's linguistic diversity, often considered a challenge, becomes an arena of opportunity with the strategic implementation of AI in language learning platforms. This not only addresses the practical need for effective language education but also serves as a cultural preservation tool. The infusion of AI goes beyond a mere technological addition; it signifies a paradigm shift in

⁶ 'When the Teaching Assistant Is a Robot' (*The Chronicle of Higher Education*, 23 October 2016) <<https://www.chronicle.com/article/when-the-teaching-assistant-is-a-robot/>> accessed 3 January 2024.

⁷ Christothea Herodotou and others, 'A Large-Scale Implementation of Predictive Learning Analytics in Higher Education: The Teachers' Role and Perspective' (2019) 67 *Educational Technology Research and Development* 1273 <<https://doi.org/10.1007/s11423-019-09685-0>> accessed 26 January 2024.

how education stakeholders, including edtech startups, schools, and universities, conceptualise and achieve their objectives. AI becomes a catalyst for innovation, offering a unique blend of technological advancement and cultural heritage preservation in the African educational sphere. In tracing the historical trajectory of education, technology emerges as a pivotal force, consistently influencing learning dynamics and refining teaching methodologies. From ancient abacuses to contemporary calculators and the recent pivot to online teaching during the global pandemic, technology has continually shaped educational practices on a global scale.⁸

However, within sub-Saharan African nations, technology integration in the education sector has been restrained, as elucidated by the French Development Agency and UNESCO in 2015. Afrobarometer's (2020) assessment underscores this reality with a digital non-readiness score of 56.6% for the region and a digital literacy rate of 31%. Despite these challenges, EdTech startups in Africa are strategically positioning themselves to leverage this transformative technology, envisioning an evolution in education and fostering positive change across the continent. In response to the escalating demand for personalised learning and remote education, these innovative companies are increasingly exploring the vast potential of Artificial Intelligence (AI) to elevate their educational initiatives.

The deployment of EdTech initiatives in the region has been accused of marginalising vulnerable groups, especially those residing in rural areas without reliable access to electricity or the internet.⁹ Exclusion and marginalisation in accessing education and related resources encompass various factors such as learners' socioeconomic status (SES), geographical locations (distance from educational sources or educational capital), and the availability or accessibility of critical infrastructure such as internet, electricity, and roads. The effectiveness of EdTech in improving learning outcomes is intricately linked to these crucial factors.

For AI policy enthusiasts in Africa, this landscape presents a critical juncture in the adoption of AI in education. South Africa, in particular, has been proactive in embracing technology in education, with the potential of AI in primary schools gaining recognition. The ADvTech Group has taken a pioneering step by introducing its AI-powered digital learning platform,

⁸ 'How Startups Can Leverage AI to Transform Education in Africa' (*Bendada.com, modern tech media in SSA*, 28 July 2023) <<https://www.benjamindada.com/artificial-intelligence-african-edtech-startups/>> accessed 2 January 2024.

⁹ Vollan Okoth Ochieng and Moses Waithanji Ngware, 'Adoption of Education Technologies for Learning During COVID-19 Pandemic: The Experiences of Marginalized and Vulnerable Learner Populations in Kenya' (2023) 32 *International Journal of Educational Reform* 464 <<https://doi.org/10.1177/10567879221076081>> accessed 2 January 2024.

ADvLEARN, designed to enhance learning in Mathematics, Physical Sciences, and Mathematical Literacy. The platform utilises AI to provide personalised learning experiences, allowing students to progress at their own pace.¹⁰ Noteworthy initiatives like Xander, an AI-powered language learning app¹¹, and Zeraki, an innovative technology company based in Nairobi, Kenya, are reshaping education and learning systems in East Africa. Zeraki operates the Zeraki Learning Management System (LMS), a robust platform offering an engaging learning experience through virtual classrooms, interactive content creation tools, and personalised learning modules.¹² This marks an exciting phase of technological change in Africa's education sector, calling for a concerted effort to formulate and implement comprehensive policies that align with the evolving educational needs and technological advancements across the continent.

Concerns of the Use of Artificial Intelligence in Education

The ethical implications surrounding the integration of AI in education are centred on the privacy concerns of both students and teachers, as highlighted by various sources.¹³ ¹⁴ The prevailing trend towards a “more data is better” model, particularly in the realm of personalised learning within education technology startups, raises crucial questions about the purpose of data collection, its intended beneficiaries, and the ethical utilisation of acquired data.¹⁵ Data-driven personalised learning algorithms heavily rely on diverse data points. However, a substantial ethical challenge, underscored by proposed national and state legislation, lies in the lack of transparency. This opacity creates confusion regarding the types of data collected, their application, and who holds access rights. Many students and teachers are uninformed about the extent and implications of their daily generation of digital data, compounded by insufficient training or awareness about the value of student data. This lack of clarity contributes to an unstable foundation for personalised learning initiatives.¹⁶

¹⁰ ‘ADvTECH Group | Education - Resourcing’ <<https://www.advtech.co.za/>> accessed 2 January 2024.

¹¹ ‘About’ (*Xander Apps*) <<https://xander.co.za/about/>> accessed 2 January 2024.

¹² ‘ABOUT’ (Zeraki NEW) <<https://www.zeraki.app/about>> accessed 2 January 2024.

¹³ Priscilla M Regan and Jolene Jesse, ‘Ethical Challenges of Edtech, Big Data and Personalized Learning: Twenty-First Century Student Sorting and Tracking’ (2019) 21 *Ethics and Information Technology* 167 <<https://doi.org/10.1007/s10676-018-9492-2>> accessed 26 January 2024.

¹⁴ Bernd Carsten Stahl and David Wright, ‘Ethics and Privacy in AI and Big Data: Implementing Responsible Research and Innovation’ (2018) 16 *IEEE Security & Privacy* 26 <<https://ieeexplore.ieee.org/abstract/document/8395078>> accessed 26 January 2024.

¹⁵ ‘Personalized Learning’ (*Data & Society*)

<<https://datasociety.net/library/personalized-learning-the-conversations-were-not-having/>> accessed 26 January 2024.

¹⁶ Sophie Quinton and National Journal, ‘Are Colleges Invading Their Students’ Privacy?’ (*The Atlantic*, 6 April 2015) <<https://www.theatlantic.com/education/archive/2015/04/is-big-brothers-eye-on-campus/389643/>> accessed 26 January 2024.

The ethical dilemma is further exacerbated by the clash between business models and technology development strategies, which advocate for extensive data collection, and the desire of parents and advocacy groups to comprehend the necessity of specific data types. This discord adds to the uncertainty surrounding the present and future use of these datasets. The expansion of data collection beyond proficiency assessments and school-provided demographic information into students' personal lives, facilitated by school-issued devices and the monitoring of social media accounts, compounds these privacy concerns.¹⁷

Another significant ethical concern revolves around surveillance or tracking systems. These systems, fueled by algorithms and machine-learning models, not only necessitate real-time activity monitoring but also aim to predict future preferences and actions of users by anticipating various aspects of students' learning experiences, such as strengths, weaknesses, and learning patterns. While monitoring student actions can be seen as part of a teacher's responsibility, it introduces concerns about privacy infringement, potentially limiting student participation and hindering their willingness to take ownership of their ideas.

Regulatory Frameworks for Artificial Intelligence in Education

Despite increasing awareness of the potential negative impacts of AI technologies, navigating the responsible AI landscape remains a complex task. The adaptation of responsible AI frameworks is challenging, with over 160 AI ethics guidelines globally, largely influenced by Western perspectives. This imbalance not only excludes African viewpoints but also leads to a dominance of Western norms, values, and cultures in the realm of AI ethics.

The right to education is unequivocally recognised under various international human rights instruments. For instance, the Universal Declaration of Human Rights (Article 26),¹⁸ the International Covenant on Economic, Social and Cultural Rights (Article 13)¹⁹, and the Convention on the Rights of the Child (Articles 28 and 29) emphasise the significance of equal

¹⁷ Natasha Singer, 'Pearson Under Fire for Monitoring Students' Twitter Posts' (*Bits Blog*, 1426637989) <<https://archive.nytimes.com/bits.blogs.nytimes.com/2015/03/17/pearson-under-fire-for-monitoring-students-twitter-posts/>> accessed 26 January 2024.

¹⁸ United Nations, 'Universal Declaration of Human Rights' (*United Nations*) <<https://www.un.org/en/about-us/universal-declaration-of-human-rights>> accessed 2 January 2024.

¹⁹ 'International Covenant on Economic, Social and Cultural Rights' (*OHCHR*) <<https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-economic-social-and-cultural-rights>> accessed 26 January 2024.

access, compulsory primary education, and the holistic development of the individual's personality.

Article 24 of the Convention on the Rights of Persons with Disabilities is specifically dedicated to inclusive education for individuals with disabilities, focusing on non-discrimination, accessibility, and adequate support measures. Similarly, the Convention on the Elimination of all Forms of Discrimination against Women (Article 10) strives to ensure equal rights for women in the field of education, addressing stereotypes and promoting equal opportunities.

In the rapidly evolving landscape of AI in education, the need for a comprehensive regulatory framework has become imperative. UNESCO's Recommendation on Ethics of Artificial Intelligence²⁰ and the UNESCO AI and Education Guidance for Policy-Makers provide essential principles and regulatory steps.²¹ These initiatives are crucial in shaping ethical AI development, addressing inclusivity, fairness, and the protection of fundamental rights.

Recognizing the evolving nature of AI, UNESCO's AI and Education Guidance for Policy-Makers (2021)²² goes beyond principles, aiming to realise Sustainable Development Goal 4 (SDG4). It assists policymakers in understanding the diverse possibilities and implications of AI in teaching and learning. The guide emphasises the importance of low-cost models for developing AI technologies, ensuring the representation of the interests of low and middle-income countries in global AI debates and decisions.

Furthermore, the United Nations, through the United Nations Children's Fund, has developed Policy Guidance on AI for Children which aims to promote children's rights in both government and private sector AI policies and practices. It raises awareness of how AI systems can either uphold or undermine the rights enshrined in the Convention on the Rights of the Child.²³ The policy specifically advocates for child-centred AI, encompassing aspects such as development, well-being, fairness, and privacy.

²⁰ 'Recommendation on the Ethics of Artificial Intelligence | UNESCO'

<<https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence>> accessed 26 January 2024.

²¹ 'AI and Education: Guidance for Policy-Makers - UNESCO Digital Library'

<<https://unesdoc.unesco.org/ark:/48223/pf0000376709>> accessed 2 January 2024.

²² 'AI and Education: Guidance for Policy-Makers - UNESCO Digital Library'

<<https://unesdoc.unesco.org/ark:/48223/pf0000376709>> accessed 26 January 2024.

²³ 'Convention on the Rights of the Child | UNICEF' <<https://www.unicef.org/child-rights-convention>> accessed 26 January 2024.

As AI continues to reshape educational landscapes, the confluence of ethical considerations, human rights, and inclusivity becomes paramount. Comprehensive regulatory frameworks, shaped by diverse perspectives, are essential to guide the responsible development and deployment of AI in education. These frameworks must consider cultural nuances, regional contexts, and the specific needs of diverse populations, fostering a globally equitable and ethically sound AI ecosystem in education.

African Policy Landscape

In the dynamic landscape of African education, the African Charter on Human and Peoples' Rights, notably Article 17, serves as a pivotal document, affirming the inherent right to education with a specific emphasis on individual participation in cultural life.²⁴ Across the continent, numerous nations have proactively crafted and implemented Information and Communication Technology (ICT) policies at the national level. These strategic frameworks, delineated in Table 1, are strategically designed to cultivate a conducive environment for the seamless integration of digital technology into education, focusing on optimising administrative processes, enhancing pedagogical activities, and fostering inclusive learning environments.

However, the pragmatic implementation of these policies faces formidable challenges, including inadequate funding, intricate political economy dynamics, limited capacity for development and training, and a lack of supportive infrastructure. Despite these hurdles, African nations remain resolute in harnessing technology for educational advancement, navigating complexities to bridge the digital divide and ensure an inclusive learning landscape that aligns with the educational imperatives of the continent. Ongoing dialogues and concerted efforts are imperative for shaping effective policies and practices in this ever-evolving educational terrain.

Nigeria	National Policy on Information and Communication Technology (ICT) in Education; Universal Basic Education Commission (UBEC) ICT Policy; National Information Technology Development Agency (NITDA) Guidelines; Nigerian Research and Education Network (NgREN); National Teachers' Institute (NTI) e-Learning Program; and State-level Initiatives.
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²⁴ 'African Charter on Human and Peoples' Rights | African Union' <<https://au.int/en/treaties/african-charter-human-and-peoples-rights>> accessed 26 January 2024.

South Africa	National Integrated ICT Policy White Paper for South Africa; National e-Learning Strategy; South Africa Institute for Distance Education; and Provincial-level initiatives
Sierra Leone	Education Sector Plan 2018-2020; National ICT Policy 2017-2022; Computer for Schools Sierra Leone; Smart Classroom Initiative; Sierra Leone Library Board
Uganda	National ICT Policy; National ICT in Education Policy; National Teacher Policy; SchoolNet Uganda; and Universal Secondary Education ICT project
Kenya	Kenya National ICT policy; Kenya Education Sector on ICT; Digital Literacy Programme; Kenya Education Cloud; Kenya Institute of Curriculum Development; and e-Learning Centers and Digital Villages
Tanzania	Tanzania Education and Research Network; Open Education Resources, e-School Initiative; Basic Education Development Plan; and National ICT Policy for Education and Training
Cameroon	National ICT Policy; National Digital Economy Strategy; ICT for Education Programme; and Schoolnet Cameroon
Benin	National Education and Training Policy; National ICT Policy; and E-Benin Project; Kenya Education Cloud; Kenya Institute of Curriculum Development
Malawi	National ICT Policy; Malawi ICT in Education Policy; Malawi National Education Plan; National Digital Transformation; National Digital Transformation Strategy; Partnership for Education; and Teacher training Programmes
Senegal	National Digital Strategy; Programme de Développement de l'Éducation Numérique; Ecole Numérique pour Tous (ENT); and Plan Sénégal Émergent (PSE)

Table 1. Ed-tech policies in selected sub-Saharan African countries²⁵

International Diagnosis on the Use of AI in Education

Various nations have strategically positioned themselves to embrace the transformative potential of artificial intelligence (AI) in the realm of education, marking a concerted effort to stay at the forefront of the fourth industrial revolution. Notably, Singapore's visionary "Smart Nation" initiative aspires to position the country as a global leader in AI by 2030.²⁶ The overarching objective is to revolutionise education by deploying AI-enabled companions, offering personalised feedback, automated grading, and sophisticated machine learning systems. This approach seeks to cater to diverse learning needs, particularly focusing on students with unique requirements.²⁷

In South Korea, a pioneering AI-based educational system is already in place, tailoring homework and assignments based on individual students' educational levels and learning behaviours. The ambitious plan involves providing each student with a personalised AI tutor and access to an online learning platform. The emphasis is on cultivating social-emotional skills and hands-on learning experiences, envisioning a departure from traditional end-of-course exams to a continuous assessment model integrated into daily assignments.²⁸ South Korea is gearing up for an AI-centric future by integrating AI coursework into the national curriculum across all grade levels by 2025. The Korean ministry of education, through its Keris unit, is actively involved in designing and implementing extensive teacher development programs centred around AI and emerging technologies. Finland, renowned for its exemplary education system, has embraced AI with a national commitment to provide free online coursework. The ViLLE platform, adopted by nearly half of Finnish schools, provides immediate feedback and analytics on student assignments, exemplifying the integration of AI to enhance the learning experience.²⁹

²⁵ Adapted from Data by the United Republic of Tanzania (2010); Karsenti et al. (2012); Dele-Ajayi & Taddese (2020); Federal Ministry of Education [FME] (2019a); Otieno & Taddese (2020); Republic of South Africa (2018); Malawi Ministry of Education, Science and Technology (2019); UNESCO (2019); Ministry of Basic and Senior Secondary Education (2020).

²⁶ 'Singapore, National AI Strategy (2019)'

<<https://oecd.ai/en/wonk/documents/singapore-national-ai-strategy-2019>> accessed 26 January 2024.

²⁷ 'National AI Strategy' <<https://www.smartnation.gov.sg/nais/>> accessed 3 January 2024.

²⁸ www.etnews.com, 'South Korean Government to Introduce AI-Based Personalized Learning Service to Public Education' (*ETNEWS :: Korea IT News*, 6 September 2019)

<<https://english.etnews.com/20190906200002?SNS=00002>> accessed 3 January 2024.

²⁹ 'ViLLE' <<https://en.learninganalytics.fi/ville>> accessed 26 January 2024.

India has embraced AI in education through platforms like Embibe, revolutionising the understanding of complex maths and science concepts. Additionally, predictive AI models are employed to anticipate and address students' performance issues, enabling proactive intervention.³⁰ Governments across the globe are making substantial investments in AI teacher training programs and revising national curricular frameworks. Singapore, for instance, is spearheading a comprehensive initiative to enhance AI literacy among students and educators, ensuring a nuanced understanding of the risks and benefits associated with this advanced technology.

In China, significant governmental investments have propelled the adoption of AI tools like the adaptive tutoring platform Squirrel AI, focusing on large-scale data sets and surveillance technologies.³¹ While ethical considerations and equitable access may not be at the forefront of priorities in China, Finland's "AI in Learning" project stands out for its commitment to equity and quality education.³² This collaborative effort involves international researchers and companies working together to design and test an intelligent digital system assessing student wellness and providing valuable insights to both students and educators. This global landscape underscores the multifaceted approaches countries are employing to harness AI's potential in shaping the future of education.

Case study

Use of Automated Decision-Making in Kenya's Education System

In Kenya, the Form One selection process has undergone a groundbreaking transformation with the integration of an artificial intelligence (AI)-powered automated system. This cutting-edge approach involves the systematic compilation and shortlisting of intricate details about learners, leveraging AI algorithms to analyse biographical data, overall examination results, and national exam grading. The Ministry of Education, Technology, and Science has spearheaded this

³⁰ 'EMBIBE - The Most Powerful AI-Powered Learning Platform' <<https://www.embibe.com/>> accessed 26 January 2024.

³¹ Michelle R Davis, 'Global Artificial Intelligence Boom Predicted in Education, Particularly in China' (*Market Brief*, 4 June 2019) <<https://marketbrief.edweek.org/marketplace-k-12/global-artificial-intelligence-boom-predicted-education-particularly-china/>> accessed 26 January 2024.

³² 'AI in Learning' <<https://blogs.helsinki.fi/ai-in-learning/>> accessed 26 January 2024.

technological advancement through an online portal, categorising the selection into distinct tiers for various schools.³³

The selection categories are delineated to accommodate diverse educational institutions:

- a) Form One selection for National Schools.
- b) Form One selection for Extra-County Schools.
- c) Form One selection for County Schools.
- d) Form One selection for Sub-County Schools.

As stipulated in the 2021 Ministry of Education, Technology, and Science Guidelines, the entire selection and placement process are meticulously orchestrated through AI-driven computerisation. This comprehensive process encompasses advanced data verification and validation procedures.³⁴ Initially, data on the capacities of each public secondary school, categorised by County, is meticulously processed by AI algorithms. This intelligent system ensures the accuracy and reliability of the data for the Form One selection process.

The pre-selection phase, a pivotal step in this technologically infused process, engages candidates in expressing their school preferences. Harnessing the capabilities of AI, this information is then submitted to the Ministry, where it undergoes seamless integration into the computer system. Notably, candidates with hearing and visual impairments receive specialised attention during the pre-selection phase, with AI algorithms facilitating their placement in special or integrated secondary schools designed to cater specifically to their respective disabilities.

Upholding the principles of equity in Form One selection, an intricate AI-powered formula is applied to distribute available places. This advanced algorithm computes quotas for each sub-county, ensuring a fair and just allocation of educational opportunities.

While the utilisation of AI in the Form One selection process in Kenya undeniably expedites the selection timeline and introduces a layer of transparency, it has not been without scrutiny,

³³ 'Form One Selection | Ministry of Education - Kenya' <<https://www.education.go.ke/form-one-selection>> accessed 3 January 2024.

³⁴ 'Education Ministry Releases Guidelines on How the 2024 Form One Selection and Placement Was Done - Education News Hub' <<https://educationnewshub.co.ke/education-ministry-releases-guidelines-on-how-the-2024-form-one-selection-and-placement-was-done/>> accessed 3 January 2024.

occasionally yielding outcomes deemed unfair. The incorporation of artificial intelligence in this crucial educational undertaking represents a significant leap forward in leveraging technology for efficiency and data-driven decision-making.

The positive aspects of AI in this context include the swift processing of a vast amount of data, ranging from learners' biographical information to their academic performance metrics. This not only accelerates the selection process but also introduces a level of transparency by automating various stages of data verification, validation, and analysis. The algorithmic approach ensures an objective and consistent application of predefined criteria, mitigating potential biases that may arise in manual processes.

However, the introduction of AI has not been immune to challenges. Scrutiny has emerged as some instances resulted in outcomes perceived as unfair. The intricate algorithms, while designed to be objective, may inadvertently perpetuate biases or fail to account for certain nuances that are crucial in the selection process. Additionally, concerns have been raised regarding the transparency of the AI algorithms themselves, with stakeholders seeking clearer insights into the decision-making processes embedded within these systems.

The utilisation of AI in this context exemplifies Kenya's commitment to leveraging advanced technologies for efficient, equitable, and data-driven educational practices. However, striking a balance between the efficiency gains offered by AI and the imperative to ensure fairness and equity is an ongoing challenge. As Kenya navigates this intersection of technology and education, there is a pressing need for ongoing scrutiny, stakeholder engagement, and adaptive governance to address emerging issues and optimise the positive impact of AI in shaping the educational landscape.

Research Methodology

The research conducted a comprehensive examination of the utilisation of automated decision-making and AI in education, with a specific emphasis on their application in the Form One selection process in Kenya. The study meticulously focused on the existing literature concerning AI and automated decision-making in education, delving into ethical considerations surrounding these technologies. Adopting a qualitative content analysis, the research thoroughly

reviewed journal articles, working papers, reports, policy briefs, and books dedicated to the intersection of AI and education.

In addition to the literature review, the study integrated primary research methodologies, employing questionnaire interviews to gather insights directly from key stakeholders in the Kenyan education sector. This inclusive approach targeted a diverse group of participants, including parents, teachers, and officials from the Ministry of Education at both the national and county levels. The empirical data collected through these questionnaires underwent detailed analysis and evaluation, forming the basis for informed suggestions and recommendations to enhance the Form One selection process in Kenya.

The research encountered challenges, most notably slow responses and, in some instances, a lack of participation from critical players within the Ministry of Education in Kenya. This limitation highlighted a significant challenge, as the information gathered predominantly reflected the perspectives of beneficiaries, such as parents and students, while the official viewpoints from the Ministry of Education remained underrepresented.

Despite these challenges, the study contributes valuable insights to the ongoing discourse on the ethical implications and practical considerations associated with the integration of AI in educational decision-making. The recommendations derived from the research aim to inform improvements in the Form One selection process, offering guidance for policymakers, educators, and other stakeholders involved in shaping the educational landscape in Kenya.

Demography

The survey targeted a diverse pool of over 100 respondents, ultimately garnering insights from 30 participants across various demographics. This included 7 parents, 9 tertiary-level students, 10 independent professionals, 2 individuals from academia, and 2 government officials not affiliated with the Ministry of Education. The intentional diversity in participants ensures a comprehensive analysis of automated decision-making in education, encompassing perspectives from parents, students, professionals, and government officials. Although the sample size is modest, the varied backgrounds contribute to a well-rounded understanding of the topic.

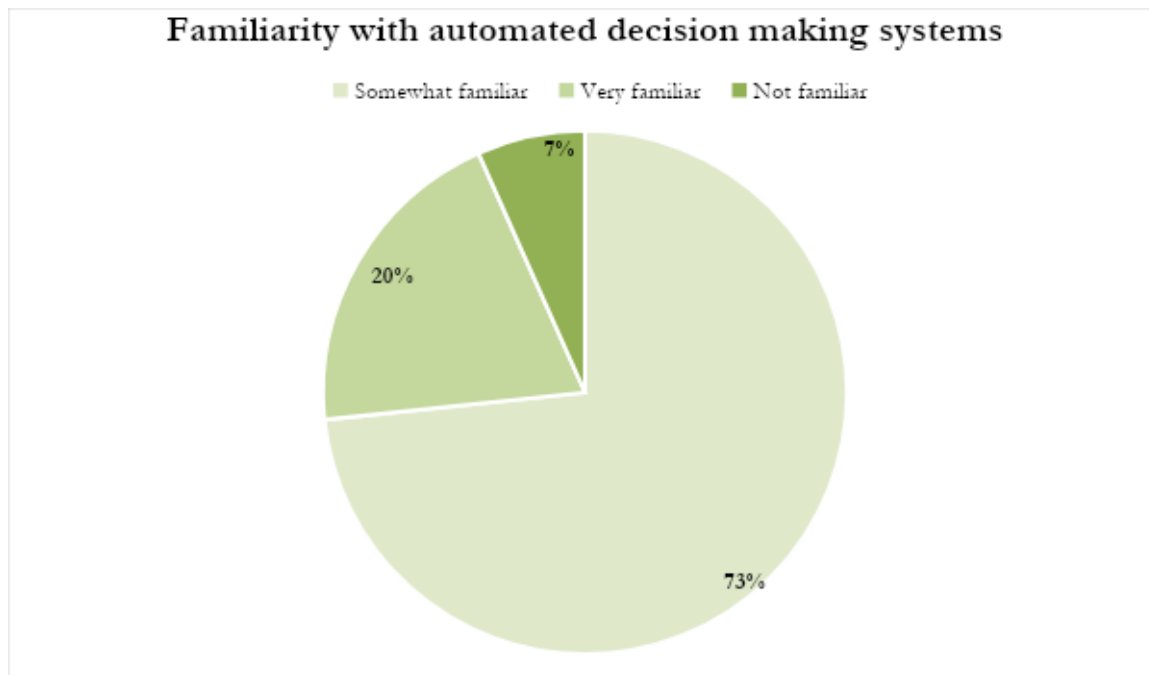
In the initial phase of the study, the primary objective was to assess the participant's familiarity with the concepts of automation and automated decision-making. The findings revealed a spectrum of familiarity among the respondents, providing valuable insights into their awareness of these technological processes.

Somewhat familiar: A considerable majority of the participants, totaling 22 individuals, indicated that they possessed a certain degree of familiarity with automated decision-making. This suggests a moderate level of awareness and understanding of the principles and applications associated with automation.

Very familiar: Six participants demonstrated a higher level of familiarity by categorising themselves as "very familiar" with automated decision-making. This subset likely possesses a more comprehensive understanding of the intricacies and implications of automated systems.

Not familiar at all: Notably, only two participants acknowledged that they were not familiar at all with automated decision-making. This minority may lack exposure or knowledge regarding the functioning and impact of automated systems.

These findings provide an initial overview of the participants' knowledge base concerning automation and automated decision-making. The diverse range of responses emphasises the need for targeted educational initiatives to enhance understanding and promote informed discussions about these technological processes.



In the study, 8 participants shared experiences of interacting with the Ministry of Education's automated decision-making systems during processes such as Form 1 school selection, university placement, job applications to the Ministry of Education, and junior secondary school selection. Conversely, 13 participants reported no interaction with these systems, and 9 were uncertain. Regarding integration into the secondary school selection process in Kenya, 22 participants believed in partial integration, 6 in full integration, and 2 were certain of no integration. Benefits perceived included increased efficiency (16 participants), reduced human bias (12 participants), and faster response times (2 participants).

Ethical and Social Considerations in Automated Decision-Making Systems: Perspectives from Participants

The consensus among the majority of participants, totaling 22, underscores the existence of significant ethical and social considerations associated with the deployment of automated decision-making systems. Their perspectives highlight various concerns, including:

Manipulation and doctoring of data: Participants expressed apprehension about the potential manipulation and tampering of data within automated decision-making systems, emphasising the need for safeguards against fraudulent practices.

Data privacy issues: A major concern raised was related to data privacy, encompassing questions about the extent of information required, the specifics of data usage, and the retention of data after fulfilling its intended purpose.

Transparency challenges: Participants pointed to transparency issues in the processing of data and the ultimate selection of candidates. The lack of clarity on how decisions are reached by automated systems raises transparency-related ethical concerns.

Accountability challenges: The issue of accountability emerged, with participants questioning who bears responsibility for the decisions made by automated systems. Ensuring clear lines of accountability becomes crucial in addressing ethical considerations.

Lack of transparency in decision-making: Concerns were raised regarding the lack of transparency in how automated decision-making systems arrive at decisions on selecting or rejecting candidates and the criteria employed in the decision-making process.

Breach of privacy: Mishandling of substantial amounts of personal data by automated systems raised concerns about privacy breaches. Safeguarding individuals' private information emerged as a critical ethical consideration.

Social circumstances and personal touch: Participants emphasised the potential loss of personal touch and consideration of social circumstances in automated decision-making processes, highlighting the need for a human touch in sensitive matters.

While the majority acknowledged these ethical and social considerations, a small number of participants (4) expressed uncertainty about the existence of such concerns. Additionally, two participants held the belief that there were no noteworthy ethical or social considerations associated with the utilisation of automated decision-making systems. These diverse perspectives underscore the complexity of addressing ethical considerations in deploying automated systems and the importance of fostering awareness and dialogue to navigate these challenges effectively.

Addressing Concerns in the Student Selection Process: Perspectives from Participants

Addressing concerns about access to technology and potential disparities in access that may affect certain students' chances in the selection process necessitates a multifaceted approach, as outlined by the participants:

Creating awareness: Initiating widespread awareness campaigns to inform stakeholders, including parents, students, and educators, about the significance of technology in the selection process and potential disparities.

Human inclusion in the selection process: Advocating for the continued involvement of human decision-makers in the selection process alongside automated systems, ensuring a balanced and fair approach.

Public participation: Encouraging public participation to involve communities in decision-making processes, fostering inclusivity and preventing the exclusion of certain groups due to limited access to technology.

Adapting platforms for accessibility: Aligning online platforms with various gadgets, particularly those easily accessible, such as mobile phones, to broaden the reach of the selection process as well providing alternative means, such as offline application options, for students with limited access to online platforms.

Internet access and sensitization: Providing internet access and conducting sensitization programs in schools to empower parents and guardians with the necessary knowledge to navigate online platforms and achieve targeted goals.

Simplifying procedures: Simplifying the procedures involved in the selection process to enhance understanding, particularly for communities with varying levels of technological literacy.

Single platform utilisation: Ensuring the use of a single platform for the selection process to maintain fairness and equity in automated decision-making.

Pilot programs: Conducting pilot programs to identify and address challenges at an early stage, refining the automated decision-making system based on real-world feedback.

Further research: Undertaking additional research on the use of automated decision-making in secondary school selection in Kenya to continuously improve and optimise the system.

Infrastructure development: Developing and improving infrastructure to facilitate the utilisation of automated decision-making systems in regions with limited technological infrastructure.

Hybrid system implementation: Rolling out a hybrid system that combines automated and non-automated selection methods, addressing concerns and challenges in areas with low internet penetration and access.

Public computer facilities: Establishing public computer facilities, such as in local public libraries and community centres, to provide access to technology for students and communities.

Digitisation and public awareness: Undertaking more digitization initiatives and public awareness and sensitization campaigns on automated decision-making systems, fostering understanding and acceptance.

Regular impact assessments: Conducting regular assessments of the impact of technology on the selection process, ensuring ongoing evaluation and improvement based on feedback and outcomes.

Future Impacts and Evolution of Automated Decision-Making in School Selection Processes in Kenya

Participants provided insightful perspectives on the anticipated future impacts and developments related to automated decision-making in Kenya's education system:

Professionalisation of placement process

Participants foresee the infusion of professionalism into the secondary school placement and selection process through the use of automated decision-making, ensuring a standardised and merit-based approach.

Accelerated decision-making

Anticipation of a faster decision-making process, allowing for timely and efficient selection and placement of students, streamlining administrative procedures.

Universal system accessibility

Expectations for easy accessibility of automated systems by all stakeholders, fostering inclusivity and ensuring that the benefits reach a broader spectrum of students and educators.

Enhanced transparency and fairness

Envisaged improvements in transparency and fairness, addressing concerns related to bias and ensuring that the automated processes are equitable for all students.

Expedition selection and placement

Foreseen acceleration in the selection and placement of students, reducing wait times and providing quicker responses to applicants.

Increased operational efficiency

Participants anticipate improved efficiency in administrative operations, minimising manual efforts and optimising resource utilisation.

Personalised decision-making

Expectations for enhanced personalization in decision-making, tailoring selections based on individual student needs, abilities, and preferences.

Transparency in algorithmic processes

Anticipation of increased transparency and explainability in algorithms, ensuring that the decision-making process is understandable and trustworthy.

Alignment with legal frameworks

Foreseen alignment of automated decision-making systems with various Kenyan laws, including the Fair Administrative Law Act, Data Protection Act, and Access to Information Act, ensuring legal compliance.

Stakeholder training initiatives

Recognition of the need for comprehensive training initiatives for stakeholders, including educators, administrators, and the public, to foster understanding and effective utilisation of automated decision-making systems.

Public participation and sensitisation

Emphasis on the importance of public participation and sensitization efforts, involving the general public in decision-making processes and building awareness of the benefits and implications of automated systems.

Conclusion & Recommendations

While acknowledging the potential benefits of AI in African education, its integration simultaneously demands a nuanced and deliberate approach that resonates with Africa's unique cultures, values, and educational needs. The goal is clear – to ensure that AI serves as a tool that enhances and enriches education for the African continent.

Consequently, establishing a metric to measure the success of an artificially intelligent landscape for Africa becomes indispensable. Such metrics could involve various factors such as:

Access and inclusivity

- Percentage increase in access to quality education in remote or underserved areas.
- Reduction in the education gap between urban and rural areas.
- Inclusion and support for marginalised groups through AI-driven education.

Personalisation and adaptability

- Number of adaptive learning modules that cater to individual student needs.
- Percentage of students benefiting from personalised learning paths.
- Alignment of AI-driven curriculum with local educational standards.

Augmentation of teacher capabilities

- Training and professional development opportunities provided to educators on AI integration.
- Feedback from teachers on the effectiveness of AI tools in enhancing their teaching methods.

Technological infrastructure

- Accessibility and reliability of internet connectivity in educational institutions.
- Availability of devices (computers, tablets, etc.) to support AI-enabled learning.
- Investment in upgrading technological infrastructure for schools.

Cost-effectiveness

- Reduction in overall education costs with the integration of AI.
- Affordability and accessibility of AI-based educational resources.

Cultural relevance and localisation

- Integration of culturally relevant content in AI-driven educational materials.
- Adaptation of AI tools to local languages and cultural contexts.
- Feedback on the cultural appropriateness of the AI-based curriculum.

Continuous improvement

- Frequency of updates and improvements to AI algorithms and content.
- Incorporation of feedback from students, teachers, and other stakeholders.
- Long-term impact assessment and adjustment of strategies based on evolving needs.

As Africa embarks on this AI in education journey, it is crucial to carve out a distinct path. The motivations, applications, and regulations surrounding AI should be scrutinised through the lens of African education. While drawing insights from global practices, Africa has the opportunity to tailor AI adoption to its specific educational landscape, learning from the experiences of others. This is not merely a chance; it is a responsibility to begin the integration of AI in education differently, ensuring that it aligns with our educational values and objectives. Let AI work for African education, contributing to its advancement, innovation, and equitable access for all.

Recommendations

Governments should develop a curriculum and assessment framework for digital competencies that takes into account the pervasive role of AI in education. This framework should recognise the value of skills acquired both within and outside the traditional educational sphere aiming to equip teachers and learners with the tools to effectively leverage the potential of technology, particularly AI, in education, workforce readiness, and civic participation. This approach will advocate for a dynamic curriculum that anticipates the evolving role of AI, providing a flexible foundation for digital competence adaptable to the changing technological landscape.

Forge culturally grounded ethical frameworks: Develop and institutionalise comprehensive, culturally grounded ethical frameworks that meticulously address the multifaceted challenges associated with AI in education. These frameworks should encompass privacy safeguards that rigorously communicate the purpose, methods, and implications of data collection to all stakeholders, emphasising transparency, consent mechanisms, and inclusivity principles, reflecting the diverse socio-cultural fabric of the African context.

Champion inclusive stakeholder engagement: Initiate and sustain inclusive stakeholder engagement forums, bringing together parents, teachers, policymakers, technologists, and communities. This participatory approach will be crucial for diverse perspectives, ensuring that the development of policies for an AI-integrated education is a collaborative venture aligned with the aspirations and values of the entire community.

Empower educators through comprehensive training: Prioritise the empowerment of educators through comprehensive training programs that equip teachers with not only the

technical skills to navigate AI-infused educational systems but also the critical faculties to maximise the pedagogical potential of these tools for diverse learning outcomes.

Bridge the digital divide with strategic initiatives: Acknowledge and actively address the digital divide by implementing strategic initiatives. Collaborate with technology providers and governmental bodies to bridge accessibility gaps, especially in rural areas, ensuring that the benefits of AI in education are equitably distributed.

Foster indigenous AI solutions: Governments should catalyse a thriving ecosystem for indigenous AI solutions by supporting local innovators and startups and nurture an environment that encourages the creation of AI applications specifically tailored to address the unique challenges faced by the education sector in Africa.

Institute rigorous monitoring and evaluation mechanisms: The institution of robust mechanisms for continuous monitoring and evaluation of AI systems in education should be paramount. Regular assessment of the impact of AI on learning outcomes, privacy concerns, and unintended consequences should be conducted and such insights used to iteratively refine strategies and enhance the efficacy of these technologies.

Promote diversity and inclusivity in AI development: It is imperative to embed a steadfast commitment to diversity and inclusivity at the core of AI development processes. A holistic strategy should be adopted, encompassing both the algorithms that power AI systems and the composition of the teams responsible for designing and deploying these technologies. Additionally, fostering diversity within the teams ensures a wide array of perspectives, which is crucial for addressing the nuanced cultural variations across Africa and contributing to the creation of fair and unbiased solutions.

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