Fostering Innovation and Capacity Building in Higher Education Through Artificial Intelligence: Literature Review

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Abstract
This paper based on literature review, examines the role of artificial intelligence (AI) in fostering innovation and capacity building in higher education. The review synthesizes current research to explore how AI technologies are transforming teaching, learning, and administrative processes in higher education institutions (HEIs). Key areas of focus include personalized learning, administrative efficiency, academic research, and skill development. The review also discusses the challenges and ethical considerations associated with AI integration in higher education. By understanding these dynamics, stakeholders can better leverage AI to enhance educational outcomes and institutional effectiveness.
The review assesses the opportunities in higher education, with a focus on institutions that have effectively leveraged AI to enhance learning, educational quality, and market preparedness for sustainability. The paper also reviews the various challenges and risks that AI has on higher education and recommends mitigation measures to deal with these challenges.
Keywords: *Artificial Intelligence, Higher Education, Innovation, Capacity Building, Personalized Learning, Administrative Efficiency, Skill Development.*

I.   Introduction

Artificial intelligence has become a global force to reckon with in twenty-first century and has revolutionized societies, cultures, systems andis impacting various sectors such as business, education, entertainment, industries and transportArtificial Intelligence has been pivotal in the development of research and technology in higher education. Artificial intelligence has gained popularity and is being rapidly utilized in higher education for teaching and learning. According toHellen (2023),AI has been critical in improving learning outcomes, personalize education, and making education moreaccessible to all. The future of higher education institutions is continually linked with discoveries and development of new technologies and computer capabilities of new intelligent machines.

The sector of higher education is undergoing a considerable transformation. Artificial intelligence (AI) is emerging as a formidable tool with the potential to revolutionize the way we teach, learn, and conduct research(Hardaker, 2025). Artificial intelligence has led to the realization of new possibilities and challenges for learning and teaching in higher learning institutions, potentially impacting the governance and modes of teaching.According to Suarez (2025) higher education institutions are adopting and experimenting with the application of AI and its advantages on learning. Essentially, AI gives students more personalized learning experiences and utilizes AI's predictive capabilities to encourage more suitable and diverse applications.Students today are digitally savvy with unique learning styles and expectations. The job market has evolved and hence demands a workforce equipped with skills in critical thinking, problem-solving, and adaptation. Higher Education Institutions need to adapt and innovate to meet these evolving needs.

These global shifts highlight the increasing pressure on universities to innovate and align with labor market demands. However, in Kenya, the higher education sector faces persistent structural and financial challenges that hinder the adoption of such innovations.Kenya's higher education system has deteriorated because of scarce resources, inadequate investment in most of itsuniversities and low priority given to them by the government. Consequently, higher education has suffered from underfunding, academic and research infrastructure deterioration and unsatisfactory service conditions for staff(Okuro,2024). Not only have these problems negatively affected the quality of higher education in most of the universities but also the overall development of the graduates. Characterized by the increased number of students and inadequate learning infrastructure to support them resulting in half-baked graduates who do not meet the market standards.Unequal

access to reliable internet connectivity across the country could hinderthe widespread adoption of AI-powered educational tools. Government initiatives promoting internet infrastructure development are crucial (Ajayi & Jegede, 2020).

The COVID-19 epidemic has advanced the use of AI and other technologies in Kenyan higher education institutions. Institutions had to make a speedy shift to virtual learning environments, relying on expert guidance to traverse this new landscape. The lessons learnt throughout this period emphasize the importance of resilience, adaptation, and a comprehensive strategy to technology integration in higher education (Kirongo, 2023). Despite these developments, the evolution of AI in Kenya's higher education institutions is still limited in comparison to worldwide trends. Lack of awareness, the undetectable nature of AI-related wrongdoing, institutional policy gaps, and conceptual uncertainty are all ongoing challenges.

Despite national efforts to embrace digital technologies in education, the practical implementation of AI in Kenyan universities is constrained by several factors, including inadequate infrastructure, limited technical expertise, and the absence of comprehensive policy frameworks (Mutisya & Makokha, 2021). As Njenga et al. (2022) observe, there is a critical gap between policy intent and actual practice, particularly in institutions with fewer resources.

Kenya has the potential to become a leader in AI-driven education in Africa. By addressing the challenges, leveraging existing strengths, and fostering collaboration between government, academia, and the private sector, Kenya can create a more innovative and accessible higher education landscape for its students. These can be realized through equipping faculty with the necessary skills to utilize AI effectively for teaching and research is crucial. Collaborations between universities, Edtech startups, and the government can lead to the development of contextually relevant and affordable AI solutions. Increased government funding for AI research in education can accelerate development and implementation of AI-powered tools in Kenyan universities(Kirongo, 2023).

What is Artificial Intelligence

Artificialintelligenceis defined as computer systems that can engage in human intelligence processes such as learning, reasoning, logic and the use of data to process complex tasks. Russell (2021) defines AI as computersystem designed to interact with human beings through visual perception, speech recognition, intelligent behaviours and assessing available information from data to make coherent decisions that can be utilized. A.I for the purpose of this paperis defined as computer systems and processes used to promote, develop,innovate and enhance capacity building and digital skills of instructors, researchers and administrators (Kaplan, 2019).

According to Akello (2023),Artificial intelligence has been evolving and upgrading rapidly due to accessibility of data and computer advancements, that has resulted inimprovements in education.

not only in equipping students with information and communications technology (ICT) skills but also in achieving quality education, free from the constraints of location and time, and to encourage curiosity, creativity and collaboration.

Artificial Intelligence has not only been critical in equipping students in higher education with information and communications technology (ICT) skills but also in acquiring better quality education, free from the challenges of geography andtime, and encouraging curiosity, creativityandcollaboration.

AI has yielded significant benefits in higher learning education such as providing personalized student support, collaboration opportunities,options and control over the learning processes, personalized learning experiences, automating grading and creating virtual learning environments that can provide learners and teachers with the opportunity topursue the learning process effectively.

Therefore, university leaders believe that one benefit of AI in the future will be its ability to "assess students, provide feedback and generate and test scientific hypotheses at least as well as humans can" (Alexander et al., 2019)

Alexander (2019) posits that AI will be fundamental in the future in assessing students, providing feedback and generating and testing scientific hypotheses at least as well as humans can.

Role of artificial intelligence in higher education

AI has been utilized by various universities to foster innovation and enhance capacity-building. Many universities have educated and trainedvaried graduateswhohave joined the AI labour market, including those who venture to occupations directly related to developing AI systems, such as engineers, scientists, and product developers who use AI systems (Hodan, 2022). Universities foster technological change indirectly via their links with industry and government. Daniel Zhang's(2022) report finds that collaborations in A.I publications between universities and various industries, universities and government, and universities and non-profit actors have more than doubled over the past two decades.

We will examine a few institutions that have used A.I in innovation in higher education.

MIP Politecnico di Milano Graduate School of Business

MIP Politecnico di Milano Graduate School of Business is working with Microsoft to develop FLEXA, a new digital platform powered by Microsoft Azure and AI, which enables students to assess their professional skills and provides them with personalized content to help fill skills gaps between their career goals and existing studies.

FLEXA is helping to develop personalized learning pathways that take into account assessment and the amount of time at a student's disposal. FLEXA is also intended to address the needs for lifelong learning (Alexander et al., 2019).

University of Washington and the University of Tsukuba
The two universities of Washington and Tsukuba have partnered andare supported by $110 million in combined private sector investment from NVIDIA, Amazon, Arm and Softbank Group, Microsoft, and nine Japanese companies. This collaboration between the University of Washington, University of Tsukuba, Amazon, and NVIDIA has helped provide the research and workforce training for theregion's tech sectors to keep up with the profound impacts AI is having across every sector of the economy(University of Washington, 2024).

The Carnegie Mellon University and Keio University partnership
Funded by NVIDIA, the two universities will focus on specific research themes:Multimodal and Multi-lingual Learning, Embodied AI or AI for Robots, Autonomous AI Symbiosis with Humans, Life Sciences, and AI for Scientific Discovery.This new partnership between Carnegie Mellon University and Keio University will build on Pennsylvania's and the United States' global leadership in AI technology – and will empower the workforce, lean into innovation, and capitalize on economic opportunities (CMUA, 2024).

Arizona State University and Open AI
Open AI early in (2024) announced a partnership with Arizona State University who will have full access to ChatGPT Enterprise and use it for coursework, tutoring, research and more.

With the OpenAI partnership, ASU plans to build a personalized AI tutor for students, not only for certain courses but also for study topics. STEM subjects are a focus and are "the make-or-break subjects for a lot of higher education.The goal is to leverage the knowledge core at ASU to develop AI-driven projects aimed at revolutionizing educational techniques, aiding scholarly research and boosting administrative efficiency(ASU, 2024).

University of California, Los Angeles
Ten centers and groups within the University of California, Los Angeles' Samueli School of Engineering are dedicated to furthering artificial intelligence. The Scalable Analytics Institute and the Center for Vision, Cognition, Learning, and Autonomy are two of these.

The StarAI Lab (Statistical andRelational Artificial Intelligence)
Pivotal Ventures awarded the college $26 million in 2022 to operate the Break Through Tech AI hub's Los Angeles branch. A wide range of students enrolled in the hub's free 18-month artificial intelligence curriculum. (UCLA, 2022).

Wits University
The AI Africa Consortium partners with Cirrus AI to bring large-scale AI infrastructure capacity and expertise to the African research community and industry.Wits University has partnered with Cirrus AI, a private sector-led initiative that aims to bring large-scale AI infrastructure capacity and world-class expertise to the doorstep of African universities, research institutions, researchers, and industry collaborators. Cirrus was announced at the AI Expo Africa in 2019.This partnership will promote and drive AI innovation and entrepreneurship through the infrastructure, engineering capacity, and learning programs that will be set up. Student participation and training will be central to our efforts to develop AI skills in Africa(Wits, 2021).

Opportunities for AI
There are varied opportunities that can be utilized by Kenyan higher education to foster innovation and capacity building.AI-powered research tools can assist faculty in data analysis, literature reviews, and scientific discovery. Natural Language Processing (NLP) can analyze vast amounts of data to identify patterns and trends, accelerating research progress.

Matere (2024) posits that AI-powered chatbots and virtual assistants can handle routine administrative tasks like student registration, course scheduling, and answering frequently asked questions. This frees up valuable time and resources for staff to focus on more strategic initiatives.

AI can bridge the digital divide by providing adaptive technologies that cater to students with disabilities. Text-to-speech conversion and speech recognition tools can make educational materials accessible to visually

impaired students, while AI-powered sign language translation can enhance learning for hearing-impaired students.

Kenya's emphasis on Science, Technology, Engineering, and Mathematics (STEM) education can provide a fertile ground for developing AI expertise and integrating it into the curriculum (AOU Blog, 2023).

Strengthen AI Education and workforce development

The demand for AI skills is soaring with the market opportunities readily available in the last five years. The increasing consumerization of AI technologies brings a massive increase in the number of people developing AI. The pace of innovation and development is at its fastest rate ever and the current popularity of AI should mean that innovation in higher education is a focus of attention for an increasing number of businesses (Mordor, 2025). To leverage these vast market opportunities, higher education should deploy AI tools and techniques to conduct the fine-grained analysis that allows us to track each student's development of skills and capabilities as they interact and learn over time. This tracking of individual learners can then be collated and interpreted as required to provide knowledge about progress at the school and prepare them for the best workplace environment.

In addition, organizations can collaborate with higher education institutions to ensure faculty recognize and understand employable skills and hybrid trends, and work towards teaching them.Bone (2023) denotes that various employers can be invited to higher learning institutions to dispense their knowledge on AI applications in various fields of study. Through these sessions, the higher education institution can establish common practices and expectations for generative AI knowledge and skills tied to specified ranges of positions. These can then be used to create customized modules for students seeking employment in those positions.

Research

The growing capabilities of AI depict its critical role in research in higher education. Machine learning algorithms have excelledin conducting intricate content analyses, identifying research trends, and spotlighting gaps in existing bodies of research. These functionalities allow researchers to focus on their research's conceptual and theoretical aspects, allowing for a deeper level of engagement with their research questions(Saeidnia, 2024). Moreover,AI's ability in natural language processing has proven invaluable in literature review tasks, where algorithms can scan and summarize vast quantities of literature, presenting researchers with cogent summaries and highlighting areas for future investigation.

AI can efficiently analyze data from varied academic fields allowing researchers to make correlations they might not have otherwise considered, opening the doors to novel interdisciplinary projects and collaborations (Beretta 2021). This expands the scope of individual research efforts andenriches academic discourse holistically.

AI can be used as a catalyst for methodological innovation, enabling the researcher to work on complex datasets and enhance the reliability and reproducibility of research. AI tools can be used to design data collection tools, analyze the data and cite relevant sources best suited for the scope of research study. AI can also be used to collate information sources a researcher needs and identify knowledge gaps that need to be bridged, consequently helping generate latent project ideas (Bolaños, 2024).

Personalization of Learning

AI is vital in developing personalized learning based on students' needs. With the increased number of students joining the university each year thus increasing the lecturer-student ratio, AI can be pivotal in customizing learning materials that addresses the needs of different students. AI courses such as Coursera and Open Learner Modelsare providing course designs and digital platforms that use AI to provide assessments, learning, testing and feedback to students in universities, evaluatingthe gaps in their knowledge capacity and directing them tonew contents and tasksthat add value to their education (UNESCO, 2019). The AI processesevaluate students' knowledge and data points to select the most appropriate learning content to be delivered to the learner, depending on their capabilities and needs. The AI tools can be useful in tracking the progress of students and improving the learning curriculum.AI systems can provide tailored recommendations for reading materials and activities by observing learners'behaviors.

Automate Assessments

Through the use of AI analytics tools, lecturers can create time for quality evaluations of assessment types depending on the insights acquired from the tools. According to Xiao (2020), AI and lecturers can partner in developing holistic quality assessment processes. AI is also critical in developing continuous formative assessment throughout the education process. The focus should be on the continuous learning process and assessment as opposed to the final exams that is seen as more punitive. AI assessment tools can adapt to the learning patterns and performance of learners, offering customized assessments that can accurately reflect an individual's understanding and capabilities(Yeung, 2025). AI assessment facilitates various evaluation methods,

catering to different learning styles and preferences. From automated grading for objective questions to analyzing multimedia submissions and even evaluating real-time problem-solving through simulations, AI in assessment offers a versatile package that has the potential to enhance the accuracy and efficiency of assessments in education.

Luo (2025) posits that AI is increasingly being employed in the assessment and evaluation processes in various higher educational institutions. The integration of AI in assessment and evaluation methods has revolutionized the progress of students mapping and learning improvement. It has significantly impacted the learning experiences of many students automated grading, providing instant feedback, and adaptively tailoringassessments to skill levels of individual students.

Tailored feedback is a critical resource of AI during a student's learning. AI can help in providing feedback that is personalized and growth-oriented. AI tools such as Feedback Fruits Automated Feedback help in generating instant feedback, increasing the quality of learners'assignments and stimulates deeper learning while freeing up time for teachers to provide higher-order feedback(Ji, 2025). AI tool Automated Feedback Coach can also be used as a personal coach to offer suggestions that help students adjust and improve their feedback delivery during the peer and group assessment activity. This process motivates the students to develop critical self-reflection and collaborate better with each other and enhances ownership and self-improvement.

Challenges of AI

Despite the manyapplications of AI in higher learning institutions, many scholars are skeptical on giving AI full control. AI has led efficiency and data-driven insights in higher education but has also raised ethical, epistemological, and ontological concerns. In addition, the integration of AI into higher education also raises concerns about its ethical use, including data privacy, security and the potential for bias in algorithms(Lund, 2025). Many academicians also denote that their students will use AI to cheat, as these services can produce essays that are nearly impossible to distinguish from human writing. This will undermine critical thinking, students' creativity and enhance plagiarism within higher education institutions.

Furthermore, AI in higher education can dehumanize the learning experience. With AI algorithms generating course content and deciding the pacing of the lessons, many students may miss out on the nuanced approach that human teachers offer. Additionally, AI algorithms can perpetuate bias, meaning that they may fail to provide a comprehensive, culturally based and diverse curriculum that is tailored to the needs of each student (Mulaudzi, 2025).

To mitigate these challenges, crafting policies and guidelines for using AI tools in the classroom is crucial, and educators and policymakers need to revise these policies as technology advances and evolves continually.

II.   CONCLUSION

Educators and institutions should embrace AI and recognize its potential for improving education. AI can make teaching more efficient, provide personalized feedback to students and open up new avenues of learning. However, it's also essential to ensure that the use of AI in education is responsible and does not replace critical thinking, creativity and human imagination. Inevitably, Artificial intelligenceis a field that will spur innovation, creativity and increase Kenya's higher education competitiveness in such a rich and rapidly evolving arena.Future studies can focus on the impact assessment of AI on learners' development.

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