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A systematic Review About Enhancing The Quality Of E-Learning Outcomes Using Artificial Intelligence Techniques

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Abstract

A few years ago, E-Learning become a powerful term for Study, but during the COVID-19 pandemic, educational institutions were shut down all over the world, which impacted the students and caused a massive disruption of the education system. A lot of challenges had faced as Instructors and students were not prepared for those massive sudden changes in learning styles. The personal differences among students in their learning goals and needs make it challenging for Instructors to be more engaged in designing educational tasks, assisting, and coping with their students learning. This paper aims to identify the major problems faced learners and instructors while using e-learning tools for the first time and to present how artificial intelligence (AI) techniques could help in improving the e-learning to fulfil the incremental users' needs.

Keywords: *Artificial Intelligence; Machine Learning; E-Learning; Blockchain; Performance prediction.*

1. Introduction

After the total lock-down faced for the first time, E-Learning has become the only way to reach students and give them the hope that life is going on and that it's a matter of time to get back to their normal lives and complete their studies. According to the World Health Organization (WHO, 2020), coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The WHO further asserted that people infected with the COVID-19 virus experience mild to moderate respiratory illness and recover without requiring special treatment.

The unexpected closure of educational institutions prompted the authorities to suggest emergency remote teaching to ensure that students are not left idle in this pandemic era. Therefore, the conventional methods (traditional face to face teaching) have been replaced by online (e-learning) for the time being.

It was found that developing countries are facing infrastructures' challenges such as poor internet connectivity, lack of knowledge on the use of Information Communication Technology (ICT) and the weakness of content development to be suitable for e-learning. For instance, delivering content like video and other applications is still new to many learners in developing countries. This new trend demands better technology and changes the learners' workplace culture. An important factor to consider before implementing e-learning is whether the learners are ready and will be successful in an online environment. Although learners may demonstrate success in conventional education and classroom, that alone is not enough to guarantee success in an online learning situation [1].

The educational industry has experienced tremendous changes over the last decades. Universities are facing problems in providing the necessary Information Technology (IT) support for educational, research and development activities. The need to customize their services according to their users' needs is become vital. Likewise, the massive change in the information technology (IT) environment and the growing needs for new technologies to cover the demand of users of higher education institutions. Therefore, the study problem could be stated as the personal differences between learners to gain knowledge through e-learning systems.

Accordingly, this study attempts to implement AI techniques on educational sector massive data in order that the learners can obtain their benefits and Instructors can personalize their materials according to their students' difference needs and capabilities. The analysis of these data set obtained from different educational institutions in Egypt with applying Machine Learning techniques may yield useful outcomes to researchers in the educational sector decision makers.

The remaining of this paper is organized as follows; Section 2 introduces theoretical background of study, it is divided into two main issues; first is about E-Learning, second is for AI, ML and Blockchain concepts. Section 3 introduces AI in the Educational Sector. Finally, section 4 presents the conclusion and future work.

2. Theoretical Background

As known E-learning or online learning is applying traditional education with Information Communication Technology (ICT) to enable students and Instructors to be connected anytime and anywhere online.

E-learning began to be used years ago. During this period, e-learning has completed its first phase of development from the first idea to the radical experiences in the application- in higher education, but also in primary and secondary schools, continuing education in lifelong learning. Early applications coincided with changes experienced Web, from Web for reading (Web 1.0) to Web for reading and writing (Web 2.0). The traditional approach to learning, e-learning, involves the virtual learning environment, so called. VLE (Virtual Learning Environment), a costly software whose purpose is to establish a structure around the cores, work plan and testing. This approach is geared more towards the needs of the institution rather than individual students. Meanwhile, the development of the Web has brought many new tools and services- such as blogs, wiki, podcast, and other social software to support the communication of the ad hoc learning communities. Contemporary socio-cultural theories of learning that emphasize different social and cultural factors must be considered when trying to explain learning. In this concept, students are active participants who share ideas, solve outstanding problems, using different sources of information together and create new knowledge. This approach to collecting little bit of content, loosely connected formed in an ad hoc community of learning called e-learning 2.0 [2].

Several studies have addressed the challenges associated with the introduction of e-learning. There has been evidence that the introduction of electronic learning initiatives has failed because institutions and their constituents were not prepared for the experience. Besides, people are attached to already existing pedagogies and practices making it difficult for them to adjust to innovations and upgrade existing ones. The view that student perception about on-line learning has been negative due to past experiences resulting in high dropouts and low motivation of learner. Other factors were found to be low student satisfaction associated with online learning experience. Nonetheless, research suggests that some students and instructors are satisfied with online learning just like traditional learning [1]

As Winarto [3] aims to measure the acceptance of students to the adoption of the blended learning based on the technology acceptance model, perceived usefulness and perceived ease of use; the results shows that students have high level of adoption towards easy classes using the learning managements tools for the blended learning but the students should have been introduced to the new Easy Class for the first time as they are new users of Easy Class. However, the data analysis shows that their level of adoption is high. One of the reasons is that the students are millennial generations who are native users and active on using technology such as laptops, smartphones and the Internet.

Understanding learning culture based on learning activities is important for learning success in e-Learning. It is necessary to build a student learning culture based on students' activities. E-Learning needs to consider the diverse cultural factors of students to achieve the most effective use of the learning process. In e-Learning, paying attention to the students' learning culture has a significant impact on student abilities. The aim of considering the learning culture of the students in e-Learning is to personalize the learning process. It can be based on digital content as a learning resource for students [4].

Assessing the attitudes and satisfaction of students and teachers of such a system is becoming increasingly important to its success as it presents a new learning environment for them [5]. Ghenghesh try to determine Egyptian student attitudes and satisfaction and Egyptian teachers' satisfaction and perception of the usefulness of E-learning. Data were gathered from two sources: a student questionnaire and a teacher questionnaire. Ghenghesh et al finds that there were no significant differences between male and female students and the different degree years in their attitudes to and use of E-learning; the Preparatory Year appear to be less satisfied with the activities, although some factors are beyond the control of the teachers (speed and bandwidth of the Internet) most of the reasons found to have a positive impact on E-learning in this study are influenced to a large extent by the teachers. For example, the presentation of material (colorful, attractive and user-friendly), interesting activities and effective feedback. These factors will have an important influence on the students' perception of how useful they consider this technological tool to be for developing their knowledge and skills and encouraging them to work independently. Teachers feedback on E-

learning in comparison with the other degree years and teachers are satisfied with E-learning and regard it as a useful tool as it complements face-to-face teaching and saves them valuable time [5].

AI was defined by [6] as A set of sciences, theories and techniques whose purpose is to reproduce by a machine the cognitive abilities of a human being. Current developments aim, for instance, to be able to entrust a machine with complex tasks previously delegated to a human. AI is a Machine-based systems that can, given a set of human-defined objectives, make predictions, recommendations or decisions that influence real or virtual environments. AI systems interact with us and act on our environment, either directly or indirectly. Often, they appear to operate autonomously, and can adapt their behavior by learning about the context.

Artificial intelligence and education (AI&ED) have the various connections between AI and education that include what might be called "learning with AI", "learning about AI" and "preparing for AI". Learning with AI has also been called "artificial intelligence for education." [6]

The progress of computing technologies has facilitated the implementation of AIED (Artificial Intelligence in Education) applications. The use of AI technologies or application programs in educational settings to facilitate teaching, learning, or decision making is known as AIED [7]. The help of AI technologies simulate human intelligence to make inferences, judgments, or predictions, computer systems can provide personalized guidance, supports, or feedback to students as well as assisting instructors or policymakers in making decisions.

By incorporating human intelligence, a computer system could serve as an intelligent tutor, tool, or tutee as well as facilitating decision making in the educational system. The integration of AI and education will open new opportunities to extremely improve the quality of teaching and learning. Teachers can benefit from intelligent systems that help in assessments, data collection, enhancing learning progress, and developing new strategies. Students can benefit from smart tutors and asynchronous learning in advancing learning outcomes. Additionally, the integration of AI and Education is not only a transformation of education but also a transformation of human knowledge, cognition, and cultures. As such, AI in Education is becoming a primary research focus in the field of computers and education [7].

Machine learning can be used to customize and personalize learning, it is flexible enough to adapt with all students' capabilities regardless of their learning speeds. By making use of algorithms that learn how the student consumes information, machine learning allows the learner to move ahead only after they have truly understood the previous content. This process ensures that no student is overlooked or left behind. This is true even if they are the only one in class that has not yet understood the content. The machine learning system also allows teachers to individually monitor students and help them in those areas where they are deficient. This contrasts with the traditional educational method, which focuses on a one-size-fits-all management where everyone in class is taught the same way. This type of learning can be found in the EdTech and Magic Box learning systems [8].

Online educational information systems have a huge amount of data related to students in digital education, AI and ML can use educational data to improve digital education. AI will have an increasingly important role in higher education as it allows students to have a personalized approach to learning issues based on their own unique experiences and preferences [9].

Machine learning focuses on creating computer algorithms that can access data, and then using it to make future predictions. Its learning process begins with observing, then checking for data, and finally making better decisions. ML is the future of eLearning as it can offer online learners a variety of benefits by delivering more personalized e-Learning content, its ability to motivate learners to achieve the learning goal. Unlike generic eLearning courses, personalized courses help learners to save the time of having to go through irrelevant content to acquire the learning goal [10].

As shown in Figure 1 the primary elements of E-Learning are students, educators and content. The learning experience is primarily shaped by the interaction of student with the content, other students and educators. To successfully engage in interactions, students are required to have high level of digital literacy to be self- efficient and motivated to engage in learning activities. Likewise, Educators' attitude towards technology use and their levels of digital literacy has an important role in shaping overall learning experience [11].

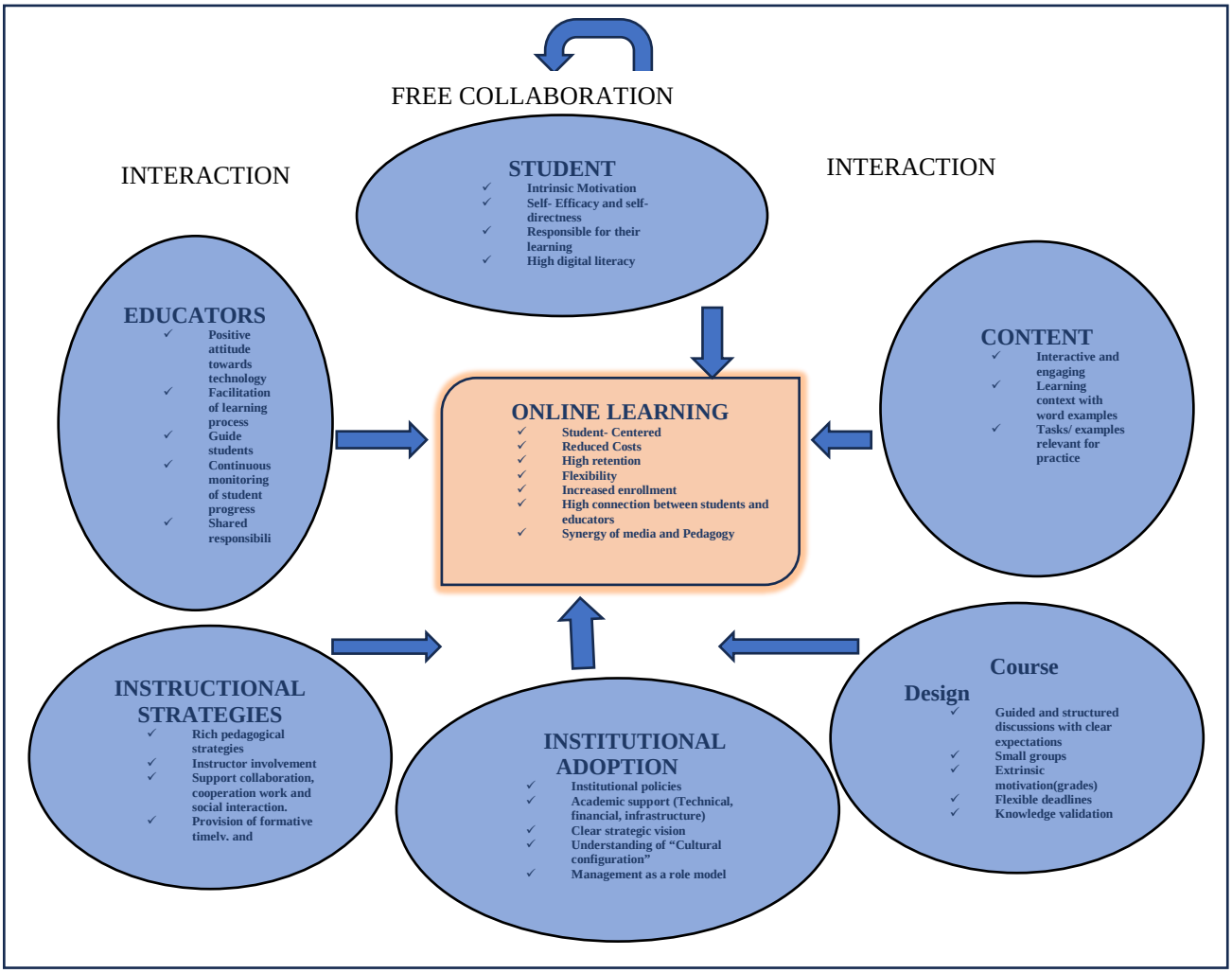

Figure 1:A conceptual Diagram of Online Learning settings

3. Related work

ML has been used in the educational sector as follows:

Machine learning can be used to customize and personalize learning, it is flexible enough to adapt with all students' capabilities regardless of their learning speeds. By making use of algorithms that learn how the student consumes information, machine learning allows the learner to move ahead only after they have truly understood the previous content. This process ensures that no student is overlooked or left behind. This is true even if they are the only one in class that has not yet understood the content. The machine learning system also allows teachers to individually monitor students and help them in those areas where they are deficient. This contrasts with the traditional educational method, which focuses on a one-size-fits-all management where everyone in class is taught the same way. This type of learning can be found in the EdTech and Magic Box learning systems [8].

Nafea finds that Machine learning with AI has opened incredible possibilities in various fields. The future of e-learning will be highly personalized with the ability to help learners to realize their abilities and the most fulfilling way. There will be a steady adoption of machine learning in the educational sector. The adoption of machine learning will save teachers' time in both the classroom and non-classroom activities. The future work on machine learning, especially in the education context, shall witness the development of more sophisticated AI tools. There are multiple prospects for designing complex chatbots that will improve the sophistication of virtual assistants [8].

[12] mentioned that although machine learning one of the most significant techniques that process and analyze educational big data, but no one thought of finding an effective way to guide high schooled students to reach their

appropriate major that will be suitable to their abilities. Those students need to be guided to pass this critical phase with high efficiency and good results.

Education is considered one of the most prominent areas affected by this change. In recent years, the educational institutions became able to collect, use, and exchange the data easily with high speed more than any previous time, so such institutions include primary schools, high schools, universities, and the educational service providers online [12].

[12] concluded that expecting students' performance can help universities and schools to make the right training and guiding them from the beginning can support planning for suitable training to improve the percentage of the students' success. Discovering the educational data can help in achieving the wanted educational purposes.

AL Junaid [13]identify the concept of cloud computing and explaining the benefits of using cloud computing in the educational process and understanding the impact of the application of cloud computing on the quality of e-learning in developing mathematical knowledge and skills among university students, the study used the semi-experimental approach, and the study sample consisted of a group of female students of the year Preparatory at the University of Tabuk, and the results of the study indicated the effectiveness of cloud computing in developing mathematical achievement and developing skills related to mathematics for university students, and the study provided a set of recommendations Research and proposals to increase the use of cloud computing at the University of Tabuk.

Munir [9] stated that Online educational information systems have a huge amount of data related to students in digital education that can be used with AI and ML techniques to improve digital education. Munir suggested that machine learning and deep learning algorithms are used in several themes of digital learning. These themes include using intelligent tutors, dropout predictions, performance predictions, adaptive and predictive learning and learning styles, analytics and group-based learning, and automation.

With the massive increase in studies about AI in the educational field, many scholars in the field believe that the role of teachers, school and leaders in education will change [14]. The purpose of the study is to examine what possible scenarios are there with the arrival of AI in education and what kind of implications it can reveal for the future of schools. The research was designed as a phenomenological study, a qualitative research method, in which the opinions of participants from different sectors were examined. The results show that schools and teachers will have new products, benefits and face drawbacks with the arrival of AI in education. The findings point out some suggestions for use of AI and prevention of possible problems. While participants generally seem to have positive perceptions towards AI, there are also certain drawbacks, especially highlighted by teachers and academicians, regarding the future of teaching. Lawyers and jurists tend to focus more on legal grounds for AI in education and future problems, while engineers see AI as a tool to bring quality and benefit for all in the education sector [14].

Munir et.al. [9] clarifies that AI can open new possibilities for digital education in terms of enhancing teaching and facilitating future digital education. Digital education refers to "teaching and learning activities which make use of digital technology as part of in-person, blended, and fully online learning contexts". Digital education is seen as the effective integration of digital technologies in student learning and teaching activities. As a part of digital technologies, AI deals with intelligent applications and machines to solve real-world problems. Machine Learning is a subset of AI that provides the ability to learn and improve from experiences and data automatically, whereas Digital Learning is a subset of Machine Learning methods; it provides the ability to analyze different factors and structures like human brain thinking to solve complex problems [9].

The contribution of computer science (AI) within the field of education has invariably been important. From robotic teaching to the event of an automatic system for answer sheet analysis, AI has invariably helped each the lecturers and the students. [15] The study shows that AI is that the backbone of all the information science enabled intelligent tutor systems. These systems help in developing qualities like self-reflection, responsive deep queries, partitioning conflict statements, generating artistic queries, and choice-making skills. AI in education has been applied to numerous domains, like physics, programming, writing essays, and reading yet because of the development of educational systems. AI in education has created powerful learning environments and positive interactive experiences for college students over the decades [15].

Using advanced AI technology in learning environments is one of the latest challenges for educators and education policymakers. Conversational AI brings new possibilities for alternative and innovative Information and

Communication Technologies (ICT) tools, such as AI chatbots [16]. This paper presented experiments with an AI chatbot that provides insights into the contribution of this technology (conversational AI) to the learning of cultural content and a foreign language at the same time (content and language integrated learning). The developed educational AI chatbot, called AsasaraBot, supports human tutors in teaching cultural content related to the Minoan Civilization. The related chatbot-based educational program has been evaluated in English and French at public and private schools in Greece, with encouraging preliminary findings. The use of AI chatbot technology for interactive ICT-based learning can efficiently support the learning of foreign languages and cultural content at the same time [16].

Blockchain technology, one of the most influential inventions in the last decade attracts attention for its potential to provide security from supply chain management to shipping and other areas. The education sector also needs to utilize the benefits that blockchain technology provides. Educational institutions especially tertiary institutions are now eyeing to employ this application to improve teaching and learning activities and promote collaboration among the stakeholders such as students, teachers and parents [17]. Blockchain application provides secure distributed ledger technology. Blockchain can be used in many areas of education for instance, online education, student data privacy and consent learning outcome and meta-diploma, operational skill competition, university grades, education-industry cooperative system, educational record, reputation and reward, Educational Certificate, Student Capability Evaluation System. The study can be further improved by including several other applications involving blockchain applications in education [17].

Paul [18] stated that blockchain technology is the emerging component of Information Technology and computing, it is a kind of an encrypted record of data works on distributed database. It dealt with the data related to the transaction, contract, independent record, etc. Blockchain not only reduces data breaches but also supports multiple numbers of shared copies and it works on the same database. It helps in waging data breach attacks. Earlier it was known as Blockchain but gradually it is getting treated as an important information technology. Many developing nations are in process of popularizing Blockchain Technology towards its worthy benefits in organizations, institutions, businesses, and commercial ventures are engaged in blockchain related aspects. Incubation centers are dedicated to Blockchain Technology development and getting its benefits considering various challenges and issues.

Alammary et al. [19]in their study explained that blockchain technology is novel in the field of education. In line with this they conducted several research analyses and reviewed different scientific literatures and proposed a framework for three major themes: applications, benefits, and challenges about this topic. The result yields that blockchain technology is mostly used to: issue and verify academic certificates, share students' competencies and learning achievements, and evaluate their professional ability. Additionally, it provides important benefits to education including providing a secure platform to share students' data, lowering cost, and enhancing trust and transparency.

Blockchain seems almost tailor made to help secure and protect this new model of education with a combination of information security, as well as the ability to share this data among a wide network of counterparties, and to do so in a completely virtual manner. Specifically, there are a few considerations and opportunities for online educators, institutions offering education online, and private sector blockchain organizations to improve the educational process and product [20].

Kim and Huh used AI blockchain algorithms to ensure safe verification of medical institution Personal Health Records (PHR) data and accurate verification of medical data as existing vulnerabilities. AI has recently spread and has led to research on many technologies thanks to the Fourth Industrial Revolution. This is a very important factor in healthcare as well as the healthcare industry's position. Likewise, blockchain is very safe to apply because it encrypts and verifies medical data in case they are hacked or leaked. These technologies are considered very important. Kim and Huh's paper seek to maximize the confidentiality of blockchain and the sensitivity and availability of AI [21].

Mageria [16] stated that using advanced artificial intelligence (AI) technology in learning environments is one of the latest challenges for educators and education policymakers. Conversational AI brings new possibilities for alternative and innovative Information and Communication Technologies (ICT) tools, such as AI chatbots. Mageria presents an experimental use case of an educational AI chatbot called AsasaraBot, designed to teach high school students' cultural content in a foreign language, i.e., English or French. The content is related to the Minoan Civilization, emphasizing the characteristic figurine of the Minoan Snake Goddess. The related chatbot-based educational program has been evaluated at public and private language schools in Greece. The findings from these experiments show that

the use of AI chatbot technology for interactive ICT-based learning is suitable for learning foreign languages and cultural content at the same time.

El-Naggar et al. [22]designed an Artificial Intelligent Program based on Chatbot and Learning Style in an E-Training Environment and its Impact on developing E-Learning Management System usage skills among Preparatory Stage Teachers, via determining E-Learning Management System usage skills and the teachers' needs from these skills, building the educational design for the artificial intelligence program and measuring the impact of using an artificial intelligence program based on chatbots and learning Style in an E-Training Environment on developing the cognitive and performance aspects of the E-Learning Management System usage skills among preparatory teachers. The research found a positive Impact of using an artificial intelligence program based on chatbots and the learning style in an E-Training environment in developing the cognitive and performance aspects of the E-Learning Management System usage skills among preparatory teachers on the two experimental groups with visual and kinetic learning styles, in addition to the presence of statistically significant differences between the mean scores of the two experimental groups in the post application of the achievement test and the observation card in favor of a group of teachers with a visual learning style.

Table 1: Previous studies and findings

Year	Paper	Findings

Mendaz, Bayyou (2019) [17]	Blockchain Technology Applications in Education	• Blockchain can be used for **confidential data** in education.
		• It can be used for students.
		  • Data privacy,
		  • Operational skills competition,
		  • University grades, educational records.

Aboagye, Yawson, Appiah, (2020) [1]	COVID-19 and E-Learning: The Challenges of Students in Tertiary Institutions	• Discussing the challenges learners faced in online learning situation during COVID-19: • Accessibility Issues (Required technology) • Social Issues (communication, group discussions) • Lecturer issues (Materials, Training) • Academic Issues (Effective Communication) • Learner intensions (Personal motivation, prefer to postpone semester, Training)
Kim, Huh (2020) [21]	Artificial Neural Network Blockchain Techniques for Healthcare System: Focusing on the Personal Health Records	• Use artificial intelligence blockchain algorithms to ensure safe verification of medical institution Personal Health Record data and accurate verification of medical data as existing vulnerabilities.
Nafea (2018) [8]	Machine Learning in Educational Technology	• Machine learning with AI has opened incredible possibilities in various fields. • The future of e-learning will be highly personalized with the ability to help learners to realize their abilities and the most fulfilling way. • There will be a steady adoption of machine learning in educational sector. • The adoption of machine learning will save teachers' time in both the classroom and non-classroom activities.
Ababneh, et al. (2021) [12]	Guiding the Students in High School by Using Machine Learning	• Machine learning is the most significant technique that process and analysis educational big data, but no one thinks about guiding students to reach their appropriate major according to their abilities. • Expecting students' performance early can help the universities and schools to make the right training or control.
Munir et al. (2022) [9]	Artificial Intelligence and Machine Learning Approaches in Digital Education: A Systematic Revision	• Educational data can be used by AI and ML techniques to improve Digital education. • The study's findings present six themes related to the use of machine learning and deep learning in digital education. • These themes include intelligent tutors, drop out predictions, performance prediction, predictive learning and learning styles.

Mageria et al. (2022) [16]	Educational AI Chatbots for Content and Language Integrated Learning	• Using advanced (AI) technology in learning environments is one of the latest challenges for educators and education policymakers. • AI brings new possibilities for alternative and innovative ICT tools. • Using AI chatbot technology for interactive ICT-based learning is suitable for learning foreign languages and cultural content at the same time.

4. Conclusions and future work

By reviewing previous studies, it is found that using AI in E-Learning programs is an important strategy to improve course access and flexibility in a higher education institution, especially in universities, with benefits from both the student perspective and the Lecturer perspective. AI tools can be used in tailoring the learner's needs according to his capabilities to obtain the best technique that enhance outcomes' quality of E-Learning.

Most of the previous studies were conducted in different environments, whether foreign or Arab. This study might be the first of its kind that sheds light on the impact of AI on E-learning in Egyptian universities. After reviewing many studies about AI in the E-Learning sector, it has become clear that the studies that deal with AI in the education field are quite few. To better enable the e-learning system to provide personalized or appropriate learning content, learning guidance, learning feedback, learning paths or interfaces that are tailored according to the students 'needs to get the best possible benefit from E-Learning.

We need to focus on how to motivate students to be more interested in e-Learning by personalizing their educational portal according to their capabilities and look for solutions to come up with a flexible personalized learning model that will satisfy both lecturers and students expectations. AI will be used to produce personalized learning content based on the preferences and profiles of individual students by generating customized materials that is suitable to their learning styles, abilities and objectives.

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