

# The 711 Development Framework of Artificial Intelligence in Higher Education

Wang Qiang<sup>1,\*</sup>

<sup>1</sup>Institutional affiliation: Faculty of Education, Beijing Normal University, P. R. China

\*Correspondence: No.19, Xijiekouwai St, Haidian District, Beijing, 100875, P. R. China.  
E-mail: drywq@hotmail.com

Received: January 27, 2025 Accepted: March 8, 2025 Published: March 20, 2025

doi:10.5296/ije.v17i1.22740 URL: <https://doi.org/10.5296/ije.v17i1.22740>

## Abstract

The exploration of digital transformation in higher education around the world is becoming increasingly active, and universities around the world are taking stronger actions to promote digital education. This study summarizes 11 typical application scenarios of artificial intelligence in the development of universities. Based on 11 typical application scenarios, design an "11 scenario pyramid development and advancement diagram" for higher education in the era of artificial intelligence, to help universities gradually develop and use artificial intelligence in various scenarios, thereby enhancing the overall competitiveness of universities. At the same time, in order to ensure that universities develop and use artificial intelligence in compliance with laws, regulations, and social values, this article designs a "7 Principles Guarantee Map" to provide more sustainable guidance for the improvement of various aspects such as information management, education and teaching, scientific research, and information construction in universities. The "11 Scenario Pyramid Development Advanced Map" and the "7 Principles Guarantee Map" form the "711 Artificial Intelligence + Higher Education Development Framework", helping global universities grasp the development trend of the information age and jointly create a new ecology of human education.

**Keywords:** artificial intelligence, higher education, application scenarios, educational reform, sustainable development

## 1. Background

UNESCO points out that artificial intelligence has a significant impact on education, teaching, learning, as well as the roles and abilities of participants. Artificial intelligence can process vast amounts of information and text far beyond human capabilities, recognize data presented in various formats, and facilitate human decision-making through predictive analysis. The emerging practice of using artificial intelligence in education clearly demonstrates the potential of AI in achieving new forms of teaching, learning, and educational management, enhancing learning experiences, and supporting teacher tasks (Miao, 2023). Top universities in the United States, the United Kingdom, and China are actively exploring the application of artificial intelligence in different scenarios of higher education to ensure the sustainable development of education. For example, Chinese universities such as Tsinghua University and Peking University have launched pilot projects to empower teaching with artificial intelligence, exploring the use of AI for student assistance, teaching assistants, and management. However, artificial intelligence may pose significant risks to learners, the teaching community, the education system, and society as a whole. Artificial intelligence may threaten human agency, exacerbate climate change, violate data privacy, deepen long-standing systemic inequality and exclusion, and lead to new forms of discrimination.

“Artificial Intelligence + Higher Education” is a comprehensive concept that refers to a new type of education model that deeply integrates artificial intelligence technology into the field of higher education, optimizes the educational environment through intelligent means, and promotes fundamental changes in traditional education models, teaching methods, and learning experiences. Narrowly speaking, “artificial intelligence + higher education” means using artificial intelligence technology to assist in various aspects such as teaching, management, evaluation, and feedback, in order to achieve more efficient and personalized educational services. In a broader sense, “artificial intelligence + higher education” is not limited to technological applications, but represents a revolution in educational philosophy and models. The scenario of “artificial intelligence + higher education” is the main carrier for various activities in universities, and it is an important basis for understanding the internal behavior patterns and overall development of education in universities. The aim of this study is to analyze and summarize typical application scenarios of artificial intelligence in transforming higher education, ensuring that artificial intelligence becomes a truly beneficial tool for learners, teachers, researchers, education managers, and stakeholders, and accelerating the sustainable development of higher education empowered by artificial intelligence. The specific objectives are as follows:

Objective one: Identify typical application scenarios of artificial intelligence in higher education.

Objective two: Design an advanced development diagram based on typical application scenarios of artificial intelligence in higher education

Objective three: The principle of design and development ensures that artificial intelligence promotes the rapid development of higher education.

UNESCO releases the first global “guidance for generative AI in education and research” in 2023 (Miao & Holmes, 2023). It emphasizes on guiding the use of artificial intelligence tools through the principle of putting people first, constructing action frameworks to regulate the application of artificial intelligence in education and research, cultivating the artificial intelligence skills and literacy of faculty and students, and studying its long-term impact in a cross departmental and interdisciplinary manner. The guide delves into the application scenarios of generative artificial intelligence in research, teaching, personalized learning, learning resources, learning assessment, ethical issues, copyright, and intellectual property.

## 2. Literature Review

The EU's “Digital Education Action Plan (2021-2027)” outlines the direction for the development of high-quality, inclusive, and accessible digital education in Europe. Among them, enhancing the ethical standards for educators to use artificial intelligence and data in teaching, improving the ability of teachers and students to deal with false information, and strengthening the digital skills and literacy of teachers and students in digital transformation are one of its main action directions (European Commission, 2022).

“2024 EDUCAUSE Horizon Report (Teaching and Learning Edition)” has become an important reference for countries around the world to predict the high-quality development of higher education teaching in the future. The report analyzes the key practices of empowering higher education with artificial intelligence from six aspects: "exploring the appropriate application of artificial intelligence technology", "developing artificial intelligence literacy", "supporting fair and inclusive learning", "protecting data privacy and security", "responding to erroneous information", and "maintaining mental health", helping researchers to innovate and think about the macro development trends of future higher education teaching (Xu & Duan, 2024).

Scholars from various countries have used methods such as bibliometrics, systematic reviews, or narrative reviews to study the application of artificial intelligence in education. By analyzing the research results of 132 papers on the application of artificial intelligence in higher education in Web of Science and Scopus databases from 2007 to 2017, the most cited articles on artificial intelligence in higher education in both databases mentioned that the implementation of intelligent tutoring systems is one of the main factors for improving learning. In addition, researching intelligent systems to predict students' emotions and detect learning styles is also a major application of artificial intelligence in education (Hinojo-Lucena et al., 2019).

By reviewing the research topics and evolution trends of artificial intelligence in major educational journals from 2000 to 2019, and searching for over 400 articles on the application of artificial intelligence and deep learning technology in teaching, eleven research topics of artificial intelligence in education are presented based on the increasingly prominent emerging trends in the field of educational research: 1) AI assisted teaching; 2) Virtual reality in education; 3) Intelligent tutoring system; 4) Augmented reality in education; 5)

Educational games; 6) Predictive modeling in education; 7) Adaptive learning/teaching; 8) Evaluate design; 9) Learning analytics; 10) Intelligent agent; 11) Teaching evaluation. Mainly covering the transformation of teaching with artificial intelligence technology, enhancing learning, assisting in evaluation and prediction, and empowering the learning environment (Guan et al., 2019). In terms of teaching and learning, artificial intelligence technology can provide personalized teaching resources and exercises based on students' learning habits and abilities. By utilizing artificial intelligence chatbots, universities can provide students with round the clock tutoring services, answer common questions, and provide instant feedback, offering customized learning experiences. In terms of administrative management: Artificial intelligence technology can help reduce labor costs in universities and improve administrative management efficiency, such as grade entry, course scheduling, classroom allocation, inventory management, and user services. In terms of evaluation and prediction: Artificial intelligence technology can provide timely feedback and evaluation to students by analyzing their data. Predicting students' academic performance and helping universities take early intervention measures to improve graduation rates (Li, 2024). In terms of learning environment: Building a smart learning environment is an important way to achieve personalized education, self-directed learning, collaborative learning, and lifelong learning on a large scale. Through a survey of 12 universities in 5 provinces and cities in China, it was found that a smart learning environment can promote the occurrence of deep learning (Xu et al., 2023). Artificial intelligence technology provides important support for building smart learning environments, achieving accompanying data collection, environmental perception, precise chemical analysis, and personalized learning guidance (Huang et al., 2012).

Based on analyzing the English literature on "Artificial Intelligence + Education" in Web of Science from 1984 to 2022, typical scenarios of artificial intelligence in educational applications were identified, covering adaptive learning and personalized tutoring, intelligent assessment and management, timely learning analysis and accurate prediction, and enhancing the interaction between learners, learning environments, and resources (Wang et al., 2024). 1. Intelligent tutoring system. Intelligent mentors are often involved in research and "intelligent agents". The specific application functions can be divided into three main types: learner state diagnosis and providing adaptive feedback, adaptive testing, and adaptive learning content recommendation. 2. Adaptive hypermedia learning system. We attach great importance to adapting to learners' learning styles and preferences, placing students at the center of the learning environment, and tailoring demonstrations and navigation support for each student to support hypermedia. 3. Intelligent evaluation system. Performing assessment tasks with high precision and efficiency in the educational environment provides valuable feedback for students and mentors. The main applications can be divided into three types: assessing students' learning abilities and behaviors, automatic grading, and teaching evaluation. 4. Study management systems. Providing learning resources to students, supervising and strengthening learner interaction, and optimizing course management workflows play a crucial role in promoting teaching management tasks. The learning management system serves as a hub connecting teachers, students, and administrators, aggregating a large amount of activity data to achieve adaptive and intelligent management of learning and teaching activities. The main functions of a learning management system are collaborative learning

support, classroom and exam management, and information and resource management: (1) Collaborative learning support. Its functions include promoting collaborative writing through document visualization and remote group discussions. AI can monitor students' participation, contribution, and interaction in collaborative learning, and provide real-time feedback. (2) Classroom and exam management functions. Strengthening classroom teaching through the integration of various technologies, including conducting remote control experiments and providing online exams, and real time automatic notification of student performance. (3) Information and resource management functions. AI has greatly improved the efficiency of teaching and learning material communication between teachers and students through intelligent resource management, personalized recommendations, content generation, real-time interaction, learning tracking, multilingual support, virtual classrooms, collaborative learning, intelligent search, sentiment analysis, multimodal presentation, and automated grading. These technological supports not only optimize the allocation and use of teaching resources, but also enhance students' learning experience and effectiveness, providing powerful tools and methods for modernizing education. 5. Learner model. By using support vector machines, decision trees, neural networks, and naive Bayes models, learner models can be constructed and predictions can be generated. This model collects and analyzes learners' behavioral data to provide effective cognitive and management support. The analysis and prediction application functions are mainly presented in four aspects: academic failure and dropout warnings, Academic performance prediction, Learning analytics and learner modeling, and Course arrangement and classroom performance. 6. Educational robots. Various literature mainly focuses on chatbots. Educational Chatbot is a virtual assistant based on artificial intelligence (AI) technology, specifically designed to support teaching, learning, and educational management. It interacts with students, teachers, and administrators through technologies such as natural language processing (NLP), machine learning (ML), and dialogue systems to provide personalized educational services. Educational chatbots can answer students' questions about course content, assignments, exams, etc., help them understand homework requirements, and provide problem-solving ideas. 7. Virtual reality and augmented reality. Virtual Reality (VR) and Augmented Reality (AR) are two immersive technologies that are demonstrating tremendous potential in the field of education. VR and AR help students better understand complex knowledge by visualizing abstract concepts. VR and AR create immersive and interactive learning experiences, changing traditional teaching methods and enhancing students' interest and effectiveness in learning.

By analyzing empirical research on artificial intelligence education published in the Web of Sciences database and selected professional journals on artificial intelligence education from 1993 to 2020, the main artificial intelligence technologies include chatbots, expert systems, intelligent mentors or agents, machine learning, personalized learning systems or environments, and visualization (Ke & Ayse, 2021). Artificial intelligence technology has brought almost unlimited possibilities to education, empowering education to present various forms such as digitalization of educational resources, intelligence of educational platforms, mixing of teaching modes, personalization of learning forms, precision of educational evaluation, and scientific governance of education (Liu & Hu, 2024).

Based on a search of 100355 articles from ERIC, ProQuest, Scopus, and Web of Science databases between 2012 and 2021, an analysis revealed four key areas and 12 key roles of artificial intelligence in educational applications. 1. Artificial intelligence empowers students in the field of learning: (1) personalized learning; (2) Provide human-machine dialogue; (3) Analyze student assignments to obtain feedback; (4) Improve adaptability and interactivity in the digital environment. 2. Artificial intelligence empowers teachers in the field of teaching: (1) providing adaptive teaching strategies; (2) Enhance the teaching ability of teachers; (3) Support the professional development of teachers. 3. Artificial intelligence in empowering the field of learning assessment: (1) providing automatic scoring; (2) Predict students' performance. 4. Artificial intelligence empowers the field of administrative management: (1) improving the performance of management platforms; (2) Provide convenient and personalized services; (3) Provide educational decision support (Chiu et al., 2023).

Through analysis of 304 articles on AI enabled higher education published in the Scopus database from 2012 to 2021, it was found that the main research topics in this field include strategic management of AI in higher education, deployment of AI systems to create efficient higher education environments, use of AI for student-centered learning, use of AI to promote academic research innovation, exploration of AI driven educational methods, implementation of AI enabled innovative teaching practices in higher education, analysis of the transformation of teaching, research, and training in higher education institutions in the era of AI, and analysis of the profound impact of AI on students and educators (Maphosa, V., & Maphosa, 2023). Based on a review of 138 papers on the transformation of artificial intelligence in higher education from 2016 to 2022, the main application areas of artificial intelligence in universities include learning testing and evaluation, learning prediction, and managing student learning (Crompton & Burke, 2023).

### 3. Methodology and Findings

Theme analysis used based on the collected relevant information by literature review. Theme analysis provides a systematic approach for organizing, analyzing, and describing qualitative data. According to Braun and Clarke's thematic analysis steps, identify typical application scenarios of artificial intelligence in higher education.

**Table 1.** Identify Typical Application Scenarios of Artificial Intelligence in Higher Education

Code	Subcategories	Categories	Theme
Virtual reality in education, intelligent tutoring systems, augmented reality in education, educational games, predictive modeling in education, adaptive learning/teaching, evaluation design, learning analysis, intelligent agents, chatbots, expert systems, intelligent	Teaching mode, learning experience, testing, evaluation, learning environment, prediction, teaching resources, intelligent educational	Teaching, learning, assessment and prediction, learning environment, learning	Typical application scenarios of artificial intelligence in higher education



---

evaluation systems, intelligent mentors, management, resources,  
adaptive hypermedia learning systems, scientific research, scientific  
learning management systems, learner emotional research,  
models, educational robots, machine communication, administrative  
learning, personalized learning systems or talent cultivation management,  
environments, visualization, assisted mode, teaching physical and  
exploration of smart teaching models, methods and mental health,  
collaborative learning support, classroom practices, ethics and  
and exam management functions, administrative morality,  
information and resource management management, information  
functions, academic failure and dropout academic research, literacy,  
warnings, academic performance prediction, learning assessment, leadership, plan  
learning analysis and learner modeling, ethics and morality, and strategy,  
course scheduling and classroom information skills and environmental  
performance, classroom learning assistance, nutrition, sustainability,  
peer support, emotional connection environmental exchange and  
promotion, remote robot teachers, enhanced protection, mental cooperation  
learning experience Assist evidence-based health, educational  
scientific research, provide digital environment,  
decision-making references, digitize educational strategy,  
educational resources, digitize educational partnership  
platforms, mix teaching modes, personalize  
learning forms, refine educational  
evaluation, scientize educational  
governance, innovate talent cultivation  
models, reform teaching methods, enhance  
educational governance capabilities,  
improve research efficiency and intelligence,  
personalize learning, learning resources,  
learning assessment, ethical issues,  
copyright and intellectual property, ethical  
guidelines for educators to use artificial  
intelligence and data, teachers and students'  
ability to respond to false information,  
teachers and students' digital skills and  
literacy, respect for human rights in artificial  
intelligence values, promote the application  
of artificial intelligence, promote  
environmental protection, research and  
innovation, strengthen skills training,  
promote partnerships, appropriately apply  
technology, develop artificial intelligence  
literacy Supporting fair and inclusive

---

---

learning, protecting data privacy and security, maintaining mental health, empowering student learning, empowering teacher teaching, empowering learning assessment, empowering administrative management, AI strategy, educational environment, student-centered learning, academic research innovation, AI driven educational methods, innovative teaching practices, research and training transformation

---

Based on thematic analysis, the typical application scenarios of artificial intelligence in higher education are concentrated in 11 areas, including “AI + Higher education” plan and strategy, smart learning environment, AI literacy, AI-Augmented leadership, management, teaching, learning, assessment and prediction, research, physical and mental health, and sustainable development and cooperation.

#### **4. Discussion**

Based on 11 typical application scenarios of artificial intelligence transforming higher education, this study designs a "11 scenario pyramid development advancement diagram" that requires higher education to be promoted from bottom to top in the era of artificial intelligence, in order to provide universities with clear development ideas and help them gradually develop and use artificial intelligence in various educational scenarios, promoting sustainable development of universities. Level 1: Universities need to develop an artificial intelligence action plan to provide direction for overall development. Level 2: Based on the action plan, create a smart education environment to pave a broad path for inclusive growth in education and the boundaryless dissemination of knowledge. Level 3: Enhance the digital literacy and leadership of relevant participants, promote digital governance of education, and strengthen research and practice of digital teaching methods. Level 4: Applying artificial intelligence to empower university management, research, learning, teaching, evaluation, and prediction, enhancing the overall competitiveness of universities. Level 5: While applying artificial intelligence, ensure the well-being of teachers and students, promote healthy growth of students, promote lifelong development of teachers, and create a healthy and orderly application atmosphere. Level 6 is to promote sustainable development of society and improve cooperation. The level 1 and level 2 are the low level of artificial intelligence applications, the level 3 and level 4 are the medium level of artificial intelligence applications, and the level 5 and level 6 are the high level of artificial intelligence applications.

It is worth noting that when applying artificial intelligence technology to different scenarios, it may lead to the perpetuation of bias, infringement of privacy rights, and unethical behavior. Universities must develop responsible artificial intelligence, design, develop, and deploy it in an ethical, fair, transparent, and responsible manner to ensure that AI systems do not



perpetuate or amplify bias, protect individual privacy and security, and enhance the interpretability of AI decisions. Universities should aim to serve humanity, develop and use artificial intelligence in accordance with social values and legal norms, and contribute to sustainable human development. Based on the typical application scenarios mentioned above, combined with multiple documents from UNESCO on the transformation of education with artificial intelligence and important views from globally renowned universities on empowering education with artificial intelligence, this article summarizes and designs the "Seven Principles Guarantee Chart" that education needs to follow in the era of artificial intelligence. Extending from principle one to principle seven, continuously deepening and guiding universities in the rational development and application of artificial intelligence in educational settings, providing more possibilities for the improvement of various aspects such as information management, education and teaching, scientific research, and information construction, thereby enhancing the overall competitiveness of universities.

Principle 1: Ensure morality and safety.

Principle 2: Ensure social fairness and meaningfulness.

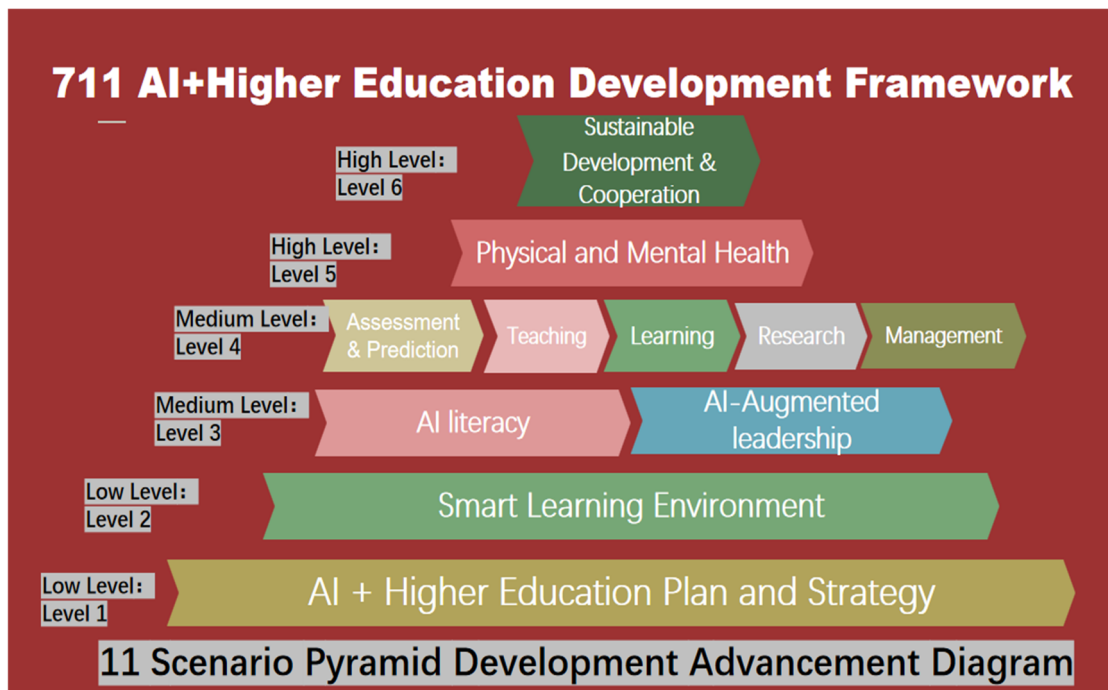
Principle 3: Ensure inclusivity and cultural diversity.

Principle 4: Ensure human emotional bonds and physical and mental health.

Principle 5: Ensure human initiative and intellectual development.

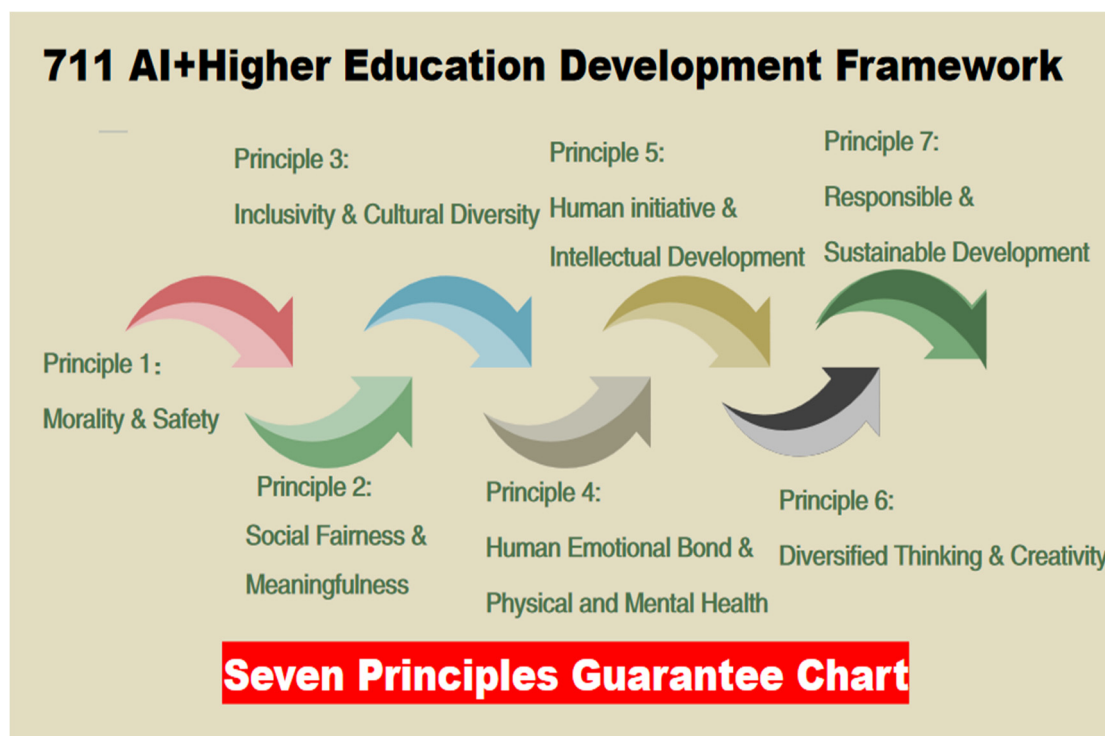
Principle 6: Ensure diverse thinking and creativity.

Principle 7: Ensure responsible and sustainable development.



**Figure 2.** 711 AI + Higher Education Development Framework-11 Scenarios Pyramid Development Advancement Diagram

Based on the 11 typical application scenarios and 7 application principles mentioned above, the overall "711 AI + Higher Education Development Framework" is formed to assist global universities in grasping the development trend of the information age and jointly creating a new ecology of human education.



**Figure 2.** 711 AI + Higher Education Development Framework-Seven principles Guarantee Chart

## 5. Conclusion

This article summarizes eleven typical scenarios of the application of artificial intelligence in higher education, comprehensively demonstrating the interaction between artificial intelligence and higher education, and revealing the various changes in the education landscape in the era of artificial intelligence. The potential for artificial intelligence to revolutionize administrative management, education and teaching, learning models, educational environments, and research methods in universities is evident, and it poses new capability requirements for different participants. Under the seven principles of educational development proposed in this article, universities need to responsibly implement artificial intelligence, carefully analyze its potential advantages and risks, and meet the development needs of teachers, students, and stakeholders. It is very important to consider the impact of the continuous changes in artificial intelligence technology on higher education. The biggest change in artificial intelligence in the future will be the possibility of achieving human level artificial intelligence. The probability of this happening is expected to be 50% before the end of the 21st century (Roser, 2023). Before this moment arrives, it can be foreseen that traditional higher education will be greatly impacted. The role of higher education will

change with the level of understanding and expectations of managers, researchers, and faculty towards artificial intelligence. Even in the current digital age, the speed of social change is disruptive. Now, it's time to make a change.

## References

- Chiu, T. K. F., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, 4, Article 100118. <https://doi.org/10.1016/j.caeai.2022.100118>
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education*, 20, 22. <https://doi.org/10.1186/s41239-023-00392-8>
- European Commission. (2022). Digital Education Action Plan (2021-2027). <https://education.ec.europa.eu/focus-topics/digital-education/action-plan>
- Guan, Chong et al. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, 4, 134-147. <https://doi.org/10.1016/j.ijis.2020.09.001>
- Hinojo-Lucena, F.-J., Aznar-Díaz, I., Cáceres-Reche, M.-P., & Romero-Rodríguez, J.-M. (2019). Artificial Intelligence in Higher Education: A Bibliometric Study on its Impact in the Scientific Literature. *Education Science*, 9, 51. <https://doi.org/10.3390/educsci9010051>
- Huang, R. H., Yang, J. F., & Hu, Y. B. (2012). From Digital Learning Environment to Smart Learning Environment: Changes and Trends in Learning Environment. *Open Education Research*, 18(1), 75-84. <https://doi.org/10.13966/j.cnki.kfjyyj.2012.01.009>
- Li, M. L. (2024). Intelligent Transition in Higher Education: A Historical Comparative Study. *Tsinghua Journal of Education*, 45(04), 14-24+59. <https://doi.org/10.14138/j.1001-4519.2024.04.001411>
- Liu, G. P., & Hu, H. L. (2024). Technology empowers the construction of a strong education country. *Journal of Southwest University(Social Sciences Edition)*, 50(02), 168-180. <https://doi.org/10.13718/j.cnki.xdsk.2024.02.014>
- Maphosa, V., & Maphosa, M. (2023). Artificial intelligence in higher education: a bibliometric analysis and topic modeling approach. *Applied Artificial Intelligence*, 37(1). <https://doi.org/10.1080/08839514.2023.2261730>
- Miao, F. C., & Holmes, W. (2023). *Guidance for generative AI in education and research*. UNESCO. <https://doi.org/10.54675/EWZM9535>
- Miao, F. C., & Cukurova, M. (2023). *AI competency framework for teachers*. Paris, UNESCO. <https://doi.org/10.54675/ZJTE2084>

- Roser, M. (2023). *AI timelines: What do experts in artificial intelligence expect for the future?* Our World in Data. <https://ourworldindata.org/ai-timelines>.
- Wang, S., Wang, F., Zhu, Z., Wang, J. X., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications*, 252(124167), 1-19. <https://doi.org/10.1016/j.eswa.2024.124167>
- Xu, D., & Duan, X. W. (2024). Artificial Intelligence Literacy: Challenges and Responses in Higher Education - Interpretation and Implications of the 2024 Horizon Report: Teaching and Learning Edition. *Open Education Research*, 30(3), 24-36. <https://doi.org/10.13966/j.cnki.kfjyyj.2024.03.003>
- Xu, Z. G., Zhao, C. Y., Wang, Y., Xie, W. L., & Gao, Y. P. (2023). The influencing factors of deep learning for college students in a smart learning environment. *Modern Educational Technology*, 33(1), 58-65. Retrieved from [https://kns.cnki.net/kcms2/article/abstract?v=th5-mUcNE0Opa475BwF8XJMihU2-wulisNGILg3TOM4dxIJc-nKSP49h\\_uzzHzrP8SVrBc3aq6U2jCf-P0bVgdskzWWPH0iflWi1vGgQ4SNSNIjzAMYr-MOE3MEnX9ns-xghmp2TqWCFekZ-bWGoDSBGiwPiBhDXLA5hmiUTkf5LanSsIEo8tSUzK8bSmxz&uniplatform=NZKPT&language=CHS](https://kns.cnki.net/kcms2/article/abstract?v=th5-mUcNE0Opa475BwF8XJMihU2-wulisNGILg3TOM4dxIJc-nKSP49h_uzzHzrP8SVrBc3aq6U2jCf-P0bVgdskzWWPH0iflWi1vGgQ4SNSNIjzAMYr-MOE3MEnX9ns-xghmp2TqWCFekZ-bWGoDSBGiwPiBhDXLA5hmiUTkf5LanSsIEo8tSUzK8bSmxz&uniplatform=NZKPT&language=CHS)
- Zhang, K., & Ayse B. A. (2021). AI technologies for education: Recent research & future directions. *Computers and Education: Artificial Intelligence*, 2(100025), <https://doi.org/10.1016/j.caeai.2021.100025>

## Acknowledgments

I greatly appreciate the valuable contributions of my Prof. Huang Ronghuai.

## Authors contributions

Dr. Wang was responsible for study design, drafting the manuscript and revising it. The authors read and approved the final manuscript.

## Funding

Not applicable.

## Competing interests

The author declares that there is no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Informed consent

Obtained.

**Ethics approval**

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

**Provenance and peer review**

Not commissioned; externally double-blind peer reviewed.

**Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

**Data sharing statement**

No additional data are available.

**Open access**

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

**Copyrights**

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.