## IMPACT OF ARTIFICIAL INTELLIGENCE ON RWANDAN EDUCATIONAL SUSTAINABILITY

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#### ABSTRACT

In this century "Artificial intelligence (AI) has been crucial in developing different sectors and the educational sector". "This study explores the impact of Artificial Intelligence (AI) on education sustainability in Rwanda, using a mixed-methods approach involving data from 173 respondents out of 300 Google Forms circulated in different demographic profiles in Rwanda and a literature review from Google Scholar". The research aims to assess current AI integration in Rwandan education, analyze the relationship between AI utilization and educational sustainability, identify barriers to adoption, and propose strategies for equitable AI access in both urban and rural contexts by comparative methods between where there is access to AI and where neither. Respondents' insights also are considered in this paper. Results indicate a significant correlation between AI integration and education sustainability, emphasizing challenges related to unequal access. Recommendations on Rwanda Educational Board (REB) and MINEDUC include targeted development of AI solutions for diverse educational settings, infrastructure investments, specialized training, and awareness campaigns. The study provides actionable insights for policymakers and suggests future research directions such as long-term impact assessments, strategies for socio-economic inclusivity, evaluations of AI in personalized learning, and comparative studies across African nations.

Keywords: Artificial intelligence, Education, Internet of things, Technology

## INTRODUCTION

The AI domain has been penetrating educational fields with great speed, and many more tentative innovations have been thrown into the air: "virtual assistants being developed to cater to personalized learning experiences and tracking systems" made for monitoring students and teachers. The assorted bright sides AI has presented in education are still being argued; however, there arise relevant issues due to the negative perspectives on privacy and welfare. Al will also bring about a major restructuring of the society, among which will be educational systems. Al disrupts the workings of most educational systems and thereby demands an urgent critical view and restructuring of pedagogical traditions<sup>[9]</sup> (Dignum, V., 2021). Within education, artificial intelligence creates change and serves as the motor engine driving the evolution of tasks and responsibilities<sup>[3]</sup> (Alam, A., 2021). We should permit AI to invade the core of education in nurturing minds that will comfortably adapt to and make sense of the complexities of the AI-run world. AI literacy and AI thinking embedded within school curricula still have a long way to go across countries but can truly be the means through which such understanding and adaptability can be achieved<sup>[32]</sup> (Vazhavil et al., 2019). That said, higher education will be impertinently stubborn as Al arms reach deeper into the assorted sectors of our world. Control of AI in Education (AIED), it seems, has witnessed phenomenal growth in the recent past. This study attempts to map the paths through which the implementation of AI is reshaping the university experience of teaching and learning and its integration consequences (Jain, S. & Jain, R. 2019)<sup>[20]</sup>.

The study on AI impacts on education sustainability in Rwanda identifies key research gap areas. Key areas left gaping include the need for intensive longitudinal impact assessments on different educational outcomes, the study of socio-economic factors that lead to differential access to AI, and the investigating of AI effectiveness in personalized learning with comparative analyses against other African countries. Closing these gaps will help give a broad understanding of AI (Artificial Intelligence) in education for specific

and fair strategies for its integration in different contexts raised through several contributions offered by the respondents.

Diffusion of artificial intelligence (AI) impacts towards educational sustainability has been the major focus of research concerning rural education conducted in Rwanda. However, this typically allows most researchers to discover very critical gaps that need to be widened-nine in this instance being the much-needed longitudinal as well as in-depth assessments on the impacts of AI in educational outcomes over time together with the socio-economic factors which cause variations in access to AI amenities, effectiveness of AI in personalized learning complemented by comparison among several African countries. Closing these gaps offers a further and broader understanding of AI in education as a resource towards focused and fair strategies for its integration into various local contexts.

# Perspectives of Rwandans on use of Artificial intelligence (AI) in education and its impact

The below Rwandan perspectives have gathered from the survey conducted across Rwandan citizen in different demographic profile where the most Rwandans see the significant role in the use of AI in Rwanda education. However, few of them argue but not sure, suspect that may lead to laziness of the student. While the study finds significant role through the analysis of the data collected among Rwandans.

"My view on education in Rwanda is that I appreciate the emphasis on promoting technology in schools across our country. However, we face a shortage of experienced teachers and lecturers with knowledge of AI. Therefore, we need someone from outside who is well-versed in AI to assist us in utilizing this technology and innovating within our educational framework. Otherwise, we risk relying on external resources without the ability to create our own AI-driven solutions, as seen in other countries that prioritize AI development". "Actually, AI is most important in Rwanda education for the purpose enhance the education level through using machines, study and also helps student to make problem solving however has negative impacts to the education of Rwanda because, little student has had gained machines and other missing". "Rwandan Education should be more focus than impressive.

We only have to copy the wide world achievements to Meet global needs. Artificial intelligence should be more objective than being subjective, in case Rwanda is a developing country there should be new strategies for improving the quality of education in Rwanda". "Artificial intelligence in Rwandan education is like somehow neutral due to



the costs on going to the AI's requirements and infrastructures is expensive and some of the requirements comes from the outside the country and take long process to reach to the users". "AI if used in accurate measure. It can lead in transformative journey of education that proves sustainable education and future. U recommend that AI students can be given access to technology tools like AI as it can impact in positive way and shape our future education and wellbeing".

"Al is becoming more and more relevant in Education in Rwanda. It provides students with personalized and adaptive content to enhance their learning experiences. Alpowered tools can assist teachers in evaluation processes and in providing targeted help to students. Moreover, Al can help overcome educational access barriers by offering materials and assistance to isolated regions. The transformation of education in Rwanda through Al and how students are empowered to reach their potential fully is quite interesting." "Artificial intelligence aids in access and quality of education in Rwanda. Al powered chatbots can serve students at any time; also, learning platforms provide tailored instructions to specific students. Inform decisions through data analysis, and Al-generated content can target gaps in language inclusivity and effectiveness in education." "Well, some of the students have access to Al assisted tools, but it is not common knowledge for most people to utilize Al technology in Rwanda". "Rwanda's governance need to integrate advanced Al materials like Sophia, and develop other programs like Al-chat that assist students with educational problems. For example, encountering students' challenges can be addressed with help from Sophia or the Al-chat program".

"In Rwanda, AI has the potential to positively transform education by personalizing learning for students, automating back-office processes, facilitating learning from a distance, and increasing the number of available educational materials. It is equally important in recognizing and closing learning gaps, monitoring learners, and ensuring educational productivity through customized programs". "Increasing infrastructure for AI use in education, such as laptops, desktops, projectors, and screens, proves helpful due to the eagerness to apply AI in education".

"My recommendation regarding the use of AI in Rwanda would be to limit its accessibility to students as it may hinder their mental engagement with academic tasks." "Rwanda's education system does not actively integrate AI technologies and, while they don't presently impact education greatly, they may do so in the future." "AI has an important place within the education system of Rwanda, but if mismanaged overlooks its potential it stifles the creativity of learners."

All the above views of Rwandan citizen highlight the significant important of artificial intelligence in education sector of Rwanda through different cases to strengthen Rwandan education and sustain it.

### LITERATURE REVIEW

As AI's tentacles creep into every corner of our lives, even classrooms aren't spared. Its impact on learning is undeniable, but integrating it into schools sparks debates and ethical concerns. This study delves into both the bright-eyed promises and the tricky tangles of Al in education, using research to map the current landscape and pave the way for future explorations. Buckle up, educators, for the AI revolution in schools is just beginning, especially in tech-savvy corners of the world. We'll also peel back the layers on the challenges and point you towards promising avenues for further investigation<sup>[31]</sup> (Tahiru, F. 2021). "Rwanda's governance need to integrate advanced AI materials like Sophia, and develop other programs like Al-chat that assist students with educational problems. For example, encountering students' challenges can be addressed with help from Sophia or the Al-chat program". "In Rwanda, AI has the potential to positively transform education by personalizing learning for students, automating back-office processes, facilitating learning from a distance, and increasing the number of available educational materials. It is equally important in recognizing and closing learning gaps, monitoring learners, and ensuring educational productivity through customized programs". "Increasing infrastructure for AI use in education, such as laptops, desktops, projectors, and screens, proves helpful due to the eagerness to apply AI in education".

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"Recent developments in computing technologies have made it possible to introduce AI (Artificial Intelligence) in Educational (AIED) applications. AIED is the application of artificial intelligence technologies within the educational context to enhance teaching and learning as well as assist in decision making. Using AI technology that simulates human cognitive processes such as reasoning, decision making, and forecasting, computer systems are capable of giving students personalized attention, guidance, and feedback. These technologies also help policymakers and teachers in decision making. Although I



am informed that computers and education has remained a prime focus of research, the interdisciplinary AIED is often said to be a problem because of the diverse backgrounds of the researchers. This paper defines AIED studies and explains its purposes to highlight its perspective in responding to the gap in education<sup>[18]</sup>" (Hwang et al, 2020)

Across the globe, universities grapple with predicting student success. Without effective tools, identifying struggling students before they fall behind remains a challenge. Uncertain of their abilities, these students are left to navigate alone. In Rwanda, we're tackling this head-on by building an Al-powered early warning system. Using data from both high schools and universities, we trained and tested different machine learning models. But there was a snag: the data was unevenly distributed, favoring students who succeed. To overcome this, we employed a clever technique called Synthetic Minority Oversampling, balancing the playing field. The champion models? The Decision Tree, with a 63% accuracy rate. It also revealed surprising insights: your high school program matters most for academic success, followed by your final high school exams. This is a game-changer for education in Rwanda. Now, policymakers and educators can pinpoint students at risk early on, offering crucial mentorship and support. It's not just about numbers; it's about empowering students to reach their full potential<sup>[23]</sup> (Masabo et al 2023).

"The study discovered a growing interest and influence of AIED research, marking a difference in the application and use of deep learning methods in educational systems. More primitive AI methods, particularly natural language processing, were widely implemented, while more sophisticated approaches were less common. Interdisciplinary studies that simulated AI with educational technology as the primary focus remained relatively unexplored. Recommendations derived from the results include applying AI technologies in face-to-face classroom interactions, dealing with responsive behavior to explain conceptual understanding, applying more sophisticated algorithms of deep learning, using natural language processing to personalize education with precision, employing biomedical technology to augment learners, and developing educational theories in tandem with AI (artificial intelligence) technologies"<sup>[6]</sup> (Chen et al 2020). "Proposing the use of artificial intelligence techniques for the classification of pupils into learners by module categorization, this tool is meant to facilitate the estimation of the broad range of learning models and retrieve the right one for the context"<sup>[4]</sup> (Bajaj & Sharma, 2018).

"Integrating technology into learning encourages innovative pedagogical practices and the exploration of new methods of teaching, resulting in improved learning outcomes.



Technology has numerous advantages to bring to education, but it should be noted that effective integration requires thorough planning, intense training, and continuous evaluation. These are crucial steps to ensure that the integration is completely aligned with learning objectives and enhances the learning experience overall"<sup>[2]</sup>(Aggarwal, D. 2023).

Research in Artificial Intelligence and Development moved at a faster pace in Artificial Intelligence in Education varieties during the previous decade<sup>[11]</sup> (Gayed et al 2002). Research content analysis divided questions into three major categories: development which included subjects such as classification and matching and recommendation and deep learning; application which included feedback and reasoning and adaptive learning; and integration which focused on affection computing and role-playing and immersive learning and gamification. The authors identified four upcoming trends regarding which researchers must prepare: deep learning along with the Internet of Things and swarm intelligence and the field of neuroscience. The Authors emphasize "The assessment of artificial intelligence in education effect constitutes a strong recommendation for future research"<sup>[35]</sup> (Zhai et al 2021).

Al technology expansion has pushed researchers to address problems in various fields while education stands as their principal target. Both developed and developing nations have designated appropriate education accessibility for wide audiences and enhanced learning outcomes as their primary educational objectives during the past few years. Current educational objectives come to the forefront because of personalization enabled by conventional educational technology<sup>[30]</sup> (Srinivasan, V. 2022). The main objective of this research assessed the factors which influenced small-scale dairy farmers in the Rwamagana district of Rwanda to incorporate Artificial Insemination Technology.

The data collection phase consisted of offering Artificial Insemination technology users and nonusers semi-structured questionnaires supported with in-depth key informant interviews. The conceptual phase also utilized second-hand data retrieved from public officials. The quantitative information was examined using descriptive statistics together with a binary regression model yet qualitative information was analyzed by content analysis methods. Artificial Insemination Technology stands out as an essential factor for improving reproductive outcomes which benefits the dairy productivity of small-scale dairy farmers according to the study findings<sup>[19]</sup> (Ingabire et al 2018).

In accordance with a needs assessment conducted by UNESCO, forthcoming priorities should center around promoting economic growth through digital innovation and extending support to start-ups. Initiatives must address overarching issues, including



education, skills training, the facilitation of research and development, data governance, and the mitigation of gender-related bias and discrimination in the development and utilization of artificial intelligence <sup>[14]</sup> (Gwagwa et al 2020), What was once a distant dream, artificial intelligence has rapidly become a concrete reality, seamlessly entering our daily lives and impacting every field, including education. Although established as a field in its nascent stage, the trend of evolution of AI and its untapped potential is an interesting subject to keep following. In this regard, this chapter discusses contemporary understandings and predicts future prospects of AI, examining its applications in various areas like natural language processing, machine learning, as well as deep learning"<sup>[12]</sup> (Goksel, N., & Bozkurt, A. 2019).

"Artificial intelligence has achieved remarkable advancement in the area of education, assuming a strategic and central position in educational development.". It is also functioning as a digital assistant, providing helpful support to both students and teachers. Al is assisting in various manners, including providing students with an extensive range of learning material tailored and matching to their personal needs and specific subjects"<sup>[22]</sup> (Limna et al, 2022).

The research aimed to outline the requirements for deploying a biometric system, specifically a fingerprint system, in an educational environment. It further assessed the suitability of fingerprint technology in contrast to other biometric techniques. Key considerations included selecting an appropriate fingerprint device and determining its role in either identification or verification to enhance operational efficiency. The study also explored the implementation of biometric attendance systems in different regions, shedding light on their limitations, particularly in the educational context, with a particular focus on the case of Rwanda<sup>[25]</sup> (Munyaneza et al 2023)

If such a scenario were to materialize, the objections to a permanent substitution of teachers by AI programs in the classroom might lose relevance, as genuine I–Thou relations between teachers and students could become a realistic possibility. Emerging developments in AI, employing strategies like:

- 1. Observing human expert teachers,
- 2. Deriving insights from learning theories, and
- 3. Empirically studying both human and simulated students, are utilized by Artificial Intelligence Educational Programs such as GURU and INSPIRE<sup>[13]</sup> (Guilherme, A. 2019). "This paper explores the political economy of AI (artificial intelligence) and its interplay with education in China through an examination of government policies and initiatives from the private sector. Contrary to



prevalent narratives that portray China's AI development as a unified national strategy engaged in a global geopolitical competition for future dominance, this analysis offers a more nuanced perspective. It underscores the internal complexity marked by diverse regional networks and the influence of international corporate activities in shaping the dynamics of AI and education in China"<sup>[21]</sup> (Knox, J. 2020).

The technological field of Artificial Intelligence grows rapidly to transform multiple social contact domains. The delivery of new teaching approaches and educational solutions with artificial intelligence is already happening while researchers conduct testing in different settings. The working paper written for education policymakers provides AI impact predictions on the education field to support policy decisions through relevant solutions<sup>[28]</sup> (Pedro et al 2019). The study validated the widespread use of Artificial Intelligence in education by educational institutions which manifests through multiple different implementation methods. Teachers initially started using computers and their associated technologies which led to the creation of web-based and online intelligent education systems. Embedded computer systems have advanced into a system which combines humanoid robots with web-based chatbots together with embedded computer systems. Educational technologies fulfill two functions through autonomous operations and collaborative assistance that helps teachers in their teaching tasks with human counterparts ("Chen et al 2020")<sup>[7]</sup>

Al and machine learning research today shows significant promise to develop student understanding as well as teacher competence. Al education approaches cover personalized student recommendation systems and also include auto grading applications and educational resource systems. Al educational programs group themselves into three informal categories including Guidance systems and Learning tools and Teacher assistance programs<sup>[26]</sup> (Nguyen, N. D. 2023). The document explains my prediction about Artificial Intelligence and Education (AIED) research development over the next years by analyzing three essential model applications: models as scientific equipment, models in educational artifacts and models used for designing educational artifacts. The present focus on collaboratively oriented learning situations has led research to demand new kinds of theoretical frameworks which transcend traditional computational models for single intelligence. Educational technology needs to be exposed to the educational system stakeholders and stakeholders need to be provided with complete training to merge technological learning systems in schools "Top of Form(Baker, M. J. 2000). Al technology introduced into education created a new shape



which brings the potential to revolutionize established educational methods. A thorough investigation of AI technology for educational applications along with recognized limitations constitutes the main research objective<sup>[5]</sup>. According to (Adiguzel et al 2023) the research aims to analyze chatbots alongside their algorithms which duplicate dialogue interactions and produce real human text outcomes from user-input through natural language processing<sup>[1]</sup>.

The practice of no dilation leads to short patient commitments together with elevated convenience because patients maintain clear vision. The implementation of AI screening programs using internet connectivity in Africa has not shown any connectivity issues during research conducted in four African locations up to a remote area distant from Kigali. This model utilizes printed reports for patients combined with health education opportunities through which it promotes acceptance in diabetic retinopathy referrals<sup>[34]</sup> (Whitestone et al, 2023).

Students are like hungry minds when it comes to Al! They get its use in medicine and ethics, but they're itching to roll up their sleeves and build algorithms, code like pros, and see how it all works. To satisfy their hunger, let's bring in hackathons, mix science with computers, and get them collaborating – they'll be Al chefs in no time. Forget textbooks, it's time to hack for Al! Students everywhere want to get hands-on: building algorithms, coding, and evaluating the impact of Al tools. They already understand its use in medicine and ethics, now let's give them the tools to experiment and collaborate with computer science experts. Hackathons and multidisciplinary education are the ingredients for an Al education revolution<sup>[10]</sup> (Ejaz et al, 2022). Exactly that which is being achieved though technological innovations is rapidly changing the faces of higher institutions, teaching, and learning by students. In nursing education, such innovation offers an opportunity to reach the maximum number of students outside the confines of time and distance. In the Rwandan context, the use of electronic-learning in nursing education was necessitated by the necessity to develop within a short time and on a larger scale the skills of functioning nurses and midwives in the country<sup>[15]</sup> (Harerimana, A., & Mtshali, N. G. 2020).

"Innovative technologies now usher in new ways of transforming teaching and learning. The speed with which artificial intelligence (AI) technology has advanced has recently raised its visibility in education integration. This article provides a detailed exposition on the applications of American Institute of Physics in education, from adaptive learning to teaching evaluation and virtual online classrooms"<sup>[17]</sup> (Huang et al, 2021). The current concept of artificial intelligence serves as a solution against educational problems. Al solutionism trends continue to establish their position according to the views of at least



some sociologists studying education<sup>[8]</sup> (Davies et al, 2021). The "Science Technology Engineering Arts and Mathematics" (STEAM) context implements AI analytics by using scaffolding education to drive AI-thinking development through human-first reasoning aided with artificial intelligence<sup>[16]</sup>. Students benefit from this method as it enhances their development of knowledge and competencies according to How, M. L., & Hung, W. L. D. (2019). The brief history of Artificial Intelligence in Education (AIE) has experienced different paradigm shifts as explained in this paper which includes three core paradigms that feature the learner as recipient, collaborator, and leader respectively<sup>[27]</sup> (Ouyang, F., & Jiao, P. 2021

Progress in artificial intelligence advances rapidly through innovations such as OpenAI's ChatGPT which suggests major changes will occur in educational systems. The article conducts a broad assessment of ethical ChatGPT application in education to encourage additional research about this fundamental matter. The research underlines how crucial it is to keep principles of privacy alongside fairness non-discrimination and transparency while using ChatGPT as well as additional principles mentioned in the text. The study says 'these so-called 'guidelines' must be implemented for sustaining ethical accountability in education across worldwide territories'<sup>[24]</sup> (Mhlanga, D. 2023).

The rapid progress of artificial intelligence technology enables individuals to advocate its utilization for school resources that promote maximum student learning outcomes. The teachers' desire to use AI tools functions as a vital element in these processes when operating under such circumstances. The examination of variables affecting teacher adoption of educational applications and design techniques for higher education assignments remains highly compelling for researchers (Wang, et al 2021). Multiple experts predict that AI-assisted educational tools will create significant benefits for learning environments since they continue expanding rapidly in educational technology. AI technology enables teachers and learners to tailor their responses to both instructional content and the methods and emotional aspects of learning<sup>[29]</sup> (Pokrivcakova, S. 2019).

## METHODOLOGY

This research employs a mixed-methods approach to examine the impact of Artificial Intelligence on Rwandan education sustainability. The study involves a random diverse sample of 173 participants through a structured Google Forms survey and existing literature review from google scholar. Quantitative data analysis includes descriptive statistics and correlation analysis, while qualitative insights are obtained through thematic



analysis of written notes from Rwandan perspectives. The research is ethically conducted with a focus on participant confidentiality and informed consent.

#### Research objective

This study evaluates the influence of Artificial Intelligence (AI) on educational sustainability in Rwanda by analyzing existing AI integration while examining its connection to sustainability issues along with obstacles for adoption and recommending equalization strategies. This research uses survey data from 173 participants together with in-depth interviews to develop thorough knowledge about Rwandans' opinion on AI education. The goal is to establish practical recommendations for officials and teaching professionals and stakeholders to implement effective AI integration that supports education sustainability in Rwanda.

#### **Research gap**

This research study identifies the limited knowledge about how AI affects educational results in Rwanda through time-intensive evaluation. The study omits a thorough investigation of socioeconomic elements affecting digital technology equality while providing minimal information about AI efficiency in adaptive education and restricts its research to Rwanda with no regional comparisons.

#### Hypothesis

			"I here is no significant correlation between the integration					
Null Hypothesis (H0)		of	Artificial	Intelligence	(AI)	in	Rwandan	education
		Sus	stainability					
Alternative (H1)	Hypothesis	"Th of sus	nere is a s Artificial stainability	ignificant con Intelligence "	relatio (AI)	n be in	etween the Rwandan	integration education



#### **Statistical results**

Statistics							
		Age	Gender	Educational_level	Occupation	Sector	
	Valid	173	173	173	173	173	
N	Missing	0	0	0	0	0	
Mean		2.21	1.60	2.23	2.55	1.60	
Std. Error of	f Mean	0.078	0.037	0.068	0.107	0.037	
Median		2.14a	1.60a	2.19a	2.43a	1.60a	
Mode		2	2	2	1	2	
Std. Deviation	on	1.026	0.491	0.898	1.403	0.491	
Variance		1.053	0.241	0.807	1.969	0.241	
Skewness		0.507	-0.417	0.354	0.320	-0.417	
Std. Error of Skewness		0.185	0.185	0.185	0.185	0.185	
Kurtosis		-0.450	-1.848	-0.586	-1.203	-1.848	
Std. Error of Kurtosis		0.367	0.367	0.367	0.367	0.367	
Range		4	1	3	4	1	
Minimum		1	1	1	1	1	
Maximum		5	2	4	5	2	
Sum		383	277	386	442	277	
	10	.b,c	.b,c	.b,c	.b,c	. <b>b,c</b> /	
	20	1.18	1.00	1.28	1.11	1.00	
	25	1.33	1.10	1.44	1.31	1.10	
	30	1.49	1.20	1.59	1.52	1.20	
	40	1.81	1.40	1.90	1.92	1.40	
Percentiles	50	2.14	1.60 2.19		2.43	1.60	
	60	2.47	1.80	2.48	2.96	1.80	
	70	2.81		2.77	3.47		
	75	2.98		2.92	3.73		
	80	3.24		3.13	3.98		
	90	3.81		3.71	4.70		
a. Calculated from grouped data.							

b. Percentiles are calculated from grouped data.

Table 1 : Statistical Analysis table



#### **Demographic variables Results**

					Cumulative
Variables	Valid	Frequency	Percent	Valid Percent	Percent
Age	18-24	50	28.9	28.9	28.9
	25-29	59	34.1	34.1	63.0
	30-35	44	25.4	25.4	88.4
	36-41	17	9.8	9.8	98.3
	42& above	3	1.7	1.7	100.0
	Total	173	100.0	100.0	
	Male	69	39.9	39.9	39.9
Gender	Female	104	60.1	60.1	100.0
	Total	173	100.0	100.0	
	A2/High	37	21.4	21.4	21.4
	school				
Educational	Bachelors	76	43.9	43.9	65.3
level	Masters	43	24.9	24.9	90.2
	PHD	17	9.8	9.8	100.0
	Total	173	100.0	100.0	
	Student	60	34.7	34.7	34.7
	Teacher	25	14.5	14.5	49.1
	Academician	40	23.1	23.1	72.3
Occupation	Professor	28	16.2	16.2	88.4
	Non-	20	11.6	11.6	100.0
	acadimician				
	Total	173	100.0	100.0	
Sector	Private sector	69	39.9	39.9	39.9
	Government	104	60.1	60.1	100.0
	sector				
	Total	173	100.0	100.0	

Table 2 : Demographics result Analysis table

#### Demographic result demonstration

This demographic profile ensures diverse perspectives, encompassing students, educators, and professionals from both private and public sectors, enriching the study's insights into the impact of (AI) Artificial Intelligence on Rwandan educational sustainability.



The data offers a comprehensive overview of the 173 respondents, revealing a diverse and educated participant profile. The majority of respondents fall within the 25-29 age group (34.1%), indicating a predominantly youthful sample, while those aged 18-24 contribute significantly as well (28.9%) followed by 30-35, 36-41, 42& above as well with 25.4%, 9.8%, and 1.7% respectively. The gender distribution is slightly skewed towards females (60.1%), suggesting a higher representation of women in the study. Educationally, the majority have completed a bachelor's degree (43.9%), with a substantial representation of master's degree holders (24.9%), high school coves 21.4% while PHD cover 9.8%. Occupation-wise, students form the largest group (34.7%), followed by academicians (23.1%) and professors 16.2%, teachers (14.5%) non-academicians coves 11.6%. In terms of sectors, there is a balanced representation, with 60.1% of respondents working in the government sector and 39.9% in the private sector.

Correlations Results						
		Artificial Intelligence	Education			
ence	Pearson Correlation	1	.428**			
llig	Sig. (2-tailed)		0.000			
Artificial Intel	Sum of Squares and Cross- products	50.598	17.865			
	Covariance	0.294	0.104			
	Ν	173	173			
Education	Pearson Correlation	.428**	1			
	Sig. (2-tailed)	0.000				
	Sum of Squares and Cross- products	17.865	34.495			
	Covariance	0.104	0.201			
	Ν	173	173			
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 3 : Correlation results analysis table

#### **Correlations Results demonstration**

Research results show a statistically important positive connection (Pearson's r = 0.428, p < 0.05) among Artificial Intelligence (AI) and Education measures which leads to rejecting the null hypothesis and confirming the alternative hypothesis. Education grows positively parallel with AI usage patterns in the course of time. Educational activities together with their outcomes show direct connection to AI implementation in educational



institutions. The reliability and strength of this relationship stands confirmed by the 0.428 correlation value with p < 0.01 (2-tailed). The positive relationship between AI and Education factors is confirmed through values of both sum of squares and cross-products and covariance which demonstrate positive effects.

#### **Discussion and Implication/ Recommendations**

The study provides actionable insights for shaping the coming of education in Rwanda, emphasizing the transformative potential of AI while acknowledging the importance of cautious implementation to avoid misuse and its potential impact on imaginative thinking. Furthermore, challenges related to unequal access to AI resources are highlighted, necessitating targeted development, infrastructure investments, and specialized training. Policymakers are urged to focus on creating locally-driven AI solutions to avoid dependency on external resources.

The Rwanda Education Board (REB) along with MINEDUC, should take strategic actions based on the research findings and perspectives of Rwandans on Artificial Intelligence (AI) in education. It is crucial for MINEDUC and REB to invest in localized AI solutions tailored to the Rwandan education context, promoting collaboration between the education board, technology developers, and educational institutions. Addressing the shortage of educators knowledgeable in AI is imperative, and REB should implement professional development programs and partnerships with external AI experts to enhance educators' skills. Equitable access to AI resources across urban and rural areas must be a priority, involving infrastructure development and training programs. Creating awareness campaigns to educate the public about the benefits of AI in education is essential. REB (Rwanda Education Board) should foster innovation by supporting research initiatives and implementing guidelines for the ethical use of AI. Collaborating with the private sector can provide access to advanced AI technologies, while continuous monitoring and evaluation will help measure impact and inform future decisions. By undertaking these measures, REB can ensure the effectiveness and responsible integration and use of AI, positively impacting education in Rwanda.

#### Limitations

This study faces limitations from self-reported responses obtained from 173 participants leading to possible constraints in generalization of research outcomes. The survey technique exposes itself to response biases and requires interpretation which can affect how accurately survey participants express their perspectives. This type of research design prevents researchers from identifying causal links between variables in sequential



periods. The researcher collected data mainly through internet-based methods which could have excluded participants without computer access leading to selection biases in the results. The findings obtained from this study could encounter changes which emerge from advancements in educational programs combined with changes in technological practices after the completion of research activities.

## CONCLUSION

The research examines the effects that Artificial Intelligence (AI) integration has on Rwandan education through multiple viewpoint analysis. The analysis shows multiple barriers especially the differences in AI access. The Rwanda Education Board (REB) should establish a close partnership with the Ministry of Education (MINEDUC) to execute strategic approaches dealing with these challenges. The implementation strategy should focus on developing localized AI answers combined with teacher education improvement and equalized resources distribution followed by guided collaboration with private sector providers. Nations goals will be achieved through these steps which will enable efficient AI adoption toward sustainable educational outcomes throughout Rwandan society. The study offers decisive advice to REB and MINEDUC in steering AI integration in education for positive results as Rwanda progresses with technological development. Future academic work should research long-term AI integration effects and create social accessibility plans while conducting AI education studies nationwide across African nations.



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