LEVERAGING THE BENEFITS OF ARTIFICIAL INTELLIGENCE IN TECHNICAL EDUCATION

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Abstract

The use of Artificial Intelligence technology in education has become an increasingly popular topic in recent years. AI offers a lot of potential to enhance students' learning experiences, assist teachers in delivering more effective instruction, and even identify learning issues that may go unnoticed by humans. "Technical education is the kind of training that concerns a particular aspect of science, occupation or profession which have both theoretical and practical instructions that are given to those who are going to be employed in commerce and industry using tools and machinery for the operation, production, preservation and distribution of goods and services." Technical education has suffered neglect for many years. This could be the main reason why Africa is still backward technologically. The main objective of this research is to identify and analyze how Artificial Intelligence can be used to enhance the quality of learning, skill development, and the relevance of technical education programs. The primary contribution of this research is to provide a deeper understanding of the role of Artificial Intelligence in technical education and to provide a framework that can be used as a guide in implementing Artificial Intelligence in this context. It is expected that this research will assist educators and decision-makers in effectively harnessing Artificial Intelligence to improve learning, skills, and the preparation of vocational students for the ever-evolving workforce.

INTRODUCTION

The interest in Artificial Intelligence (AI) in education had erupted during the last few years, primarily due to technological advances in AI. It is therefore argued that students should learn about AI, although it is debated exactly how it should be applied in education. AI literacy has been suggested as a way of defining competencies for students to acquire to meet a future everyday (Karin and Hallstrom, 2024). Artificial Intelligence (AI) has been studied for decades and is still one of the most elusive subjects in Computer Science. This is partly due to how large the subject is. AI ranges from machines truly capable of thinking to search algorithms used to play board games. Artificial Intelligence is a technology that has rapidly developed in this decade. Its capability to perform tasks previously achievable only by humans has made this technology popular and utilized across various sectors, including vocational education (Atik et al, 2024). In vocational education, Artificial Intelligence plays a role in enhancing the efficiency and effectiveness of teaching. One example is the development of adaptive learning programs that can adjust the curriculum according to students' abilities and needs. Additionally, Artificial Intelligence is also used to evaluate students' performance and provide automatic feedback. This system can assist in assessing and monitoring student performance, enabling teachers to focus on teaching and student development.

Artificial Intelligence (AI), is a term coined by emeritus Stanford Professor John McCarthy in 1955, who defined it as "the science and engineering of making intelligent machines". Much research has humans program machines to behave in a clever way, like playing chess, but, today, we emphasize machines that can learn, at least somewhat like human beings do. According to the father of Artificial Intelligence John McCarthy, AI it is *"The science and engineering of making intelligent machines, especially intelligent computer programs"*. Technical education plays a vital role in preparing skilled and trained workers. In an increasingly complex and rapidly changing world, vocational education must continuously adapt to technological advancements and relevant industries. We cannot deny that the rapid pace of technology has brought significant changes to the education sector, including a shift in focus from a teacher-centered approach to a student-centered approach in learning (Adinoyi, 2015). The advancements in science and technology have raised awareness among the public about the importance of technology mastery. One technology that has experienced rapid development and has the potential to transform Technical education is Artificial Intelligence.

BRIEF HISTORY OF ARTIFICIAL INTELLIGENCE (AI)

The 20th century marked a historic rise in the development of artificial intelligence, with every age having a significant impact on science, technology and humanity. In 1923**,** Karel Čapek's play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English. In 1945, Isaac Asimov, a Columbia University alumni, coined the term *Robotics.* Alan Turing in 1950 introduced Turing Test for evaluation of intelligence and published *Computing Machinery and Intelligence.* Claude Shannon published *Detailed Analysis of Chess Playing* as a search. John McCarthy in 1956 coined the term *Artificial Intelligence, a* demonstration of the first running AI program at Carnegie Mellon University. In 1958 McCarthy invented LISP programming language for AI.

Investment and interest in AI boomed in the first decades of the 21st century, when machine learning was successfully applied to many problems in academia and industry due to the presence of powerful computer hardware. This was in the form of access to large amounts of data (known as "big data"), faster computers and advanced machine learning techniques which

were successfully applied to many problems throughout the world's economy. By 2016, the market for AI related products, hardware and software reached more than 8 billion dollars. The applications of big data began to reach into other fields as well, such as training models in ecology and for various applications in economics. Advances in deep learning (particularly deep convolutional neural networks and recurrent neural networks) drove the progress of AI to image, video processing, text analysis, and speech recognition.

TECHNICAL EDUCATION

Any nation that intends to make reasonable progress must embrace a system of education that has some applicability to real life. Williams (2009) argues that, seeing technological literacy as the goal of technology education has appeal because of its multidimensionality. It can be related to having a technologically literate workforce, which would benefit the national economy. It could also relate to the individual's level of literacy and the personal satisfaction connected to that. Also, it relates to social responsibility and democracy in a technological society. Technical education deals with the training of technocrats and technicians for the purposes of initiating, facilitating and implementing the technological development of a nation and creation of the basic awareness of technological literacy to our youths. According to Hidayat & Abdillah (2019), Technical education can be a solution to address unemployment issues and prepare the younger generation to face challenges in the digital era. It can be concluded that vocational and Technical education plays a vital role in preparing a skilled workforce, enhancing economic growth, and reducing unemployment rates.

Technical education contributions are widespread and visible aspects of work, ranging from metal work technology, mechanical/automobile technology, electrical and electronic technology, building and woodwork technology etc. Consequently, it can serve as change agents not only for technical systems but also for many other societal changes. The practical nature of technical education makes it unique in content and approach thereby requiring special care and attention. The inputs of technical education are, so visible to the extent that even an illiterate could see when failures occur. In many African countries because of the impact on human resource development, productivity and economic growth, there is a gradual shift of emphasis from general education to technical education which guarantees the growth of locally based mini, micro and macro industries. Technical education involves the practical use of machines and methods in science and industry. This form of education can be leveraged with the use of machines because artificial intelligence. AI is a machine driven area of human adventure and exploration that hinges on a careful application of science and technology.

ARTIFICIAL INTELLIGENCE (AI) DRIVEN INTERVENTIONS IN TECHNICAL EDUCATION AND TRAINING

AI is concerned with extending the capacity of machines to perform functions that would be considered intelligent if performed by people. Its goal is to construct machines, and, in doing so, it can be thought of as a branch of advanced engineering. But in order to construct such machines, it is usually necessary to reflect not only on the nature of machines but on the nature of the intelligent functions to be performed. (Papert, 2020). However, Papert's vision of using AI and machine learning to develop students' metacognition has not gained a strong impact in education. Instead, most of today's AI in education have different goals, focusing more on the machines as intelligent rather than on understanding human intelligence.

Education was previously seen as fundamental, not only to the economic development, but also to the social and political development within nations and for individuals. Investment in education and training produces benefits to the individual and to society as a whole. The return on investment for society will be a skilled workforce that will enable global competitiveness and economic growth, while the return of the individual will be a better career path, increased earning and a better quality of life. In the views of Ming (2023), technical education can be leveraged through the following procedures:

1) Push resources for independent learning

The whiteboard is used before class to push pre-learning resources to students, such as catechism, micro-courses, learning courseware, pre-learning tests and other learning tasks. With the help of smartphones or PC terminals and other devices, independent learning, pre-class pre-learning and submission, students have a sense of anticipation for learning, mobilizing the students' motivation.

2) Analyze the learning situation to clarify the goal

With the help of easy classroom to obtain students' answer, data can be analyzed in the learning situation and prominent cases for research be extracted in order to make clear the objectives of the learning process. Within the learning process, the distribution of tasks, interactive sessions, personalized push, personalized guidance and use of technology, means and methods can be employed to facilitate learning.

3) Situation introduction to stimulate interest

In actual teaching, make full use of the whiteboard on the image, video and other playback functions and classroom activities of the game design function to set up teaching situations, flexible choice of ways to adapt to mobilize the classroom atmosphere. The classroom atmosphere is to influence the teaching of the important psychological conditions, how the beginning of the class will be, the student's interest in learning and the desire to stimulate the desire to learn, the context of the introduction is particularly important.

4) Task-driven cooperative inquiry

Teachers will assign learning tasks in the form of questions to students' terminal tablets through the whiteboard so that students can try to explore. Driven by the target tasks, students conduct cooperative discussions and explore the problems through the groups in the Easy Classroom.

5) Testing and Evaluation for Cultivating Excellence and Remediating Differences

Dynamic assessment data on students' learning effectiveness can be recorded, analyzed learning history data, data mining and in-depth analysis based on the results of data analysis for intervention.

The development experiences of countries in Western Europe and North America during the 19th and early 20th centuries were mostly tied to technical education. However, the driving force for this development is the technical knowhow provided by the long neglected technical education.

LEVERAGING TECHNICAL EDUCATION THROUGH ARTIFICIAL INTELLIGENCE

In the increasingly competitive environment today, there are still educational institutions that do not incorporate technology into their learning objectives. In line with this, schools in the modern era should leverage new technologies that facilitate the work of teachers or other staff members (Tjahyanti et al., 2022). Thus, there will always be a teacher's role in education, but that role and what it implies may change due to AI. Assisting students in improving their learning and even serving as a substitute for in-person tutoring, AI can perform tasks such as grading and even

serve as a substitute for in-person tutoring. However, AI can also be applied to various other forms of education. AI systems are equipped to provide insight, serve as a forum for students to ask questions and seek knowledge, and even take a teacher's position file for fundamental course material. AI will transform the teacher's position into that of a facilitator (Rosalina, 2022). Some ways of leveraging technical education may include:

Machine Learning (ML)

This is the part of AI studying how computer agents can improve their perception, knowledge, thinking, or actions based on experience or data. For this, Machine Learning draws from computer science, statistics, psychology, neuroscience, economics and control theory. For over four decades, Africa has experienced retrogression in industrialization and economic growth due to neglect of technical education. African countries seeking to industrialize have used various models (Mumo, 2010).

Personalized learning

With the use of AI tools, trainers are able to design tailor-made study schedules and customize learning based on the specific needs of individual learners. It assists the trainers to identify the gaps in knowledge, create instructions, testing and feedback systems for learners from preschool to college. It enables customization of individual lesson plans based on students' individual needs and go a long way in differentiated and adaptive learning that can build a solid foundation for all kinds of learners. AI-powered software, games and tools enables the trainers to setup a machine-assisted classroom environment with an individualized strategy for the trainees to learn at their speed, time and requirements for repeated practice (Tedre, 2021). AI based tools can streamline the operations of the institution to ensure that its objectives are achieved.

Promoting Personalized Learning

In the last decade, the effectiveness of traditional education has been repeatedly questioned. College dropout rates are at an all-time high, a testament to disinterested students and low student morale. Fortunately, advances in AI technology, especially in areas of Big Data and Machine Learning, have already yielded results. Several startups have developed tools to make learning more enjoyable for learners and more custom-made to fit their needs. This is largely accomplished by designing a personalized learning experience based on the abilities and preferences of the students. Personalized learning is a learning experience that is tailored to each student's specific needs (Bell, 2021). Learning elements such as learning speed, material, series, technologies, quality, instructional approach, instructional materials, and other aspects of personalized learning can be tailored to each child's needs and learning goals.

Adapting learning to meet the requirements of individual students has been a concern for educators for years, but AI could provide a level of differentiation that is unthinkable for teachers who must handle 30 students in each class. Several companies, including Content Technologies and Carnegie Learning, are currently developing intelligent instructional design and digital platforms that use AI to provide learning, testing, and feedback to students from pre-K to college level, identifying gaps in knowledge and redirecting them to new topics when appropriate. As AI advances, it may be conceivable for a machine to scan the expression on a student's face that suggests they are trying to understand a subject and alter a lesson to respond to that. Customizing curricula to meet the requirements of each student is not feasible now, but it will be for AI-powered robots.

Smart content

AI tool enables the creation of 'smart content' and customized environments for the educational organization based on strategies and specific goals. AI tools has made 'personalization' of training program possible. Augmented Reality (AR) and Virtual reality (VR) based learning

environments as well as web-based lessons are the future global trend in TVET training. AI also assist in the development of Resources such as digital textbooks, guides, instructional snippets, videos to accompany learning. AI powered algorithms can identify the areas that can be improved in the curriculum to fill in the gaps in defective or ineffective content and help teachers correct.

Intelligent tutoring

Intelligent tutoring systems (ITS) based on artificial intelligence are equipped to handle personalized feedback and instructions for one-on-one teaching. This can be a very effective tool in e-learning platforms and could easily solve the major problem that has hindered the successful roll out of e-learning for engineering and technical content. They can be designed to factor in engagement, metrics for grading and comprehension.

Virtual learning environment

Artificial Intelligence tool enables the design and implementation of Virtual learning environments that are effective in offering group educational experiences and facilitate an immersive learning experience. VR headsets can further improve the experience by blocking out distractions and increasing attention spans. Additionally, learners can also aid learners in soft skill coaching, skill coaching, skills, self-development with interactive virtual simulation.

Universal access to education

AI technologies can significantly bridge the boundaries and scale geographical barriers between trainees, trainers and educational administrators. Smart data gathering, individualized schedules, custom tasks, 24/7 access to education can be made possible with AI tools. AI tool are capable of creating subtitles and language translation hence breaking up the language barrier in training. Most of AI tools and software are plug and play cross-platform system that can be distributed globally to ensure a truly global and universal learning, breaking down silos between traditional educational approaches that are outdated or inadequate. AI-powered tools paired with the power of cloud integration provide robust training platforms capable of handling large number of trainees and data in real-time, enabling institutions to expand their capacities globally.

Voice assistants

These AI-powered voice assistants can be used in apps and they provide the following benefits in education:

1 Efficient saving of time for students and teachers

2 Providing community learning opportunities

3 Providing personalized education within seconds. Given this broad outlook however, it is necessary to specify some of the factors that militate against technical education and industrialization in Africa.

Technical education programmes are still fraught with problems, including: administrators' misconception of the nature of technical education, inadequate political will by the government, deficient educational monitoring and evaluation procedures, poor funding, poor incentives for teachers and a rapid rate of technological changes. These problems are numerous and have to varying degrees, affected the advancement of technical education in Africa.

Staff training and retention:

In academics, sustainability and continuity constitute the bed rock of knowledge. The training of academic staff is ordinarily a continuous exercise to ensure consistent improvement in the quality of their outputs. Thus, training on the application of artificial intelligence should be

incorporated into the scheme for vocational and technical education. The training is two-fold: training to acquire minimum qualification (Ph.D) to teach and continued professional training. Both types of training can be acquired either locally or abroad. Nigeria for instance has a statutory agency under the umbrella of tertiary education trust fund to promote the training and retraining of university staff. Usually, local training within the nation is cheaper than overseas training but more strenuous because of inadequate facilities, literature and distractions arising from the need to meet the necessary demands. Staff can go on professional training in developed nation where artificial intelligence is the main hob of teaching and training. Technology intelligence is much needed in the future to ensure the learning process and effective teaching among teachers and students and will be indispensable for progress system education (Yufeia, 2020).

CONCLUSION

Artificial Intelligence can be used to enhance students' learning experience by providing customized content based on individual needs and abilities. Artificial Intelligence can also assist teachers in assessing student progress more effectively and providing timely and accurate feedback. Furthermore, Artificial Intelligence can also aid in the development of a more relevant curriculum aligned with the demands of the current and future job market. By utilizing this technology, educators can predict future industry needs and design relevant training programs to equip students with the necessary skills. However, the use of Artificial Intelligence technology in technical education also poses several challenges, such as concerns about the replacement of educators by Artificial Intelligence and the potential biases in the algorithms used by Artificial Intelligence. Therefore, it is important for educators to consider ethical standards and develop policies that ensure responsible and effective use of Artificial Intelligence technology in technical education.

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