The Application of AI in Higher Education

Yuxin Han

Birmingham Business School, University of Birmingham, Birmingham, UK
YXH260@student.bham.ac.uk

Abstract. This research essay explains the intricate relationship of artificial intelligence (AI) and higher education, and the challenges and opportunities it presented. It first describes current AI applications in education, such as individualized learning environments tailored to each student's particular needs, smart teaching systems to support course planning and assessment for instructors, virtual learning environments that simulate interactive classroom environments, and AI-powered assistants that offer instant academic support. The study then delves into key challenges: the growing need to train teachers to deploy AI abilities in the application of those tools effectively, and the possibility of bias in AI systems that evaluate learning success, which could oversimplify complex educational progress. On the opportunity side, it highlights AI's role in enabling flexible learning that breaking geographical and temporal barriers and its ability to craft individualized learning plans aligned with students' unique schedules, learning paces, and academic goals. With specific recommendations, the paper advocates for the enhancement of AI training for educators to build their digital pedagogy and encourages students to rencounter AI learning tools in a reflective, ethical, and effective manner. Finally, the research essay aims to clarify the intersection of AI on higher education.

Keywords: Personalized Learning, Teaching Challenges, Artificial Intelligence, Development Opportunities, Higher Education.

1 Introduction

As with the introduction of new technology into all walks of society, Artificial Intelligence (AI) is reshaping People's Daily life with its intelligence, efficiency, and convenience. Education-wise, the potential of AI in transforming the teaching pattern and surmounting the limitations of traditional learning has been gaining greater attention [1,2]. From intelligent lesson preparation system to dynamic learning platform, the instructional use of AI technology has undergone a transformation from an auxiliary tool to a key propelling force in redefining the educational structure [2]. Though such reform generates educational innovation in manufacturing, it also makes possible a deep-seated contradiction: how do the education system reconcile the essence of scientific and technological innovation and education with organizational innovation. Moreover, through which technological innovations AI technology affects the efficiency of teaching and the quality of learning in higher education. These two questions are not only questions

A. J. Moshayedi (ed.), *Proceedings of the 2025 International Conference on Hybrid Commerce, Human Capital, and Economic Dynamics (ICHCH 2025)*, Advances in Economics, Business and Management Research 374,
https://doi.org/10.2991/978-2-38476-585-0_46

about the scope of technology application, but also problems of epochal reconstruction of the essence of education, which have become key propositions to be resolved urgently on its part of global higher education. Previous research has already revealed the ways AI can be applied to higher education from a technical standpoint. At Georgia Tech, for example, an IBM Watson-designed AI chatbot called Jill Watson was used as a course teaching assistant for 300 students. Jill Watson answered with 97% accuracy approximately 10,000 student questions per semester in her human-like productivity.

But there are three research gaps remaining in the adaptation level of education system. First, the shortage of in-depth and systematic studies on teachers' and students' digital literacy [3]. The digital literacy of quite a large majority of ordinary teachers, students, and managers at higher education institutions remains to be improved, but specific research regarding how to advance the digital literacy of teachers and students in a way that they can reasonably and proficiently use AI technology to support teaching and learning and avoid ills such as shallow thinking and digital dependency is not systematic and extensive. Second, the shortage of sufficient theoretical foundational research of AI apply in education. AI technology has only been applied in teaching at the tertiary level for a relatively short time, and there is no perfect theoretical system to explain the mechanism of action and development regulations. It is still necessary to conduct in-depth research on how to envision the new ecology of education and teaching based on AI from the theoretical point of view, and on the nature and in-built rationality of AI technology in order to contribute to the development of higher education. Third, the moral and ethical issues are not researched thoroughly. Most of the moral challenges posed by AI, such as cognitive autonomy threats, equity and academic ethics threats are induced by AI, but corresponding research has not been able to solve these problems fully [4]. For example, how to set the scope of originality and human-machine collaborative creation achievement knowledge ownership, and how to set up an effective multi-subject collaborative governance mechanism are all problems to be solved. The present study focuses on the situations of application of technology and lacks systematic research on the mechanism of interaction between "technology-education."

Based on the above background, this research paper takes the ternary interaction "technology-education-human" theory, adopts the "literature survey method and case analysis method", and the general structure is as follows: To begin with, the four application scenarios of AI in tertiary education (intelligent teaching system, personalized learning platform, etc.) are outlined. Second, it looks at how the teacher role and evaluation system have been influenced by technology from both the challenge and opportunity sides. Third, as per orientation to the problem, this research suggested countermeasures and recommendations such as teachers' technical training and students' capacity training. Lastly, this research will conclude the research findings and anticipate future directions for research.

2 Application Status of AI in Higher Education

2.1 Personalized Teaching Platform

Smart teaching platform can incorporate learning devices, video projectors, cameras, and other software to fuse education and technology to improve teachers' and students' interactions [5]. On the one hand, the AI-powered classroom answer system is capable of gathering students' answer data in real time and outputting a mastery of knowledge chart of data so that teachers can shift the teaching focus and explanation in real time according to the feedback from data. On the other hand, smart lesson preparation system can provide rich teaching materials, teaching cases and suggestions on teaching methods according to teaching goal and teaching contents planned by teachers to assist the teachers in optimizing teaching design. According to the learning history of students, the classroom difficulties are predicted and differentiated teaching plan is arranged.

2.2 Intelligent Teaching

Intelligence teaching assistance tools can support teachers in teaching activities. Teachers can avail the support of AI in performing certain tasks related to teaching, e.g., the implementation of automatic grading tools for homework, not only saving the teachers' time but also bringing in higher quality classroom instruction [6]. Additionally, virtual teaching assistants can help maintain classroom order, automatically keep a record of the frequency of students' speeches and prompt teachers to keep silent students under watch in order to optimize classroom participation.

2.3 Virtual Platform

In students' learning process, virtual platform constituted by AI provides students with extensive learning resources. The virtual learning platform enables the students not only to navigate the virtual environment but also to interact with the virtual environment in an effort to allow learners to learn immersive [7]. Virtual platform not only breaks the geographical limit of students' learning, but also in some scientific and engineering subjects, virtual laboratory and simulation teaching based on artificial intelligence have been widely used. Students can conduct experimental activities through virtual environments and simulate various experimental conditions without the limitations of space and time. This not only reduces the cost of the experiment, but also improves the safety and repeatability of the experiment. For example, in chemistry experiments, students can conduct experimental activities on hazardous chemicals in virtual laboratories, away from the risks in real operations.

2.4 Intelligence Learning Assistance

Storage and data analysis functions of AI have the ability to generate personalized learning plans for different students in line with their learning behaviors and historic

data. Through artificial intelligence technology, by acquiring and analyzing the learning data of students, like the learning progress, answers, online study time, personalized learning plans and paths are generated for individual students [7,8]. Such as, some resourceful learning platforms can forwards learning materials like course videos, exercise questions and supplemented reading materials to students with accuracy according to students' knowledge mastery and learning habits to support students to learn more efficiently.

3 Challenges and Occasions of AI Apply in Higher Education

3.1 Challenge of Teachers' Technical Application Ability

The popularization of AI platforms such as smart lesson preparation system and learning analysis platform that do not only qualified the educators' teaching knowledge of subjects, but also the digital competencies such as data understanding and comprehension of algorithm logic [3]. As teachers need to understand the data feedback from AI in order to be expert at students' learning, they should also apply AI to assign homework and tests to students. If the teachers cannot apply technology correctly, many things will be affected. As the AI-based homework correction system applied that teachers need to change the rule of grading on their own. If the teachers do not possess skills for the utilization of technology in this context, the teaching process will be hindered and the process of teaching will be affected.

3.2 Controversy of the Evaluation System

AI tracks students' efficiency in learning through behavioral information such as learning time on the internet and precision in answers. Nonetheless, AI cannot witness students' abilities such as creative thinking and emotional engagement. Since AI lacks of understanding of human emotions, it can merely be trained to grade students stereotypically [9]. For example, there are inconsistencies in the scoring criteria of AI for papers and subjective teacher judgment for papers, which may be a reason for the lack of accuracy of the scoring system.

3.3 Break the Limitation of Learning Scenarios

Virtual simulation laboratory, metaverse classroom and other technologies can enable students to perceive the course's practical operation and historical scene reproduction through VR devices anytime and anywhere, which can stimulate students' interest and enable them to learn immersively [7]. Traditional learning is confined to the physical state of "classroom + class time", whereas the emergence of virtual learning platform makes learning no longer bound by the collective behavior of "one time, one place". At the same time, virtual laboratory and other scenarios can make students steer clear of the harm caused by operational errors and other adverse effects, and increase the safety of students' learning.

3.4 Precise Learning Program Customization

Traditional education is like production on an assembly line, covering all students with the same content and schedule. However, AI-driven precision learning enables the machine learning-based personalized recommendation system to classify and dissect students' learning behavior data, such as online answer habits, note marking habits and cognitive capacity data, to provide personalized learning plans to students and push personalized exercises according to students' knowledge blind areas [9].

4 Impacts and Recommendations

4.1 Multidimensional Effect of AI

The effect of AI on the mode of instruction is captured in the breaking of the traditional teacher-centric classroom mode, and personalized learning platforms and intelligent assistants enable students' control of their study plans independently. AI data analysis is used to suggest relevant learning materials to students, such as ChatGPT [9]. In addition, the intelligent teaching system can offer timely feedback on students' learning effect, and promote the transformation of teaching mode from "unified learning" to "personalized guidance". However, at the same time, it may make some teachers accustomed to the traditional teaching method have a role dilemma, and teachers need to reposition their role in instruction [3,10]. From being a transmissionist teacher of knowledge to becoming that of a student learning guide.

AI has dual effects on educational equality. On the one hand, internet platforms and electronic intelligent tools shatter geographic constraints, allowing students from remote locations to access outstanding learning resources [11,12]. On the other hand, inequalities of electronic devices and usage capabilities may deepen them. Economically disadvantaged students may not be able to use AI learning platforms to their fullest potential because they do not own smart devices or have the capacity to use applications, thus creating a gap for learning compared to their peers.

The challenge of AI to the cultivation of students' ability. Students more relying on AI tools will influence students' ability to learn independently. Although the utilization of AI tools can help improve the learning efficiency of students, over-reliance on AI may reduce the ability of students to think independently, think critically, and solve problems. Such as, students can simply cut-and-paste the answers provided by AI without examining them independently, which can cause the decline of students' learning initiative in the long term and it will also makes teachers doubt the authenticity of the work submitted by students [13,4].

4.2 Recommendations for Coping with the Impact of AI

In view of the impacts, strategies need to be formulated from the three levels of teachers, students and education system to maximize the positive role of AI and avoid potential risks. Starting from the school level, schools are also able to provide systematic AI technology course training for teachers. First, schools are able to train teachers to

use AI teaching tools such as intelligent lesson preparation system and learning analysis platform so that teachers can learn to apply technology skillfully for the purpose of supporting teaching. Secondly, teachers can be trained to utilize AI in order to adopt teaching innovation, such as analyzing weak links of students based on learning data and making targeted teaching plans for students. Third, teachers must be guided to understand the complementary relationship between AI and teaching so that teachers can learn to describe their core function in emotional care, value guidance and other fields that AI cannot replace, so as to avoid role positioning anxiety.

At the level of students, the schools need to integrate the rules of the students for smart tools in their training curriculum. School can develop courses on AI tool standardization to inform the students where to use AI, for instance, sorting of data and planning of learning, and where they need to do it themselves, such as demonstration of core ideas and original homework, so that there is no academic dishonesty. Through case teaching, such as, observing the difference between AI-generated responses and independent thought, students are encouraged to value the worth of independent thought and cultivate their learning habits of independent thinking and learning through AI. Students are encouraged to develop practical projects for AI-related training to deepen their command and comprehension of intelligent technology, rather than depending merely on AI.

From the perspective of the education system, the educational administration department ought to formulate pertinent policies. And they could invest more in the education information infrastructure, provide resource support to backward areas, and fill the regional digital divide. Formulate norms for AI application in teaching, and clarify data privacy protection, such as the limits of collection and usage of student learning behavior data. There are also bottom lines for the application of technology, such as banning the use of AI by students to directly generate academic papers. So that, the educational administration department could establish a mechanism for evaluating and regularly monitoring the affect of AI on teaching quality and the learning abilities of students, so that educational administration departments can adjust the application strategy of intelligent technology in a timely manner.

5 Conclusion

This research is focused on "challenges and occasions of artificial intelligence for teaching and learning in higher education" and revolves around the following main contents. It first investigates the existing usage situation of artificial intelligence in higher education, involving some concrete situations such as personalized learning platforms, intelligent teaching, virtual platforms and intelligent assistants. Secondly, this research is concerned with exploring the dual impacts created by artificial intelligence, e.g., intensified needs for teachers' technical application ability, challenges to the objectivity of students' learning outcome measurement, and potentials such as overcoming time and space limitations and achieving personalized personalized study plans. Finally, it offers certain suggestions, such as enhancing teachers' artificial intelligence technology training to enhance digital pedagogy competencies, establishing the capacity and concept of

proper use of AI learning tools in students, and implementing relevant policies by the education ministry for real-time monitoring of usage statistics. The value of this study lies in providing a realistic roadmap to education professionals on the synthesis of AI and education, which makes teachers more clearly understand the direction of technology application, as a reference for students to use AI tools reasonably, and as a reference for education administration departments to develop corresponding policies to guide higher education to a more scientific and effective way of digital transformation. The objective limitation of the current study is that differentiated examination of AI application in different types of colleges and universities is not well-investigated.

References

1. Holmes, W., Tuomi, I.: State of the art and practice in AI in education. European Jour. Educ. **57**(4), 542-570 (2022)
2. Crompton, H., & Burke, D.: Artificial intelligence in higher education: the state of the field. Intern. Jour. Educat. Techn. High. Educat. **20**(1), 22(2023)
3. Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S.: The promises and challenges of artificial intelligence for teachers: A systematic review of research. Tech. Tren. **66**(4), 616-630 (2022)
4. Vincent-Lancrin, S., & Van der Vlies, R.: Trustworthy artificial intelligence (AI) in education: Promises and challenges. OECD educat. Work. Pape. (218), 1-17 (2020)
5. Dimitriadou, E., & Lanitis, A.: A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. Smar. Lear. Environ. **10**(1), 12 (2023)
6. Tulli, S. K. C.: An evaluation of AI in the classroom. Internat. Jour. Acta. Inform. **1**(1), 41-66 (2022)
7. Alam, A.: Harnessing the power of AI to create intelligent tutoring systems for enhanced classroom experience and improved learning outcomes. In Intell. Commun. Technol. Virt. Mob. Netw. 571-591 (2023)
8. Alam, A., & Mohanty, A.: Facial analytics or virtual avatars: competencies and design considerations for student-teacher interaction in AI-powered online education for effective classroom engagement. In International Conference on Communication, Networks and Computing. Cham: Springer Nature Switzerland. 252-265 (2022)
9. Chan, C. K. Y., & Hu, W.: Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. Internat. Jour. Educat. Technol. Hig. Educ. **20**(1), 43 (2023)
10. Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W.: A review of AI teaching and learning from 2000 to 2020. Educ. Inform. Technol. **28**(7), 8445-8501 (2023)
11. Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T.: Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. Inform. Syst. Front. **25**(1), 161-182 (2023)
12. Holstein, K., McLaren, B. M., & Aleven, V.: Student learning benefits of a mixed-reality teacher awareness tool in AI-enhanced classrooms. In Artificial Intelligence in Education: 19th International Conference, AIED 2018, London, UK, June 27–30, 2018, Proceedings, Part I 19 (pp. 154-168). Springer International Publishing. (2018)
13. Alharbi, W.: AI in the foreign language classroom: A pedagogical overview of automated writing assistance tools. Educa. Resea. Interna. **2023**(1), 4253331(2023)