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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

Artificial Intelligence (AI) is exerting a profound influence on education across various dimensions. It introduces innovations such as “virtual assistants tailored for personalized learning experiences and tracking systems” for both students and teachers. While the potential advantages of integrating AI into education are noteworthy, conversations surrounding its implications on privacy and well-being are crucial. Simultaneously, the societal shift instigated by AI necessitates a comprehensive overhaul of conventional educational systems. The transformative nature of AI calls for a fundamental reevaluation and restructuring of traditional

educational paradigms (Dignum, V. 2021). In the realm of education, artificial intelligence will act as a catalyst for change and a facilitator, reshaping the nature of tasks and the distribution of responsibilities (Alam, A. 2021). To nurture minds that can gracefully adapt and comprehend the complexities of the AI-driven world, we must not shy away from actively integrating AI into the very fabric of education. Embedding AI literacy and AI thinking into school curricula, though still in its infancy across various countries, holds immense potential to unlock this crucial level of understanding and adaptability (Vazhayil et al 2019). As AI tentacles reach deeper into diverse parts of our world, higher education isn't being spared. The field of AI-powered learning, known as "Artificial Intelligence in Education" (AIED), has been surging with progress in recent years. This exploration dives into how AI is being used to reshape teaching and learning in universities, along with the potential impact of its integration (Jain, S., & Jain, R. 2019).

The study on AI's impact on education sustainability in Rwanda identifies crucial research gaps. These include the need for in-depth, longitudinal assessments of AI's long-term impact on various educational outcomes, understanding socio-economic factors influencing unequal AI access, exploring the effectiveness of AI in personalized learning, and conducting comparative analyses across diverse African nations. Addressing these gaps is essential for a more comprehensive understanding of AI in education and for developing targeted and equitable strategies for its integration across different contexts, as mentioned in different input from the respondents.

Perspectives of Rwandans on use of 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 my 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” [1]. “Actually, Al 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” [2]. “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, incase Rwanda is a developing country there should be new strategies for improving the quality of education in Rwanda" [3]. "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" [4]. "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" [5].

"AI has become increasingly important in education in Rwanda. It helps enhance learning experiences by providing personalized and adaptive content to students. AI-powered tools can assist teachers in assessing students' progress and providing targeted interventions. Additionally, AI can help bridge the gap in access to education by providing resources and support to remote areas. It's exciting to see how AI is transforming education in Rwanda and empowering students to reach their full potential" [6]. "Artificial Intelligence in Rwanda's education can enhance access and quality. AI-powered chatbots can provide 24/7 support, while personalized learning platforms adapt to individual student needs. Data analysis helps policymakers make informed decisions, and AI-driven content can bridge language gaps, making education more inclusive and effective" [7]. "Well there are some students that have access on AI tools but it's not that well known yet for AI to be used by most of the people in Rwanda" [8]. "The government of Rwanda must increase artificial intelligence material like Sophia and try to make different programs such as Al-chat which will be able to help learners to find some solution regarding on their studies for example if people meet some challenges, they can go to Sophia or Al chat program for finding special solutions" [9]. "Artificial intelligence can enhance education in Rwanda by providing personalized learning experiences, automating administrative tasks, enabling remote learning, and improving access to educational resources. It can also assist in identifying learning gaps, tracking student progress, and creating targeted interventions for better academic outcomes" [10]. "Provision of AI infrastructures as many as possible like laptops, desktops, screens and projectors would be enough as the willingness to use AI in education is already strong" [11].

"My suggestion on use of AI in Rwanda would be to reduce the use of it because the more it's accessible to students the more it will limit them to use their minds in their academic works" [1] "AI in Rwanda education isn't really a big thing. It's not making a real difference right now, but maybe someday it will" [2]. "It plays big role in education of Rwanda but if

it is misused ,it reduces imaginative power of students" [3].

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 AI 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 (Tahiru, F. 2021). "As advancements in computing and information processing have progressed, the integration of artificial intelligence into education has become prevalent. This application of AI in education introduces fresh opportunities, potentials, and challenges to educational practices. This paper delineates three paradigm shifts observed in the brief history of AIEd: the AI-directed paradigm, wherein AI guides cognitive learning with learners as recipients; the AI-supported paradigm, where AI collaborates with learners as aids; and the AI-empowered paradigm, allowing AI to empower learners to take charge of their learning journey. These paradigms leverage AI techniques to address educational and learning challenges in various ways. In Paradigm One, AI represents knowledge models and guides cognitive learning, providing services to learners. In Paradigm Two, AI assists learning as learners actively engage with it. In Paradigm Three, AI empowers learning, enabling learners to take control of their educational path. The overarching trend in AIEd development focuses on enhancing learner agency and personalization, promoting reflective learning, guiding AI systems for adaptive adjustments, and fostering an iterative development of personalized learning driven by data and centered around the learner" (Ouyang, F., & Jiao, P. 2021).

"The swift advancements in computing technologies have facilitated the incorporation of Artificial Intelligence in Education applications. AIED entails the utilization of Artificial Intelligence technologies or application programs within educational environments to enrich teaching, learning, and decision-making processes. By employing AI technologies that replicate human intelligence for inferences, judgments, and predictions, computer systems can provide personalized guidance, support, and feedback to students. Additionally, these technologies assist teachers and policymakers in decision-making. Despite being recognized as a primary research focus in the domain of computers and education, the interdisciplinary nature of AIED presents a distinct challenge for researchers with diverse disciplinary backgrounds. This paper elucidates the definition and roles of AIED studies, underscoring their perspective in addressing educational needs" (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 AI-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 (Masabo et al 2023). "The investigation uncovered a rising interest and impact of AI in Education (AIED) research, emphasizing a gap in the incorporation of deep learning technologies into educational settings. Traditional AI tools, especially natural language processing, were widely utilized, with more advanced techniques being underused. Notably, there was a shortage of studies that seamlessly integrated AI technologies with an in-depth exploration of educational theories. The findings suggest recommendations for scholars, including exploring AI applications in physical classrooms, recognizing intricate relationships between learners' responses and conceptual understanding, adopting advanced deep learning algorithms, utilizing natural language processing for precision education, incorporating biomedical technologies to enhance the learner experience, and closely aligning AI technologies with educational theories" (Chen et al 2020). "Advocating the application of artificial intelligence techniques to identify students' learning styles, this tool seeks to streamline the comparison of diverse learning models, pinpointing the most suitable one for a given educational setting. The suggestion is to implement this tool in a cloud environment, providing a scalable solution that guarantees quick and effortless determination of learning styles" (Bajaj & Sharma, 2018). "Incorporating technology into education fosters creative teaching methods and the exploration of novel pedagogical approaches, ultimately resulting in improved learning outcomes. While technology offers numerous advantages to education, it is imperative to recognize that its successful integration requires meticulous planning, thorough training, and continuous evaluation. These measures are crucial to ensure that the integration aligns seamlessly with educational objectives and positively enhances the overall learning experience" (Aggarwal, D. 2023).

Over the past decade, there was a significant quickening in research and development within the field of Artificial Intelligence in Education (Gayed et

al 2022). "Through content analysis, it was discerned that the research questions could be grouped into three primary layers: the development layer, covering aspects like classification, matching, recommendation, and deep learning; the application layer, which involved feedback, reasoning, and adaptive learning; and the integration layer, encompassing affection computing, role-playing, immersive learning, and gamification. Furthermore, the study identified four emerging research trends for future exploration, namely, the Internet of Things, swarm intelligence, deep learning, and neuroscience. It also suggested the assessment of the impact of artificial intelligence in education as an area deserving further investigation" (Zhai et al 2021). The swift advancements in AI technologies have sparked widespread interest in their capacity to tackle challenges across various sectors, with education being a notable focus. Enhancing learning outcomes and delivering relevant education to a diverse audience have emerged as predominant goals globally, cutting across both developed and developing nations. These objectives have gained heightened significance in the contemporary era, characterized by technology-driven personalization in education (Srinivasan, V. 2022). "The main aim of this research was to assess the factors influencing the adoption of Artificial Insemination Technology within the Rwamagana district of Rwanda, focusing on small dairy farmers. The data collection process involved the administration of semi-structured questionnaires to both users and nonusers of Artificial Insemination technology, complemented by in-depth interviews with key informants. Additionally, relevant secondary data were obtained from public authorities. Quantitative data underwent analysis using descriptive statistics and a binary regression model, while qualitative data were subjected to content analysis. The results indicate that Artificial Insemination Technology is perceived as a crucial element in enhancing reproductive performance, potentially resulting in increased dairy productivity for small-scale dairy farmers" (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 (Gwagwa et al), "Formerly a distant dream, artificial intelligence has rapidly evolved into a concrete reality, seamlessly embedding itself in our daily lives and influencing every aspect, including education. Despite being acknowledged as a field in its nascent stages, the trajectory of AI's development and its untapped potential presents an intriguing subject for ongoing observation. Within this framework, this chapter delves into present understandings and anticipates future perspectives of AI, examining its applications across various

contexts such as natural language processing, machine learning, and deep learning" (Goksel, N., & Bozkurt, A. 2019). "Artificial intelligence has achieved notable advancements in the education sector, assuming a strategic and pivotal role in educational progress. It is progressively acting as a digital assistant, rendering valuable support to both teachers and students. AI contributes in various capacities, including providing students with access to an extensive range of learning materials customized to their individual needs and specific subjects" (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 specific focus on the case of Rwanda (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 (Guilherme, A. 2019). "This paper explores the political economy of artificial intelligence (AI) 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" (Knox, J. 2020). "Artificial Intelligence stands as a swiftly expanding technological domain with the capacity to revolutionize various facets of our social interactions. In the field of education, AI is already giving rise to innovative teaching and learning solutions, presently undergoing testing in various contexts. This working paper, crafted for education policymakers, envisions the impact of AI on the education sector, with the goal of offering insights for informed and fitting policy responses" (Pedro et al 2019). "The research affirmed the extensive adoption and application of Artificial Intelligence in education, particularly by educational institutions, in diverse forms. The trajectory of AI in education commenced with the utilization of computer and

computer-related technologies, evolving into web-based and online intelligent education systems. It has further progressed with the integration of embedded computer systems, accompanied by other technologies such as humanoid robots and web-based chatbots. These technologies are employed to autonomously or collaboratively execute instructors' duties and functions alongside human instructors" (Chen et al 2020).

Recent advancements in machine learning and AI offer the potential to enhance both student learning and teacher capabilities. AI approaches in education encompass a variety of applications, such as generating personalized student recommendations, autograding essays, and enhancing educational resources. AI programs designed to enhance education can be informally categorized into three groups: Guidance, Learning, and Teacher support (Nguyen, N. D. 2023). "In this manuscript, I indulge in speculation regarding the imminent future of research in Artificial Intelligence and Education (AIED), with a particular focus on three essential applications of models within educational processes: models as scientific tools, models as integral components of educational artifacts, and models as foundational elements for designing educational artifacts. Concerning the first role, I contend that the recent emphasis on studying collaborative learning situations requires a shift in the types of theories and models employed, extending beyond computational models of individual cognition. Regarding the second role, I propose that to seamlessly integrate computer-based learning systems into schools, there is a necessity to 'open up' the curriculum to educational technology, 'open up' educational technologies to stakeholders in educational systems, and 'open up' those stakeholders to the technology through comprehensive training initiatives" (Baker, M. J. 2000)."Artificial intelligence (AI) introduces novel tools to the educational realm, offering the potential to revolutionize traditional teaching and learning methods. This study comprehensively examines AI technologies, delving into their potential applications in education and the challenges they pose. The emphasis is on chatbots and related algorithms capable of simulating human interactions and generating human-like text based on input from natural language" (Adiguze, et al 2023). "Avoiding dilation reduces the time patients need to commit and enhances convenience by preventing blurred vision. While internet connectivity has been raised as a potential challenge for implementing AI screening programs in Africa, no such problems were encountered in the four locations studied, including one situated far from Kigali. Additionally, this model incorporates printed reports for patients, providing an opportunity for health education, which is a crucial element in increasing the acceptance of diabetic retinopathy referrals" (Whitestone et al, 2023).

Students are like hungry minds when it comes to AI! 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 AI chefs in no time. Forget textbooks, it's time to hack for AI! Students everywhere want to get hands-on: building algorithms, coding, and evaluating the impact of AI 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 AI education revolution (Ejaz et al, 2022). "Technological innovations, such as e-learning, are rapidly transforming the approaches adopted by higher education institutions for teaching and students for learning. In the realm of nursing education, e-learning provides opportunities to reach a significant number of students without the constraints of time and location. In the specific context of Rwanda, the integration of e-learning in nursing education was motivated by the country's need to enhance the proficiency of working nurses and midwives on a large scale and within a short timeframe" (Harerimana, A., & Mtshali, N. G. 2020). "The emergence of innovative technologies is transforming the dynamics of teaching and learning. The swift progress of artificial intelligence (AI) technology in recent years has made its integration into education more prominent. This article offers a comprehensive overview of the applications of AI in the education sector, encompassing areas such as adaptive learning, teaching evaluation, and virtual classrooms, among others" (Huang et al, 2021).

"Artificial Intelligence is presently being hailed as a solution to perceived challenges in education. Although only a few sociologists of education endorse its deterministic claims, the trend of AI solutionist thinking is gaining considerable traction" (Davies et al, 2021). In "Science, Technology, Engineering, Arts, and Mathematics" (STEAM) education, the use of artificial intelligence (AI) analytics serves as valuable educational scaffolding. It aids in eliciting students' AI-thinking skills by fostering AI-assisted human-centric reasoning. This approach contributes to the development of knowledge and competencies in students (How, M. L., & Hung, W. L. D. 2019). "In the relatively short history of Artificial Intelligence in Education (AIE), the field has undergone various paradigmatic shifts, outlined in this position paper as three paradigms: AI-directed, where the learner is a recipient; AI-supported, where the learner is a collaborator; and AI-empowered, where the learner assumes a leadership role" (Ouyang, F., & Jiao, P. 2021). "The swift progress of artificial intelligence, demonstrated by groundbreaking technologies like OpenAI's ChatGPT, holds the promise of bringing about substantial changes in the field of education. This article seeks to offer a thorough analysis of the responsible and ethical use of ChatGPT in education, encouraging further examination and discourse on this crucial subject. The study emphasizes the significance of respecting privacy, ensuring fairness and non-discrimination, maintaining transparency in the application of ChatGPT, and other factors

elucidated in the paper. To uphold ethics and accountability in the global education sector, the study advocates for the implementation of these guidelines" (Mhlanga, D. 2023).

"With the rapid advancement of artificial intelligence (AI) technologies, there is an increasing interest in promoting their use in school settings to enhance students' learning performance. The intention of teachers to adopt AI tools in their classrooms becomes pivotal in this context. Therefore, it is crucial to explore the factors that influence teachers' intention to incorporate AI technologies or applications into course designs in higher education"(Wang, et al 2021). AI-powered tools signify a rapidly expanding realm in educational technology, and numerous experts foresee significant benefits for both students and teachers. Envisioned as providing personalized, flexible, inclusive, and engaging learning experiences, AI-powered education has the potential to furnish teachers and learners with resources enabling them to respond not only to the content being learned but also to the manner in which it is being learned and the emotional state of the student (Pokrivcakova, S. 2019).

Methodology

This research employs a mixed-methods approach to investigate 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

The research aims to investigate the impact of Artificial Intelligence (AI) on educational sustainability in Rwanda by assessing the current state of AI integration, analyzing its correlation with educational sustainability, identifying adoption barriers, and proposing strategies for equitable access. Utilizing a mixed-methods approach with survey data from 173 participants and in-depth interviews, the study aims to provide nuanced insights into Rwandans' perspectives on AI in education. The ultimate objective is to offer actionable recommendations for policymakers, educators, and stakeholders to facilitate the effective and inclusive integration of AI, thereby enhancing education sustainability in Rwanda.

Research gap

The research gap in this study revolves around the need for more extensive and longitudinal assessments of the long-term impact of AI on various educational outcomes in Rwanda. Specifically, there is a lack of in-depth exploration into socio-economic factors contributing to disparities in AI utilization, a brief treatment of the effectiveness of AI in

personalized learning, and a focus solely on Rwanda without a comparative analysis across diverse African nations.

Hypothesis

Null Hypothesis (H0): "There is no significant correlation between the integration of Artificial Intelligence (AI) in Rwandan education sustainability".

Alternative Hypothesis (H1): "There is a significant correlation between the integration of Artificial Intelligence (AI) in Rwandan education sustainability".

Demographic result demonstration

This demographic profile ensures diverse perspectives, encompassing students, educators, and professionals from both public and private sectors, enriching the study's insights into the impact of 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 demonstration

The correlation results between Artificial Intelligence (AI) and Education variables indicate a statistically significant positive relationship (Pearson's $r = 0.428$, $p < 0.05$), hence to the rejection of null hypothesis in favor of alternative hypothesis. This signifies that as the use of AI increases, there is a corresponding positive correlation with educational factors. The positive correlation suggests that the integration of AI in education is associated with higher levels of educational activities or outcomes. The correlation coefficient of 0.428, being significant at the 0.01 level (2-tailed), underscores the strength and reliability of this relationship. The covariance values further support this positive correlation, with both the sum of squares and cross-products and the covariance between AI and Education variables showing positive values.

Discussion and Implication/ Recommendations

The study provides actionable insights for shaping the future 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 and responsible use of AI in education is essential. REB 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 effective and responsible integration of AI, positively impacting education in Rwanda.

Limitations

One limitation of this study is the reliance on self-reported data from a relatively small sample size of 173 respondents, potentially affecting the generalizability of findings. The survey method's susceptibility to response biases and subjective interpretations may influence the accuracy of gathered perspectives. Additionally, the cross-sectional nature of the study limits the ability to establish causal relationships over time. The data collection primarily occurred through online channels, potentially excluding individuals without internet access, introducing a selection bias. Furthermore, as AI in education is a rapidly evolving field, the study's findings may be subject to changes in technology and educational practices post-research.

Conclusion

In conclusion, this study illuminates the implications of integrating Artificial Intelligence (AI) in Rwanda's education system, drawing from a diverse set of perspectives. However, challenges, particularly disparities in AI access, are highlighted. To navigate these challenges, it is recommended that the Rwanda Education Board (REB) collaborates

closely with the Ministry of Education (MINEDUC) to implement targeted strategies. These may include fostering localized AI solutions, addressing the knowledge gap among educators, ensuring equitable access, and forming partnerships with the private sector. Such actions would align with national educational objectives and contribute to a responsible and effective integration of AI, paving the way for a sustainable and inclusive future in Rwandan education. As Rwanda continues its technological advancements, the study provides pertinent insights for REB and MINEDUC to steer AI integration in education towards positive outcomes. Future research endeavors could delve deeper into the long-term impacts, strategies for socio-economic inclusivity, and comparative analyses across African nations, further enriching the understanding of AI's role in education.

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