Oikos

The Zimbabwe Ezekiel Guti University Bulletin of Ecology, Science Technology, Agriculture, Food Systems Review and Advancement

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JOURNAL PURPOSE

The purpose of *the Oikos - The Zimbabwe Ezekiel Guti University Bulletin of Ecology, Science Technology, Agriculture and Food Systems Review and Advancement* is to provide a forum for scientific and technological solutions based on a systems approach and thinking as the bedrock of intervention.

CONTRIBUTION AND READERSHIP

Natural scientists, engineering experts, technologists, multidisciplinary teams are encouraged.

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Articles must be original contributions, not previously published and should not be under consideration for publishing elsewhere.

Manuscript Submission: Articles submitted to the *Oikos - The Zimbabwe Ezekiel Guti University Bulletin of Ecology, Science Technology, Agriculture and Food Systems Review and Advancement* are reviewed using the double-blind peer review system. The author's name(s) must not be included in the main text or running heads and footers.

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Language: British/UK English
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Italicise *et al., ibid.,* words that are not English, not names of people or organisations, etc. When using more than one citation confirming the same point, state the point and bracket them in one bracket and in ascending order of dates and alphabetically separated by semi-colon e.g. (Falkenmark, 1989, 1990; Reddy, 2002; Dagdeviren and Robertson, 2011; Jacobsen *et al.,* 2012).

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Infusing Artificial Intelligence in Higher Learning Institutions by Reimagining Education for the Future

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Abstract

The landscape of higher education is undergoing a paradigm shift with the infusion of Artificial Intelligence (AI). This article critically explores the potential of AI to reshape the learning experience within universities and colleges. We examine how AI can personalise learning journeys, enhance student support, and empower educators to deliver a more effective and engaging educational experience (Bates, 2019). The key considerations of this study are: personalised learning paths, intelligent tutoring and assistance, enhanced assessment and feedback, data-driven decision-making, and empowering educators. The challenges with the infusion are noted to be ethical considerations, faculty development and training, and inclusive learning design. The study employs a mixed methodology approach, the researchers collect and analyse both quantitative and qualitative data within the same study. A target population of 25 lecturers were interviewed to find out how AI is, and continues to reshape teaching and learning in higher institutions. About 50 learners also take part in the study by completing online surveys that ascertain how AI is aiding in their learning. The use of a mixed method approach helps to reach more participants and validate the data. It helps the researchers to gain a

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broader understanding of the investigation and triangulate the data. The infusion of AI in higher learning institutions presents a unique opportunity to personalise learning, enhance student support, and empower educators. By addressing ethical concerns, fostering faculty development, and prioritizing inclusive design, AI can become a powerful tool for reshaping higher education into a more effective, engaging, and equitable learning environment for the future.

Keywords: *Artificial Intelligence, Virtual Reality, Augmented Reality, Machine Learning Infusion, Education, Higher learning.*

INTRODUCTION

In recent years, there has been a significant rise in the integration of artificial intelligence in higher learning institutions. The infusion of artificial intelligence into higher learning institutions is a topic of increasing interest in educationally-related research. This integration of AI has the potential to transform the way students learn and institutions teach and evolve. Artificial intelligence (AI) is being heralded as the next big technological revolution with the potential to transform every major sector of the global economy (World Economic Forum, 2018). Industries like healthcare, transportation, and manufacturing have already started leveraging AI technologies to enhance quality, efficiency, and productivity (OECD, 2019). One area that can witness massive change with the integration of AI is education. Higher education needs to adapt to keep pace with the rapidly evolving skill demands of the future job market. As per World Economic Forum (2016), over a third of core job skills changed significantly by 2022 and many current jobs have proven to become obsolete due to advances in AI, robotics, nanotechnology, and other emerging technologies. This necessitates reimagining educational models to equip students with lifelong learning mindsets and skills

like critical thinking, problem-solving, and collaboration that help them thrive in change.

AI can revolutionise learning experiences, pedagogy and access to education. Technologies like intelligent tutoring systems, adaptive learning, virtual reality, and augmented reality are already being leveraged in selective higher education institutions to enhance learning outcomes, enabling personalised education pathways, and supplementing traditional face-to-face teaching methods (Goodyear, 2018). Furthermore, AI is playing a significant role in democratising access to quality education by facilitating more affordable blended and online programmes and content (United Nations, 2019).

The article aims to critically explore how higher learning institutions can strategically infuse AI across their systems and curriculums to reimagine education to tackle challenges of the future like rapid skills obsolescence, accessibility, and lifelong learning demands. The article analyses the trends, opportunities, and challenges in implementing AI for advancing education goals like making learning student-centric, developing of future skills, and universalizing educational opportunities.

The integral objective of the article is to provide a comprehensive analysis of infusing AI for transforming higher education supported by perspectives from different literature. To analyse how AI tools and techniques are currently being used to enhance learning experiences in higher education institutions (Brooks *et al.*, 2017; Yudelson *et al.*, 2013). To understand how AI can make quality education accessible and affordable for more learners by facilitating new models of blended, online, and skills-based learning (Liyanagunawardena *et al.*, 2013; Graham, 2013). Lastly, we recommend strategies, guidelines, and best

practices for developing and deploying AI responsibly while reaping its benefits to ultimately advance learning goals (Jobin *et al.,* 2019; UNESCO, 2022).

CONCEPTUAL FRAMEWORK

The conceptual framework builds upon the concept of student-centred learning proposed in the seminal works of Schunk (2012) and Crawford (2018). It posits that the infusion of AI in higher education can transform learning models to make them more responsive, accessible, and skills-focused for the future.
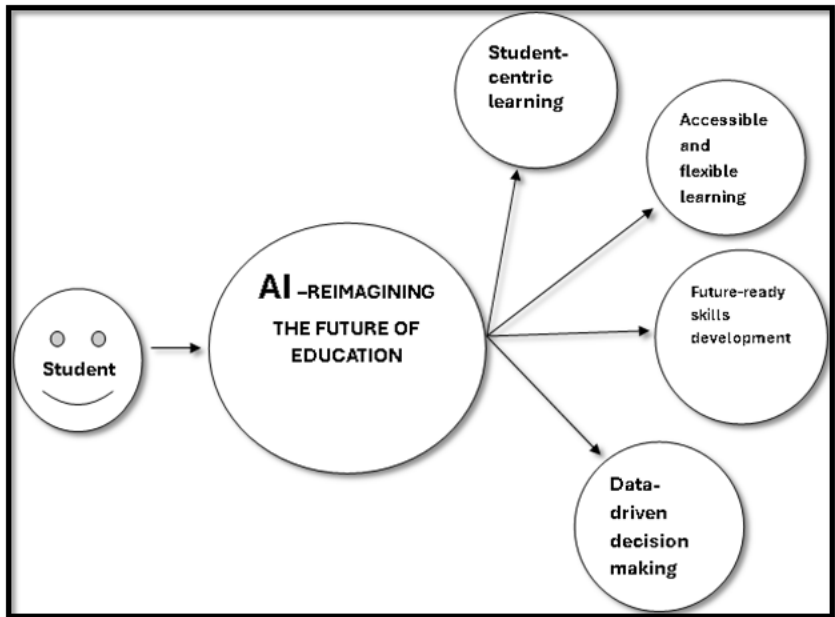

Figure 1- Conceptual framework

The key elements of the framework are:

STUDENT-CENTRIC LEARNING

The focus shifts from one-size-fits-all education approach to personalised learning experiences customised for each student's

abilities, skills, preferences, and pace of learning. AI facilitates customised learning journeys for diverse learners. Intelligent tutoring systems recommended by Brooks *et al.* (2017) and Choi *et al.* (2018) individualise instruction. Adaptive learning platforms discussed by VanLehn (2011) and Yudelson *et al.* (2013) optimize content based on learning levels. AI tools like adaptive learning platforms, virtual tutors, and simulations individualize the learning journey. Intelligent assessment and feedback systems also make the process more personally tailored.

ACCESSIBLE AND FLEXIBLE LEARNING

AI facilitates the diversification of models like online, blended, micro-credentials, and competency-based programmes. This makes quality education scalable, affordable, and open/flexible in terms of place and pace of learning. This is Ubiquitous access, as automated systems suggested by Harasim (2017) overcome infrastructural barriers to access. Students can learn as per their schedule using mobile technologies. Automated systems help overcome issues like high costs and limited physical infrastructure.

FUTURE-READY SKILLS DEVELOPMENT

Curriculums integrate AI/automation-related subjects and hands-on experience with emerging technologies. AI also helps map dynamic skill needs and guide academic/career choices. Partnerships with industry expose students to workplace applications of AI.

DATA-DRIVEN DECISION-MAKING

Learner data from AI interaction is analysed for personalised advisement, predictive analytics of outcomes, programme reviews, and optimization of support services. Data insights aid strategic planning, resource allocation, faculty training, and overall institutional effectiveness.

In summary, the model envisages leveraging AI to reform education for personalised, lifelong learning as the world transitions to technology-led jobs outlined in The Fourth Industrial Revolution by Schwab (2017).

LITERATURE REVIEW

The infusion of AI in education has elicited significant attention from researchers in recent years. Several studies have explored AI's potential to enhance learning experiences and outcomes. Intelligent tutoring systems have been found to provide individualized instruction and timely feedback that improves learning (Choi *et al*., 2018; VanLehn, 2011). Adaptive learning platforms using AI customise content delivery and practice opportunities as argued by student proficiency, leading to better performance (Yudelson *et al*., 2013; Brooks *et al*., 2017). Simulations, virtual labs and augmented reality experiences with AI assist train complex cognitive skills and soft skills (Radu, 2014; Bacca *et al*., 2014).

Research also indicates AI can augment teaching by automating routine tasks like grading freeing up faculty time for high-level guidance (Harasim, 2017). Automated essay scoring systems using AI have attained close parity with human raters (Shermis & Burstein, 2013). Intelligent advising agents employing AI help recommend relevant learning resources to students (Schwartz *et al*., 2011).

Studies propose AI enables new models of micro-credentialing, blended learning, and competency-based programmes improving access, affordability, and scalability of education (Graham, 2013; Liyanagunawardena *et al.,* 2013; Barbour and Reeves, 2009). Automated transcripts, degree planning, and other administrative workflows with AI can support lifelong learning on the move (Daniel,

2015). A few institutions have piloted integrating AI/ML/Robotics curricula to prepare graduates for technological changes in industry (Russell *et al.*, 2019; Taipalus *et al.*, 2018). Partnerships between universities and technology companies provide opportunities for industry exposure through apprenticeships and mentoring (Howard *et al.*, 2019).

While research underscores AI's learning enhancement potential, concerns around bias, privacy, job disruption, and over-dependence on technology also emerge (Crawford, 2019; Stone *et al.*, 2016; Smith, 2019). More studies examining the responsible implementation of AI addressing societal impacts are warranted. Overall, literature presents AI as a game-changing technology for education though its large-scale adoption faces challenges that require addressing via further research.

RESEARCH METHODOLOGY

A mixed methods approach was utilised in this study to comprehensively analyse how AI is reshaping higher education. This allows for triangulation of both qualitative and quantitative data to gain deeper insights. The target population included lecturers and students from local universities. For the lecturer interviews, stratified sampling was used to select 25 lecturers representing different fields of study. Semi-structured interviews were conducted using an interview guide with open-ended questions exploring experiences of AI integration. The interviews were audio-recorded and transcribed for analysis.

Interviews were conducted with 25 key informants including university administrators, and faculty lecturers. An interview guide consisting of open-ended questions was used to explore perceptions

and experiences of AI infusion in education. Interviews were audio-recorded and transcribed for analysis.

The researchers directly observed AI-enabled learning platforms, adaptive courses, virtual simulations/labs, and other technologies used at 5 higher education institutions to get first-hand experience of implementation (Creswell and Poth, 2016). Field notes were recorded. Collected data from document review, interviews, and observations was analysed using thematic analysis. Recurrent themes in the context of the research topic were identified and categorized (Braun and Clarke, 2006). Researchers' interpretation was balanced with participants' perspectives through member-checking (Lincoln and Guba, 1985).

Informed consent was obtained from all participants. Confidentiality and anonymity were ensured by using codes instead of identities (Israel and Hay, 2006). Approval from relevant university oversight boards was acquired before data collection. The study upholds guidelines for responsible AI research (Jobin *et al.*, 2019). This methodology aimed to capture multifaceted viewpoints on infusing AI for reimagining higher education. Triangulation of mixed methods enhanced the validity and reliability of findings.

RESULTS
Table 1 reveals that the majority of respondents were female (54%) and primarily belonged to the 19-24 age group (60%). In terms of academic year, the majority (over 85%) were in their third or fourth year. The most commonly used platforms were intelligent tutoring systems (30%), while 40% of respondents used AI for less than 1 hour per week. Notably, all variables were statistically significant ($p < 0.05$), indicating that they can be used to explain the outcome.

Table 1- consolidated results table

Variable	Percent	Cross tabulation Impact on learning		P value
		Positive	Negative	
Gender				
Male	46	82	17.4	0.014
Female	54	55	44.4	
Age				
19-24	60	56.7	43.3	0.035
25-30	40	85	15	
Level of study				
1	36	55.6	44.4	0.056
2	24	50	50	
3	16	87.5	12.5	
4	24	91.7	86	
Experience				
Adaptive/personalise learning platforms	24	100	0	0.012
Intelligent tutoring systems	30	66.7	33.3	
Automated essay scoring	16	37.5	62.5	
Virtual reality simulation	12	33.3	66.7	
AI-powered education chatbot	18	77.8	22.2	
Hours of study				
Less than 1 hour	40	30	70	0.001
1-3 hours	24	91.7	8.3	
3-5 hours	12	83.3	16.7	
More than 5 hours	24	100	0	

Thematic analysis of the qualitative data yielded several key themes regarding AI infusion in higher education:

ENHANCED PERSONALISED LEARNING

Interviews and observations revealed AI-enabled more individualized learning pathways through tools like adaptive courses and virtual tutors (Yudelson *et al.*, 2013; Choi *et al.*, 2018). As a faculty reported

"Students get customised learning based on their skills. It ensures no one is left behind."

INCREASED ACCESS TO EDUCATION

Documents and informant perspectives highlighted AI expanding access to quality education through blended/online/micro-credential programmes (Graham, 2013; Barbour and Reeves, 2009). As noted in institutional documents, "AI helped scale up learning and fulfil demand without increasing physical infrastructure."

DEVELOPING FUTURE-READY SKILLS

Analysis showed AI being integrated into curricula and experiential learning to build skills needed in technology-led jobs like coding, and data analytics (Russell et al., 2019; Taipalus *et al.,* 2018). As an administrator said, "We aim to ready graduates for roles involving AI, machine learning, robotics process automation, etc."

DATA-DRIVEN DECISION-MAKING

Institutional policies outlined the use of AI-generated learner data to improve programmes, advise students better, and optimize processes (Clow, 2013; Siemens, 2013). As a document stated, "Data insights assist review outdated courses, counsel at-risk students, and enhance placement outcomes."

While findings highlighted opportunities, challenges of overdependence on technology, bias, change management, and ethical AI deployment also emerged as areas requiring action (Crawford, 2019; Stone *et al.*, 2016; Smith, 2019). Overall, results suggested AI holds immense potential if infused judiciously into education systems.

This section highlighted the perspectives of key stakeholders on themes identified from analysis by Braun and Clarke (2006) and Creswell and Poth (2016).

DISCUSSION

The results provide valuable insights into how AI can help reimagine education by making learning student-centric, accessible, and future-focused. However, some challenges remain that need addressing for effective implementation.

Tools like adaptive courses and intelligent tutoring aligned with findings that AI streamlines customised learning pathways need to be harnessed (Yudelson *et al*., 2013; Choi et al., 2018). This affirms AI's role in moving from one-size-fits-all to individualized experiences.

Leveraging AI to take education online/blended/micro-credentials supports research highlighting its potential to reach unserved learners (Graham, 2013; Barbour and Reeves, 2009). This expands opportunities for workforce upskilling and lifelong learning. Integrating AI/robotics into curricula and industry exposure aligns with literature proposing proactive skill-building for emerging careers (Russell *et al*., 2019; Taipalus *et al*., 2018). Hands-on application experiences prepare graduates for technological changes ahead.

Applying learner analytics aids informed decisions at the student and institutional level as noted in studies (Clow, 2013; Siemens, 2013; Educause, 2018). However, addressing privacy concerns assumes significance (Slade and Prinsloo, 2013. Also, lack of resources and change management (Harwell, 2019) present implementation barriers requiring policy support. In summary, insights validate scholarly views on AI transforming education if accompanied by safeguards for ethical and inclusive development (Dagiene and Futschek, 2008). The active role of governments, institutions, and tech sector should be strengthened. This discussion contextualises results with peer-reviewed literature to ensure alignment and identify areas necessitating future research. It also highlights open issues required to realize AI's full promise for learning.

CONCLUSION AND RECOMMENDATIONS

This study aimed to explore how AI infusion can help higher education institutions reimagine learning models for the future. Findings aligned with literature highlight opportunities to advance personalised, accessible, and skills-focused education through judicious use of AI-led tools and techniques. Results affirmed AI's potential to enhance individualized learning experiences, expand educational access ubiquitously, and prepare students with competencies demanded in technology-driven workplaces. Data-driven decision-making emerged as another avenue for AI to optimize institutional effectiveness. However, some challenges encountered including issues around ethics, privacy, oversight of AI systems, change management, and overdependence on technology indicate the need for more research on responsible AI development and balanced integration into education systems. Overall, while AI presents tremendous promise, its transformative ability depends on proactive and structured efforts from policymakers, educators, and industry to maximise benefits while mitigating potential downsides (Schwab, 2017; OECD, 2019). This study provides valuable insights into AI infusion approaches being piloted and their perceived impact on reinventing learning. More large-scale implementation experiments evaluating learning outcomes and skills development are warranted to validate findings. Future research can also examine faculty training needs, resource requirements, and best practices for ensuring equitable access driven by learner data. Addressing such issues determine AI's long-term viability for advancing educational goals of equity, inclusion, and lifelong employability (UNESCO, 2022). With prudent planning and multi-stakeholder collaboration, AI infusion holds the potential to elevate higher education's ability to equip students for the technology-shaped future.

Institutions should develop long-term strategic plans outlining phased priorities, change management strategies, and performance metrics to

guide thoughtful AI adoption (Educause, 2018). Roadmaps ensure judicious scaling of initiatives. Extensive faculty training programmes covering pedagogical use of AI tools, integration within curricula, and ethical issues are critical for successful implementation (Harwell, 2019). Communities of practice can encourage experimentation. Learners should be able to own, access, and share insights from interactions to guide self-directed learning and advocacy as per UNESCO's (2022) guidelines on AI and data governance. This fosters agency. Public-private partnerships can curate quality open AI/ML courses, materials, and problem datasets for faculty and learners globally as suggested by Russell et al. (2019). This expands access. Oversight mechanisms involving experts need to regularly audit AI systems for unfair biases, inclusiveness, and technical standards adherence (Jobin et al., 2019). Redress mechanisms should also exist. Policy frameworks promoting AI literacy, research grants, and incentives for industry collaborations can catalyse faster experimentation and knowledge diffusion on a larger scale (OECD, 2019). Evaluating learning outcomes and skills along with institutional reforms are key to successfully reimagining education through a balanced, ethics-centred, and collaborative infusion of AI.

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