LatIA. 2025; 3:319
doi: 10.62486/latia2025319
ISSN: 3046-403X

ORIGINAL

African Education Systems in the Role of Artificial Intelligence (AI) in Automated Decision-Making

Sistemas Educativos Africanos en el Papel de la Inteligencia Artificial (IA) en la Toma de Decisiones Automatizada

Michael Keari Omwenga[1], Fredrick Kayusi[2], Everlyne Chebet[3], Linety Juma[4], Bismark Agura Kayus[5], Rhoda Moraa Siro[6], Catherine Munga[7], Petros Chavula[8]

[1]Department of Education Psychology, School of Education, Pwani University. Kilifi, Kenya.
[2]Department of Environmental Studies, Geography, and Planning, Maasai Mara University. Narok-Kenya.
[3]School of Education and Human Resource Development, Kisii University.
[4]Pwani University, Department of Curriculum, Instruction and Technology. Kilifi, Kenya.
[5]Kisii University, Department of Curriculum, Instruction & Media, School of Education & Human Resource Development. Kisii-Kenya.
[6]Department of Nursing, Greenfield Community College. Massachusetts, Greenfield, USA.
[7]Department of Environmental Sciences, Pwani University. Kilifi-Kenya.
[8]World Agroforestry Centre, St. Eugene Office Park 39P Lake Road, Kabulonga, Lusaka, Zambia & African Centre of Excellence for Climate-Smart Agriculture and Biodiversity Conservation, Haramaya University. Dire-Dawa, Ethiopia.

Cite as: Omwenga MK, Kayusi F, Chebet E, Juma L, Agura Kayus B, Moraa Siro R, et al. African Education Systems in the Role of Artificial Intelligence (AI) in Automated Decision-Making. LatIA. 2025; 3:319. https://doi.org/10.62486/latia2025319

Submitted: 10-01-2024 **Revised:** 16-07-2024 **Accepted:** 12-05-2025 **Published:** 13-05-2025

Editor: PhD. Rubén González Vallejo

Corresponding Author: Michael Keari Omwenga

ABSTRACT

The main areas of focus for reforming educational systems are the incorporation of artificial intelligence (AI). Although artificial intelligence (AI) has many applications, its use in education to improve learning, develop employable skills, and help people adjust to life in the AI era has not been as common. The study evaluated current policy initiatives and delved into African information and communication technology (ICT) policies about the education sector to offer policy suggestions for AI educational institutions from an African viewpoint. The targeted population was junior and senior secondary schools in Kenya, a range of stakeholders in the field of education, including educators, parents, Ministry of Education representatives, and other pertinent parties. A sample of 125 participants was used. The study employed a descriptive research design. A combination of articles, research papers, reports, briefs, and books a along with interviews and questionnaires, was used to collect opinions and insights from these participants, and qualitative content analysis was involved. Its goal was to promote a thorough comprehension of the ethical issues related to the application of AI in the Kenyan educational system. The result indicated that 29 (28,2 %) were very familiar with automated decision-making, 63 (61,2 %) had reported some level of familiarity, while 11 (10,6 %) admitted did not know automated decision-making. The mean was fairly close to the true mean of the general population, as indicated by the extremely small total SE of 0,07. Drawing on the result, the report offers the policy priorities and suggestions that are crucial for establishing a supportive environment for the growth of AI and for governance in the African education sector.

Keywords: Artificial Intelligence (AI); Communication Technology (ICT); Employable Skills; Reforming Educational Systems.

RESUMEN

Las principales áreas de enfoque para la reforma de los sistemas educativos son la incorporación de la

inteligencia artificial (IA). Aunque la inteligencia artificial (IA) tiene muchas aplicaciones, su uso en la educación para mejorar el aprendizaje, desarrollar habilidades empleables y ayudar a las personas a adaptarse a la vida en la era de la IA no ha sido tan común. El estudio evaluó las iniciativas políticas actuales y examinó las políticas africanas de tecnología de la información y comunicación (TIC) relacionadas con el sector educativo para ofrecer sugerencias de políticas para instituciones educativas con IA desde una perspectiva africana. La población objetivo fueron escuelas secundarias de nivel básico y superior en Kenia, así como una variedad de partes interesadas en el campo educativo, incluidos docentes, padres, representantes del Ministerio de Educación y otras partes pertinentes. Se utilizó una muestra de 125 participantes. El estudio empleó un diseño de investigación descriptivo. Se utilizó una combinación de artículos, trabajos de investigación, informes, resúmenes y libros, junto con entrevistas y cuestionarios, para recopilar opiniones y percepciones de estos participantes, y se realizó un análisis cualitativo de contenido. Su objetivo fue promover una comprensión profunda de los problemas éticos relacionados con la aplicación de la IA en el sistema educativo keniano. El resultado indicó que 29 (28,2 %) estaban muy familiarizados con la toma de decisiones automatizada, 63 (61,2 %) informaron tener algún nivel de familiaridad, mientras que 11 (10,6 %) admitieron no conocer la toma de decisiones automatizada. La media estuvo bastante cerca de la media real de la población general, como lo indica el error estándar total extremadamente bajo de 0,07. A partir del resultado, el informe ofrece las prioridades y sugerencias de política que son cruciales para establecer un entorno favorable para el desarrollo de la IA y para la gobernanza en el sector educativo africano.

Palabras clave: Inteligencia Artificial (IA); Tecnología de la Información y la Comunicación (TIC); Habilidades Empleables; Reforma de los Sistemas Educativos.

INTRODUCTION

The implementation of this innovative technology in education necessitates striking a crucial balance between enhancing educational results for all students, promoting advances in technology, mitigating and addressing concerns regarding privacy and other participant rights and making sure that virtue of honestly is upheld and informed and upon students.[1,2,3,4,5] Striking an equilibrium between teacher surveillance and student autonomy, filling in dataset gaps, and preventing bias based on a variety of factors, including race, ethnicity, status in society, income inequality, belief system, and family status.[3,4,5,6,7,8] Examining Kenya specifically, the application of AI in the educational sector is still quite small. The use of decision-making in AI or automated in the senior and junior secondary school selection process has been the most prominent use.[12,13,14,15,16,17]

This strategy has been questioned and criticized, nevertheless. Critics contend that a thorough revision of the current secondary school admissions selection procedures is necessary. In order to remove biases and address any irregularities in the system, proponents urge all pertinent parties to work together to carefully examine and update the current selection criteria.[2,3,4,5,6,7]

The Nairobi, Kenya-based organization Ideate Tech Policy Africa works to promote policy discussions, debates, and emergent challenges at the nexus of technology, policy, law, and society in Africa. This report's main goal is to carry out an exhaustive evaluation and offer recommendations for the moral development and use of AI systems in the context of African education.[4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24] The paper begins by providing a concise review of the African education system, acknowledging the dynamic difficulties that the continent faces and the role that artificial intelligence (AI) may play in changing these narratives. The article then explores some of the applications of AI in education and some of the ethical issues surrounding these applications.[18,19,20,21,22,23]

Literature Review

Contextualized AI Platforms to Promote African Education

The region that exhibits the highest rates of educational exclusion is Sub-Saharan Africa (SSA). Interestingly, more than one-fifth of children between the ages of 6 and 11 do not now attend any kind of school, followed by a third of children between the ages of 12 and 14. Nearly 60 % of children between the ages of 15 and 17 are not enrolled in school, according to data from the UNESCO Institute for Statistics (UIS). The region's efforts to improve girls' education are given top priority. According to UIS data, a startling nine million girls between their ages of roughly 6 and 11 are expected to not attend school in any capacity, which is more than the 6 million boys who will not attend school. The gender gap begins early: 23 % of girls and 19 % of boys do not complete primary school. In contrast to 32 % for males, the exclusion rate for girls increases to 36 % as they enter adolescence. In the endeavors to improve education in the area, closing the gender gap continues to be a crucial component.

In some African countries, insecurity has forced school closures. For instance, between 2019 and 2023, the number of closed schools in the Central Sahel increased sixfold, from 1700 to nearly 9000, indicating a dire

scenario. With more than 6100 schools closed as of July 2023, Burkina Faso alone is responsible for half of all school closures in Central and West Africa. There have been 147 documented instances of non-state armed organizations attacking schools directly between January and August of 2023. Education for both evacuated and adopted children is abruptly interrupted by conflicts that force families and teachers to evacuate, resulting in overcrowded schools for the latter.[2,3,4,5] The question that emerges in light of these complex issues throughout Africa is: Africa's need for AI that is adapted to its unique circumstances is highlighted by the continent's expanding amount of literature on the subject as well as the lobbying of AI policy enthusiasts. The collective cry for "AI for Africa" implies that the continent's development of AI solutions is not merely desirable but also essential.[2,3,17]

This request supports the development of AI techniques based on the particular difficulties and subtleties of the African environment, which is consistent with the idea of "African solutions to African problems." The main query, therefore, becomes whether AI can be used as a revolutionary tool, encouraging a domestic approach instead of the tendency to look outside for answers.[20,21,22,23,24] Examining AI's function becomes essential as African countries struggle with societal, cultural, and infrastructure barriers that affect the educational system. The discussion of AI in Africa reflects not just a desire for technological progress but also a strategic need to employ AI as a tool for domestic innovation, allowing African brilliance to solve the continent's challenges.[19]

AI in Education

AI is at the center of transforming individualized education by providing experiences that are specifically catered to each student's requirements, skills, and shortcomings. Apart from its benefits for students, AI is also helping teachers by saving them time with AI-powered grading systems, which allows them to concentrate more on individualized education and real-time feedback.[20,21,22,23,24] Artificial intelligence (AI)-powered systems also analyze instructional strategies and offer customized professional development courses that improve teachers' abilities and efficacy.[20,21,22,23,24,25,26,27,28,29,30] By closely examining educational patterns and behaviors, AI-driven algorithms help identify possible learning difficulties early on. All students' academic progress is maximized thanks to this proactive intervention, which guarantees that parents and teachers can offer immediate assistance.[20,21,22,23,24,25] Chatbots have been used in online learning environments and classrooms. In this way, chatbots can be useful teaching tools that react to emails and postings on discussion boards even when a human representative is not available and promote inquiry-based learning.[26,27,28,29,30,31]

Teachers' capacity to keep an eye on and assist their students can also be enhanced by artificial intelligence. Teachers and administrators can spot situations where students might need more help due to the increased examination of student data.[20,21,22,23,24,27] According to software, predictive analytics enables teachers to quickly identify pupils who are at risk and take appropriate action to guarantee they get the help they need.[20,21,22,23,28] Additionally, student skills, behaviours, and attitudes can be measured by AI, providing insights for improved engagement and results. This goes beyond simple compliance and retention monitoring to enable the early identification of a variety of problems pertaining to student behaviour in the classroom. Additionally, these systems have the potential to detect students who exhibit symptoms of undetected mental health, developmental, or learning issues.[20,21,22,23,24,29]

AI's data analysis skills can also be used to help education policymakers understand the requirements of students and create curricula that meet industry standards. African educational institutions may produce graduates who are prepared for the workforce by integrating AI insights into curriculum development and giving them marketable skills. AI plays a critical role in empowering and assisting educators in Africa.[31,32,33,34,35,36] Although intelligent grading and feedback systems relieve the strain of manual evaluation, enabling teachers to concentrate on instructional support, AI-based professional development solutions provide individualized training, resources, and feedback. Teachers can identify areas for improvement and adjust their teaching tactics by using data-driven insights.[37,38,39,40,41,42,43,44,45]

The use of artificial intelligence (AI) becomes a crucial element in the ever-changing field of African education, especially when it comes to language instruction. When AI is strategically included into language learning platforms, the linguistic diversity of the continent which is frequently viewed as a challenge becomes an area of potential. This functions as a tool for cultural preservation in addition to meeting the practical necessity for efficient language instruction. AI represents a paradigm shift in how education stakeholders, including edtech firms, schools, and universities, conceptualize and accomplish their goals.[39,40,41,42,43,44] It is more than just a simple technological addition. In the context of African education, artificial intelligence (AI) catalyzes innovation, providing a special fusion of technology development and cultural legacy preservation.[37,38,39,40,41,42,43,44,45] Technology is a key factor that continuously shapes learning dynamics and improves teaching strategies when the historical development of education is traced. Technology has continuously influenced educational practices worldwide, from the first abacuses to modern calculators and the latest shift to online instruction amid the global pandemic.

However, as the French Development Agency and UNESCO explained in 2015, technology integration in the

education sector has been limited in sub-Saharan African countries. With a digital literacy rate of 31 % and a digital non-readiness score of 56,6 % for the region, evaluation highlights this fact. Notwithstanding these obstacles, African EdTech companies are putting themselves in a position to take advantage of this game-changing technology, aiming to advance education and promote constructive change throughout the continent.[39,40,41,42,43,44,45,46,47,48,49] These forward-thinking businesses are increasingly investigating the enormous potential of artificial intelligence (AI) to improve their educational initiatives in response to the growing demand for remote learning and personalized learning. The implementation of EdTech projects in the area has come under fire for allegedly excluding disadvantaged populations, particularly those living in rural locations without consistent access to the internet or electricity. The socioeconomic status (SES) of students, their geographic location (distance from educational sources or educational capital), and the accessibility or availability of essential infrastructure (such as roads, electricity, and the internet) are all factors that contribute to exclusion and marginalization in accessing education and related resources. These important characteristics are closely related to how well EdTech improves learning outcomes.[37,45]

This context marks a turning point in the use of AI in education for Africans interested in AI policy. AI's potential in primary schools is becoming more widely acknowledged, and South Africa in particular has been a leader in integrating technology into education. By launching ADvLEARN, an AI-powered digital learning platform intended to improve learning in mathematics, physical sciences, and mathematical literacy, the ADvTech Group has taken a trailblazing step. With the use of AI, the platform offers individualized learning experiences that let students advance at their own speed. NoTable projects that are changing education and learning systems in East Africa include Zeraki, a cutting-edge technology business with its headquarters in Nairobi, Kenya, and Xander, an AI-powered language learning software.[39,40,41,42,43,44,45,46]

The Zeraki Learning Management System (LMS), run by Zeraki, is a powerful platform that provides individualized learning modules, interactive content creation tools, and virtual classrooms for an engaging educational experience. This is an exciting time for technological transformation in Africa's education system, necessitating a concentrated effort to develop and execute comprehensive policies that take into account the continent's changing educational requirements and technological breakthroughs.[20,21,22,23,24]

Issues with Artificial Intelligence's Use in Education

According to some sources, the privacy concerns of both instructors and pupils are at the heart of the ethical issues surrounding the use of AI in education. Important concerns concerning the goal of data collection, its intended recipients, and the moral use of collected data are brought up by the current trend towards a "more data is better" approach, especially in the area of personalized learning among education technology firms. Algorithms for data-driven personalized learning mostly depend on many data sources. However, the lack of openness presents a significant ethical dilemma that is highlighted by proposed state and federal legislation.[4,37,38,39,40,41,42,43,44,45] This opacity makes it unclear what kinds of data are gathered, how they are used, and who has access rights. Due to a lack of training or understanding on the importance of student data, many teachers and students are unaware of the scope and ramifications of the digital data they generate on a daily basis. Initiatives for personalized learning have an unsteady base as a result of this ambiguity.[33]

The conflict between commercial models and technological advancement strategies, which support large-scale data collecting, and the desire of advocacy groups and parents to understand the need for particular data kinds further exacerbates the ethical quandary. The ambiguity around the current and future usage of these datasets is increased by this conflict. These privacy concerns are exacerbated by the extension of data collection into students' personal life beyond competency tests and demographic data provided by the school, made possible by school-issued devices and social media account monitoring.[34]

Educational Artificial Intelligence Regulation Frameworks

Navigating the ethical AI landscape is still difficult, even with growing awareness of the possible drawbacks of AI technologies. With more than 160 AI ethical guidelines worldwide, most of which are influenced by Western viewpoints, it is difficult to adapt responsible AI frameworks. In addition to excluding African perspectives, this disparity results in the predominance of dominant Western standards, beliefs, and traditions in the field of AI ethics. Under a number of international human rights instruments, the right to education is officially recognized. According to the Universal Declaration of Human Rights (Article 26), the United Nations Covenant on Social, Cultural, and Economic Rights (Article 13), and the International Convention on the Rights of the Children, for example, equal access, mandatory primary education, and the comprehensive development of the individual's personality are all critically important.[36]

In particular, inclusive education for people with disabilities is covered under Article 24 of the Convention on the Rights of Persons with Disabilities, which emphasizes nondiscrimination, accessibility, and appropriate support measures. Comparably, by combating stereotypes and advancing equal opportunities, the Framework Convention on the Elimination of All Forms of discrimination Against Women (Article 10) aims to guarantee

women's equality in the educational sector. A thorough regulatory framework has become essential in the quickly changing field of artificial intelligence in education. Important guidelines and regulatory actions are provided by UNESCO's Recommendations on Ethics of Artificial Intelligence and the UNESCO AI and Education Guidance for Policy-Makers. These efforts, which address inclusion, justice, and the defense of fundamental rights, are essential in guiding the development of ethical AI.[37]

Additionally, the UN has come up with a Policy Guidance on Artificial Intelligence (AI) for Children under the UN Children's Fund to promote children's rights in AI policies and practices in the public and private sectors. It also improves the knowledge of how AI or technology systems uphold or violate the rights which are discussed in the Convention on the Rights of the Child. Child-centered AI, which covers themes like confidentiality, justice, growth, and well-being, is expressly supported by the policy.[38] As AI continues to change educational settings, the convergence of diversity, human rights, and ethical considerations becomes increasingly important. A wide range of perspectives must be incorporated into thorough regulatory frameworks in so that to guide the appropriate development and use of AI in education. To advance a morally sound and internationally fair in AI environment in education, these frameworks need to factor in cultural unique traits, geographic locations, and the individual needs of others.

African Policy Landscape

A key document in the dynamic field of African education is Article 17 of the African Charter on Human and Peoples' Rights, which upholds the inalienable right to education with an emphasis on personal involvement in cultural life (Chronicles of Higher Education, Singapore, National AI Strategy. National technological and informational policies have been actively developed and implemented by numerous nations across the continent. An environment that is conducive to the seamless integration of digital technology into education is to be created, with a focus on improving instructional activities, developing inclusive learning environments, and simplifying administrative procedures.[17,19,45,46,47]

The implementation of these practical policies hindered by many factors such as the funding issues, poor economic factors, unstable political factors, lack of equipment in supporting them and lack of resources needed to run education and training facilities.[20,21,22,23,24] However, despite of these challenges, African countries are committed un technology to enhance education, over obstacles to cross the digital difficulties so as to ensure a proper school environment that meets the educational needs in the African continent. Practices and policies which are effective in the educational dynamics atmosphere must develop through concerts efforts and dialogue.

METHOD

The study conducted comprehensive investigation on the role AI and automated decision-making in education sector. The target population was the both senior and junior secondary school students, teachers, parents and ministry of education officers. The sample size of the study was 47 students, 29 parents, 36 teachers and 13 educational officers. Descriptive design was employed in the study. The study evaluated articles in journals, research papers, reports, briefs on policy, and books devoted to the nexus of AI and education in great detail using a qualitative content analysis. Questionnaire interviews were also used in the study to get primary data from the participants. Parents, educators, and representatives from the national and local Ministry of Education were among the varied individuals that this inclusive approach was intended for.

RESULTS

Demographic Response

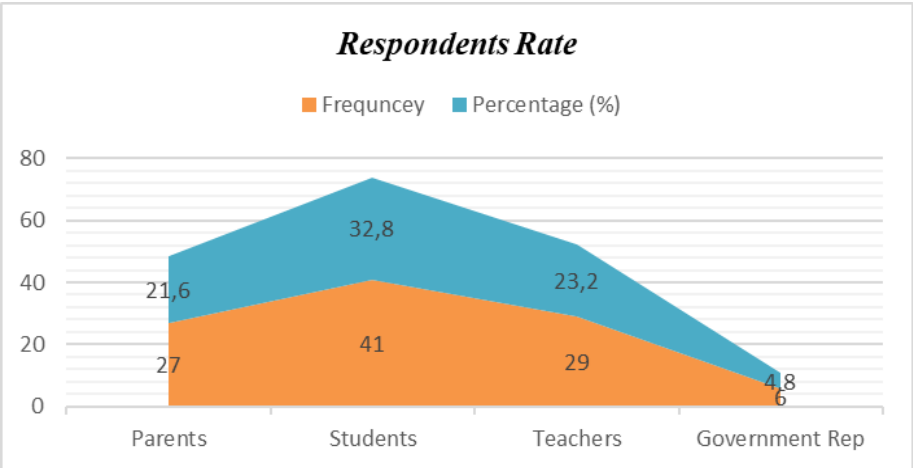

Figure 1. Respondents in the study

Targeting a broad sample of 125 respondents, the study eventually collected data from 103 (82,4 %) participants in a range of demographic categories. Among them were 27 (21,6 %) parents, 41 (32,8 %) senior and junior students, 29 (23,2 %) teachers and 6 (4,8 %) government representatives who were connected to the Ministry of Education and Information Technology. Despite the small sample size, the diverse backgrounds helped to provide a comprehensive grasp of the subject as presented (figure 1).

Gender Respondents

The gender distribution of study participants was established to evaluate the degree of gender inequality and validate the study's representativeness. The gender of the participants was recorded, and the results showed that there were males 66 (64,1 %) than females 37 (35,9 %) participation (figure 2).

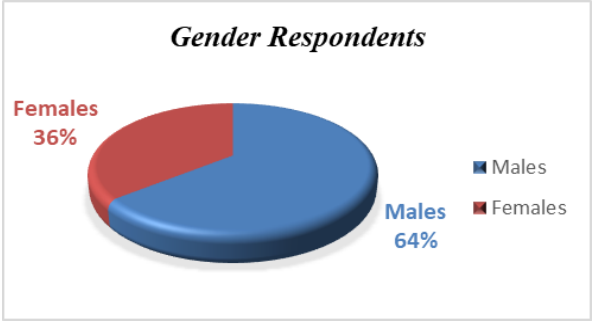

Figure 2. Respondents Gender

Artificial Intelligence in Automated Decision-Making

The main objective of the study was to evaluate the participants' knowledge of automated decision-making and automation. The results showed that respondents' levels of knowledge varied, offering important new information on how well-informed they were about these technological procedures in AI (table 1).

Table 1. Familiarity with decision making process

Acquaintance with AI's automatic decision-making processes	Frequency	Percentage (%)
Very familiar	29	28,2
Somehow familiar	63	61,2
Not familiar	11	10,6
Total	103	100

By identifying as "very familiar" with automated decision-making, 29 (28,2 %) participants showed a higher level of familiarity. The complexities and significance of automated systems are probably better understood by this group. A sizable majority of participants 63 (61,2 %) reported having some level of experience with automated decision-making. This indicates a modest level of knowledge and comprehension of automation-related concepts and applications. Interestingly, just 11 (10,6 %) participants admitted that they had no knowledge of automated decision-making. It is possible that this minority is not familiar with automated systems of AI or their effects (figure 3).

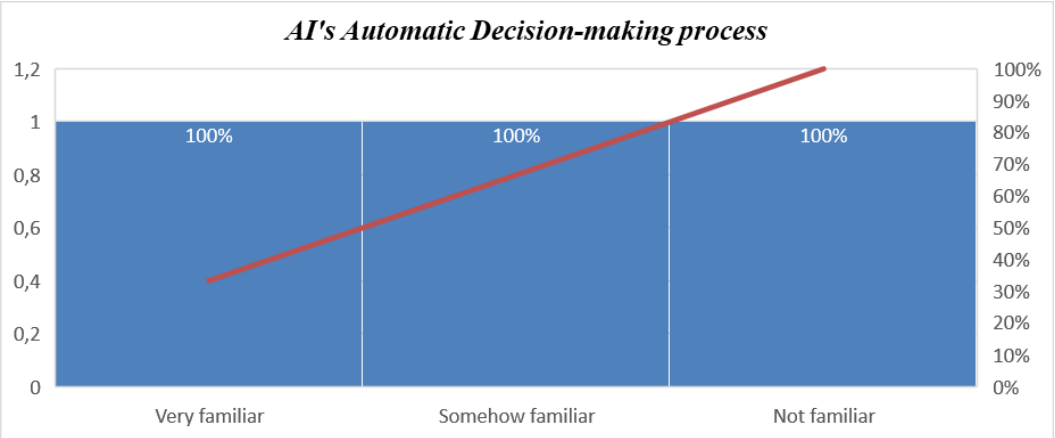

Figure 3. Familiarity with decision making process

https://doi.org/10.62486/latia2025319 ISSN: 3046-403X

Experience and Interaction with Ministry of Education in AI in Decision-Making

In the study, 56 (54,4 %) participants talked about their experiences using the Ministry of Education's automated systems for making decisions for secondary school selection, college placement, and Ministry of Education employment applications. In contrast, 13 (12,6 %) people expressed uncertainty and 34 (33 %) persons had not interacted with these systems (figure 4).

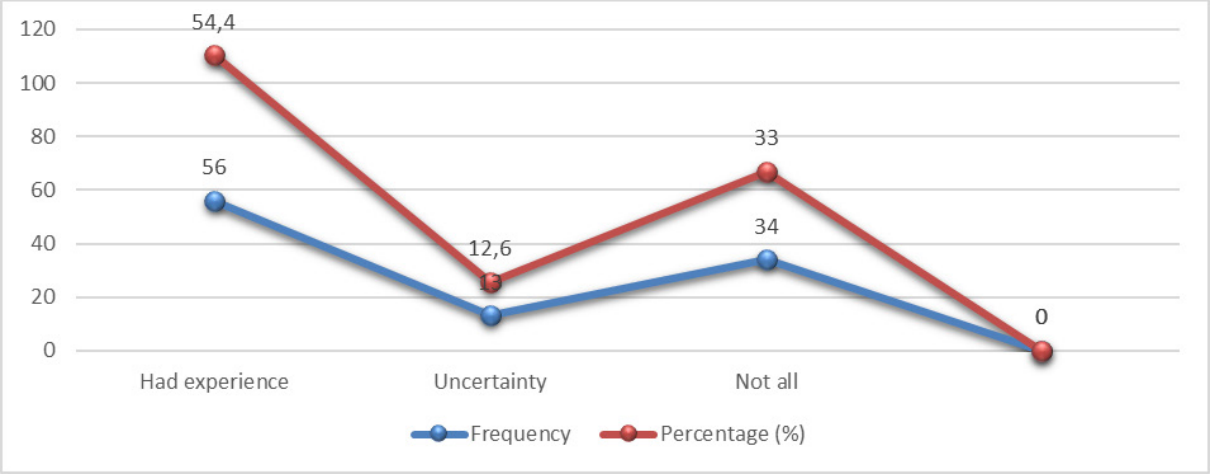

Figure 4. Experience with Ministry of Education AI in Decision-Making

Integration of AI in Secondary Schools Selection Process

Concerning inclusion in Kenya's secondary school admissions process, sixty-eight (66 %) people supported partial integration, seventeen (16,5 %) supported full integration, and eighteen (17,5 %) were adamantly against integration.

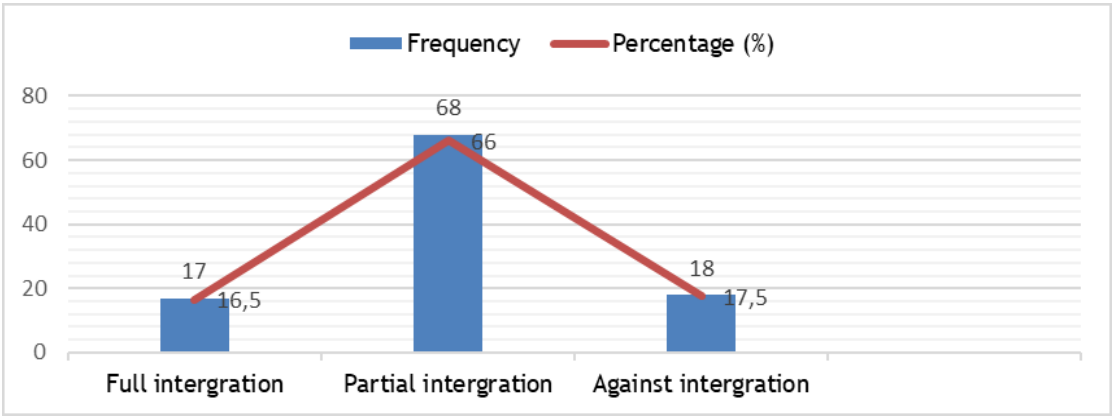

Figure 5. Integration of AI in secondary schools' selection process

Perceived benefits included faster response times (7 participants), less human bias (25 participants), and increased efficiency (71 participants). Table 2 shows that its goal of determining the role of AI in African educational decision-making is only partially achieved. It also demonstrates that Institute staff members use artificial intelligence (AI) and that it influences their decision-making to a moderate extent. The data collected from the 103 participants was used to calculate the average, variance, average error, and percentages for each variable. As the total SE of 0,07 is so minor, it indicates that the mean is quite near to the actual mean of the general population.

Table 2. Mean values of Decision making (AI)

	Stress	Frequency	Mean	SD	SE	Automated Decision-making per AI
1	Increased efficacy	71	3,23	0,97	0,08	Medium
2	Less human bias	25	2,54	0,82	0,09	Medium
3	Faster response	7	3,66	0,88	0,07	Medium
	Automated decision-making	103	3,14	0,89	0,08	Medium

https://doi.org/10.62486/latia2025319 ISSN: 3046-403X

The average AI score and the average scores for all three categories point to an intermediate level of computerised decision making. Based on the values from the study, between 2,5 and 3,5 showed that individuals made decisions in the African educational system. Hence, the findings provided an examination of the respondents' knowledge of AI and self-directed decision making. This wide range of responses call for the need of the required educational policies and initiatives to enhance and lighten the understanding and promote informed issues about the AI processes and technology.

DISCUSSION

To address issues related to AI and technology and possible gaps in access that affect students, should be addressed and their possibilities throughout the selection process. The participants in the current study agreed that a supportive strategy is required. This includes large-scale awareness campaigns to educate parents, students, teachers and other relevant stakeholders in the education sector about the role that technology and AI play in the decision-making process and any potential disparities. To promote the current fusion of human decision-making with automated technologies, which ensures a fair and impartial selection process is observed.[37,38,39,40,41,42,43,44,45]

Additionally, it promotes variety and reduces the social exclusion of particular groups due to restricted access to technology. Also, it increases public engagement, which helps in involving communities in decision-making processes by integrating internet platforms with several types of devices, which are readily available, such as smartphones, to increase the audience for the selection process and give students who have limited access to online platforms options, including offline applications.[37,38,39,40,41,42,43,44,45] Parents and guardians also need to be equipped with the skills and information needed to use online resources and fulfil their objectives if awareness programs are established in schools and they are given internet access. Simplifying the selection procedure to improve comprehension, especially for groups with different technical literacy skills in AI decision-making and guaranteeing the selection process, which is conducted on a single platform, to preserve justice and equity in automated decision-making.[47,48,49,50,51,52]

CONCLUSIONS

AI integration in African education requires a careful and sophisticated approach that considers the continent's unique customs, values, and educational demands, even as it acknowledges the potential benefits. The evident objective is to make sure AI is a tool that improves and enriches education in Africa. The development of a metric to assess the effectiveness of an artificially intelligent terrain for Africa is therefore imperative. Cultural relevance and localization, cost-effectiveness, technology infrastructure, teacher competency development, accessibility and inclusivity, flexibility and customization, and ongoing improvement are a few examples of these requirements.

It is crucial to establish a distinct path as Africa starts its next phase with AI in education system. Through an understanding of African education, the goals, uses, and laws surrounding AI should be carefully examined. By learning from other countries' experiences, Africa may adapt the use of AI to its local educational setting and acquire knowledge from global approaches. It is not just an opportunity; we should start integrating AI into education in a way that is consistent with our educational goals and beliefs. Allow AI to foster universal access, creativity, and progress in African education.

Governments should consider the widespread use of AI in education while creating a curriculum and evaluation system for digital competences. This framework should acknowledge the importance of skills learned both inside and outside of the traditional educational setting in order to give educators and students the resources they need to fully utilize technology, especially artificial intelligence (AI), in the areas of education, workforce readiness, and civic engagement. This approach will provide a cutting-edge curriculum that anticipates AI's evolving role while providing a flexible basis for digital competency that can be adjusted to the constantly changing technological context. The main objective should be to set up strong procedures for ongoing monitoring and assessment of AI systems in education.

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FINANCING

The authors did not receive financing for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Fredrick Kayusi, Petros Chavula.
Data curation: Petros Chavula, Linety Juma, Bismark Agura Kayus.
Formal analysis: Fredrick Kayusi, Petros Chavula, Catherine Munga.
Research: Michael Keari Omwenga, Petros Chavula.
Methodology: Fredrick Kayusi, Petros Chavula.
Software: Fredrick Kayusi, Petros Chavula.
Validation: Petros Chavula, Everlyne Chebet, Catherine Munga.
Display: Fredrick Kayusi, Petros Chavula, Rhoda Moraa Siro.
Drafting - original draft: Fredrick Kayusi, Petros Chavula.
Writing - proofreading and editing: Fredrick Kayusi, Petros Chavula, Catherine Munga.