The role of AI in higher education

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Abstract: The use of information and communication technology (ICT) in higher education can have a significant impact on the quality of education. This paper explores how ICT can enhance learning outcomes, increase accessibility, improve collaboration and communication, and offer personalized and flexible learning experiences. Chatbots and artificial intelligence (AI) are discussed as powerful tools for providing personalized assistance and support to students with diverse learning needs and styles. The paper also highlights the challenges of teaching individuals with neurodiverse conditions and the importance of adapting teaching strategies to meet the needs of each student, calling attention to the fact that by using inclusive language and creating an inclusive learning environment, educators can leverage the power of ICT and AI to create a more equitable and effective learning experience for all.

1   Introduction

The integration of Information and Communication Technology (ICT) into higher education has become a topic of discussion in recent years. As technology advances, educational institutions have an opportunity to adapt to new learning trends and equip students with skills that align with the modern workplace. While some argue that ICT can revolutionize higher education by providing greater access to education and enhancing the quality of instruction, others claim that it is an ineffective and costly approach that fails to address the fundamental issues facing higher education today. In this essay, we will explore the role of ICT in higher education, examining its potential benefits and drawbacks (Alonso-Garcia et al., 2019).

On the one hand, proponents of ICT argue that it can revolutionize higher education by providing greater access to education. With the availability of technology, online courses and programs have become a popular option for students. ICT can allow students to participate in courses and programs from remote locations, which can be particularly beneficial for students who live in rural or isolated areas, have mobility issues, or cannot attend traditional classes due to work or family commitments. Additionally, ICT can provide greater flexibility and convenience for students who need to balance their studies with other commitments, such as work or family responsibilities. Moreover, ICT can enhance the quality of instruction by allowing for more interactive and engaging learning experiences. ICT can provide

opportunities for collaborative learning, interactive lectures, and real-time feedback, which can enhance student engagement, motivation, and learning outcomes (Pinto, Leite, 2020).

On the other hand, opponents of ICT argue that it is an ineffective and costly approach that fails to address the fundamental issues facing higher education today. ICT can be expensive to implement, requiring significant investment in technology infrastructure, software, and training for faculty and staff (Krezic et al., 2021). Additionally, ICT can be difficult to integrate into existing teaching and learning practices, and it can be challenging to ensure that all students have access to the necessary technology and equipment. Furthermore, there is a concern that online courses may not be as rigorous as traditional courses, leading to a lower quality of education (Raccanello, et al., 2021).

Despite these concerns, it is essential to note that the integration of ICT into higher education has already started to shape the future of education. As technology continues to advance, educational institutions must adapt to new learning trends and equip students with skills that align with the modern workplace. ICT offers numerous opportunities for students to learn and develop skills that are essential for the 21st-century workforce. With the help of ICT, educational institutions can provide personalized learning experiences, enhance student engagement and motivation, and promote lifelong learning.

In conclusion, while the role of ICT in higher education has its potential benefits and drawbacks, the integration of technology into education is inevitable. Educational institutions must adapt to new learning trends to equip students with the skills necessary for the modern workforce. While ICT may not be a perfect solution to the challenges facing higher education, it offers numerous opportunities for students to learn and develop essential skills. The key to success is to strike a balance between traditional and modern teaching methods and leverage technology to enhance the quality of education.

2 The use of ICT in higher education

Information and Communication Technology (ICT) can be used in higher education in several ways to enhance the quality of education and improve access to learning opportunities.

ICT can increase access to higher education for students who may not have access to traditional educational opportunities. For example, online courses and programs can be delivered asynchronously, allowing students to study at their own pace and convenience. This can be particularly beneficial for students who are working or have other responsibilities that make it difficult to attend traditional classes (Paudel, 2021). ICT can also facilitate collaboration and communication between students and instructors, which can improve the quality of education. For example, collaboration tools, such as discussion forums and video conferencing, can provide

students with a platform to ask questions, share ideas, and work together on assignments. This can help students develop critical thinking and problem-solving skills, as well as improve their understanding of course material.

ICT is also able to help to offer students more flexibility and convenience, allowing them to study at their own pace and convenience. For example, mobile learning allows students to access educational resources and tools through their mobile devices, which can be particularly useful for students who are on-the-go. This flexibility and convenience can make it easier for students to balance their academic studies with other responsibilities, such as work or family obligations. Through this, modern day ICT can provide students with personalized learning experiences, which can improve learning outcomes. For example, big data and analytics can be used to track student progress and identify areas where students may need additional support. This information can be used to provide individualized feedback and support, helping students improve their academic performance (Sadeghi, 2019).

All in all, ICT is providing an opportunity for enhanced learning outcomes. It enables the provision of a more engaging and interactive learning experience, which can improve learning outcomes. For example, multimedia tools, such as videos and simulations, can help students visualize complex concepts, making it easier for them to understand and remember the material. ICT can also provide personalized learning experiences, allowing students to learn at their own pace and receive individualized feedback, which can help them improve their academic performance (Ali, Abdel-Haq, 2021).

There is a multitude of tools that can enable the aforementioned positive outcomes, such as online courses, collaboration and communication through ICT, interactive multimedia tools, that would not have been possible without ICT. However, recent advances, such as the AR or VR, or mobile learning may enhance the user /student experience and through it the learning process of students. However, ICT is not only there to become the tool and channel of learning, but it can also support the teachers and administrators with big data analytics or systemic solutions such as the LMS.

- Online courses and programs: Online courses and programs use ICT to provide students with access to educational content, resources, and tools through the internet. These courses can be delivered asynchronously or synchronously, depending on the design of the course. Asynchronous courses are self-paced, allowing students to work through the material at their own pace, while synchronous courses require students to attend virtual classes in real-time. Online courses and programs can be delivered through a learning management system (LMS), which provides a centralized platform for instructors to create, manage, and deliver course content.
- Collaboration and communication tools: Collaboration and communication tools, such as video conferencing, instant messaging, and social media, can be used to facilitate communication and collaboration between students and instructors. These tools provide students with a platform to ask questions, share ideas, and work together on projects and

assignments. Collaboration and communication tools can also be used to provide students with real-time feedback, helping them improve their understanding of course material and their overall academic performance.

- Interactive and multimedia tools: Interactive and multimedia tools, such as videos, simulations, and games, can be used to engage students and help them develop critical thinking skills. These tools provide students with a more dynamic and engaging learning experience, helping them retain information more effectively. Interactive and multimedia tools can also be used to promote collaborative learning, allowing students to work together to solve problems and complete assignments.

- Virtual and augmented reality: Virtual and augmented reality technologies can provide students with immersive learning experiences that allow them to explore complex concepts and ideas in a more interactive and engaging way. These technologies can be used to simulate real-world scenarios and provide students with hands-on learning experiences. For example, virtual reality can be used to simulate laboratory experiments or fieldwork, allowing students to explore and experiment with different concepts in a safe and controlled environment (Radianti et al., 2021).

- Mobile learning: With the increasing availability of mobile devices, mobile learning has become a popular option for students. Mobile learning uses ICT to provide students with access to educational resources and tools through their mobile devices. This allows students to learn on-the-go, at their own pace and convenience (Chao, 2019). Mobile learning can also promote collaboration and communication, allowing students to work together on projects and assignments regardless of their location.

- Big data and analytics: Big data and analytics can be used to track student progress, identify learning gaps, and personalize the learning experience for individual students. These technologies provide instructors with data-driven insights that can help them improve the quality of their teaching and support students who may be struggling. Big data and analytics can also be used to track student engagement and monitor student performance, providing instructors with actionable insights that can be used to improve the learning experience for all students (Aldowah, Al-Samarraie, 2019)

- Learning management systems (LMS): An LMS is a software application that provides instructors with a platform to manage, track, and deliver educational content to students. LMS platforms typically include features such as course materials, assessments, discussion forums, and grading tools. LMS platforms can also provide analytics and reporting features that allow instructors to track student progress and identify areas where students may need additional support (Chen, Almunawar, 2019).

3   AI in higher education

While traditional ICT provides access to information and communication tools, AI goes beyond that by providing analytical capabilities, personalization, automation, and predictive analytics to support student learning. By leveraging AI in higher education, teachers can gain insights into student performance, provide personalized learning experiences, and offer targeted interventions to support student success (Bates et al., 2020).

AI is primarily concerned with analyzing and processing data to provide insights that can improve learning outcomes. Since AI has the capability to analyze large volumes of data generated from various sources such as student records, learning management systems, and online assessments, AI can provide insights to teachers to help them identify areas where students need support, monitor student progress, and offer personalized learning experiences (Ma, Siau, 2018). AI-powered tutoring systems can provide individualized support and feedback to students. These systems can adapt to a student's learning pace and style and provide immediate feedback and guidance. AI-powered assessments can even adapt to a student's performance, providing more challenging questions as they demonstrate mastery of a topic, and less difficult questions when they struggle. This enriches the potential role of ICT in higher education, since traditional ICT provides access to data and communication tools but lacks the analytical power that AI offers (Popenici, Kerr, 2017).

Traditional ICT provides tools to access and share information but does not provide personalization features to the extent that AI can (Vincent-Lancrin, van der Vliies, 2020). AI has the capability to provide personalized learning experiences based on the data it collects and analyzes. For example, an AI-powered learning system can adapt to a student's learning pace, provide targeted feedback on areas where the student needs to improve, and recommend learning materials based on the student's interests and learning style. AI can even automate certain tasks such as grading assignments, providing feedback, and even answering common student questions. What is more AI is available around the clock to answer questions and provide support to students, even outside of normal class hours (Ouyang, Zheng, Jiao, 2022). One of the most important reasons for employing AI in education is that it can provide predictive analytics that can help teachers identify students who are at risk of falling behind and provide targeted interventions to support them. AI can analyze data on student performance, attendance, and engagement to identify students who are struggling and recommend targeted interventions to help them catch up. Predictions can also be based on patterns recognised through machine learning regarding students from certain demographic groups or a specific combination of traits leading to hardships in various field of studies.

4   AI for different learning styles

According to   's learning styles, there are four main learning styles: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Each of these learning styles represents a different way in which individuals learn and process information. Artificial intelligence (AI) has the potential to support and enhance the learning experience for students with different learning styles (Stankovic et al, 2021).
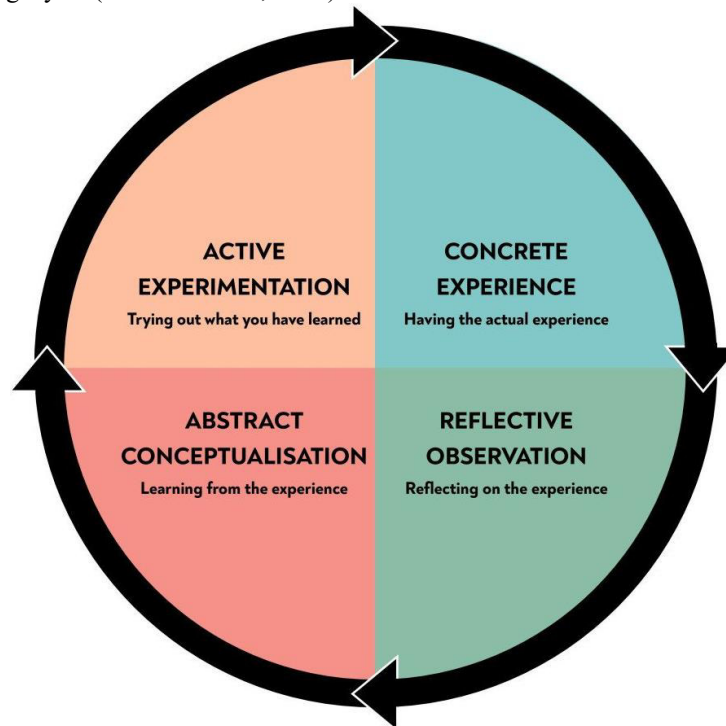

Figure 1
Source: https://www.simlypsychology.org/learning-kolb.html

For students who prefer concrete experience, AI can provide interactive simulations and virtual environments that allow them to engage with and explore new concepts in a hands-on way (Goel, 2021). These students may benefit from AI-powered chatbots that provide immediate feedback and support, helping them to build on their existing knowledge and develop new skills.

Reflective observers may benefit from AI-powered tools that allow them to review and reflect on their learning experience. For example, AI-powered analytics can provide insights on their learning progress and identify areas where they may need additional support (Fromm et al, 2021). This can help them to develop a deeper understanding of the material and identify ways in which they can improve their learning outcomes.

Students who prefer abstract conceptualization may benefit from AI-powered tools that provide personalized recommendations for learning materials and activities (Buyuksoy, Tascioglu, Ergin, 2020). By analyzing data on their learning preferences and performance, AI can recommend resources and activities that align with their individual learning style and help them to build on their existing knowledge.

Finally, students who prefer active experimentation may benefit from AI-powered simulations and games that allow them to apply their learning in a practical way. AI can provide real-time feedback and support, helping them to develop their skills and knowledge in a dynamic and engaging way (Estevez, Garete, Grana, 2019).

As described in this chapter, AI has the potential to support and enhance the learning experience for students with different learning styles (Bursac, Milosevic, Mitrovic, 2019). By providing personalized and interactive learning experiences, AI can help to improve student engagement, motivation, and outcomes, and ensure that all students have access to the tools and resources they need to succeed.

5 Chatbots, the virtual teachers

A chatbot is a computer program that simulates human conversation through text or voice interactions with users. It uses artificial intelligence and natural language processing techniques to understand and respond to user queries and provide assistance. A chatbot uses NLP to understand the meaning of user input and generate responses that are relevant and meaningful. Through its program a chatbot can recognize the intent behind a user's query and provide appropriate responses. After having recognized the users' intent, a chatbot can personalize responses based on user preferences, learning style, and history. For example, a chatbot can recommend learning materials based on a student's interests and previous interactions. Overall, a chatbot is a powerful tool that uses AI and NLP techniques to provide personalized and immediate assistance to students, enhancing their learning outcomes and academic performance.

However, or especially chatbots, and often AI in general is feared by teachers not only in higher education. Some teachers fear that chatbots could replace human interaction in the classroom, leading to a loss of personal connections between teachers and students. It is especially so, if technostress is highly prevalent in the life of the teachers, since technical issues may also be a concern for teachers who are not familiar with the technology and may not know how to use it effectively (Prebawaningsih, 2013).

Nevertheless, even teachers with high technology readiness may have some concerns regarding the use of chatbots in education. Teachers may be concerned about the accuracy of information provided by chatbots, as they rely on algorithms and data sets, which may not always be comprehensive or up-to-date (Zawacki-Richter et al., 2019). There may also be concerns about the privacy and security of

student data, as chatbots require access to personal information in order to provide personalized assistance.

These concerns, however, are not shared by students. All they see is the availability of immediate easy and cheap information support. A chatbot can provide assistance 24/7, ensuring that students have access to support even outside of regular office hours. A chatbot can provide students with access to study materials such as course readings, videos, and tutorials. It can also provide immediate feedback and assessment to students. A chatbot can support multiple platforms such as web, mobile, and social media, providing students with access to assistance anytime and anywhere. A chatbot can even support student engagement by giving reminders on upcoming deadlines, events, and activities.

However, a chatbot does not necessarily has to be a foe. It cannot only assist students, but also teachers with their everyday tasks. A chatbot can generate insights and analytics on student interactions, allowing teachers to identify areas where students need additional support and improve the quality of assistance provided. A chatbot can automate certain tasks such as grading assignments, providing feedback, and answering common student questions, saving teachers time and reducing their workload. By leveraging the features of a chatbot, educational institutions can provide students with an innovative and engaging learning experience, ultimately leading to better academic outcomes and increased success. Implementing chatbots in the classroom may require significant investment in technology and training, which may be a barrier for some institutions. Nevertheless, the application of certain AI solutions cannot be neglected since the students are already employing them in their everyday learning.

6   AI for students with learning difficulties

One of the most important roles of teachers is to enable people with less than favourable background or disabilities to still engage in and successfully complete higher education. In line with this it requires dedication and also extra efforts to provide educational opportunities and support for disadvantaged or marginalized groups in order to help them catch up with their peers and achieve greater social and economic mobility. Especially so, since learning difficulties can make it challenging for individuals to succeed in traditional educational settings. Accordingly, teachers have to pay extra attention to students with disabilities and have to have personalised study plans and materials for them However, advances in artificial intelligence (AI) are opening up new possibilities for supporting and empowering individuals with different types of learning difficulties(Campbell, 2022).

AI can help by providing text-to-speech and speech-to-text tools that can help individuals to access and create written materials, which is a great assistance for people with dyslexia. (Dyslexia is a common learning difficulty that affects an individual's ability to read and write.) Additionally, AI-powered apps and games

can help to build phonemic awareness and reading skills. The same applies to students with dyscalculia, which is a learning difficulty that affects an individual's ability to understand and work with numbers. AI can help by providing personalized math tutoring through adaptive learning algorithms and game-based learning activities (Di Fria, 2021).

However, AI is not only a way to support people with perception-based constraints but can also help students with specific physical impairments and also for individuals with neurodiverse conditions.

Individuals with visual impairments may have difficulty accessing visual materials such as diagrams and graphs. AI can help by providing audio descriptions of visual materials and tactile diagrams that can be 3D printed. Additionally, AI-powered assistive technologies such as smart glasses can help individuals to navigate their environment and access information more easily.

Teaching individuals with neurodiverse conditions can be challenging because each individual has unique strengths, weaknesses, and learning styles. What works for one individual with a neurodiverse condition may not work for another, and teachers need to be able to adapt their teaching strategies to meet the needs of each individual. This requires a deep understanding of the individual's condition and its impact on their learning, as well as a willingness to try different approaches and strategies. Another challenge of teaching individuals with neurodiverse conditions is the potential for social stigma and discrimination. Individuals with neurodiverse conditions may face negative stereotypes, attitudes, and behaviors from others, which can affect their self-esteem, motivation, and engagement in learning. Teachers need to be aware of these challenges and work to create a safe and inclusive learning environment that respects and values neurodiversity.

Finally, it can be challenging to provide the necessary accommodations and support for individuals with neurodiverse conditions within the constraints of traditional educational systems. Many individuals with neurodiverse conditions may require specialized materials, technology, or instructional methods to support their learning, and these resources may not always be readily available or accessible (Zheng et al, 2021). Teachers need to advocate for their students and work with other professionals and support staff to ensure that the necessary accommodations and support are provided. AI, however, is able to effectively support teachers in this regard too.

Individuals with Autism Spectrum Disorder (ASD), who may struggle with social interactions and communication, AI can help by providing social skills training through virtual reality (VR) simulations and chatbots that can simulate real-world scenarios. AI can also provide personalized feedback and support to help individuals improve their social interactions. Individuals with Attention Deficit Hyperactivity Disorder (ADHD) who may have difficulty with attention and concentration, AI can help by providing personalized reminders and schedules to help individuals stay on task. Additionally, AI-powered learning tools can provide immediate feedback and support to help individuals stay engaged and motivated.

All in all, AI has the potential to provide tailored and effective support for individuals with different types of learning difficulties. By providing personalized learning experiences, enhancing accessibility, supporting communication and social skills, providing reminders and feedback, and building specific skills through targeted interventions, AI can help individuals to overcome their learning difficulties and achieve their full potential.

Summary and conclusion

In summary, the use of ICT in higher education can contribute to the quality of education by enhancing learning outcomes, increasing accessibility, improving collaboration and communication, providing personalized learning experiences, and offering flexibility and convenience. By leveraging the power of technology, educational institutions can provide students with a more engaging and effective learning experience, ultimately leading to better academic outcomes and increased success. Chatbots, in particular, can provide students with personalized assistance and support that is tailored to their individual learning needs and styles. By using AI in education, we can improve access, efficiency, and engagement for all students. However, there are also concerns and challenges associated with the use of AI in education. These include the potential for job loss and ethical considerations around the use of student data. Nonetheless, the benefits of using AI and technology to support individuals with learning difficulties are numerous, from personalized learning plans and assistive technology to gamification strategies that can make learning more engaging and effective. It is also essential to recognize that teaching individuals with neurodiverse conditions can be challenging, as each individual has unique strengths, weaknesses, and learning styles. Teachers must adapt their teaching strategies to meet the needs of each student and work to create a safe and inclusive learning environment that respects and values neurodiversity.

In conclusion, the use of AI and technology in education has the potential to revolutionize learning and support individuals with learning difficulties, but we must be mindful of the challenges and ethical considerations that come with this technology. By using inclusive language and adapting our teaching strategies to meet the needs of all students, we can create a more equitable and effective learning environment for everyone.

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