

# A Study of Artificial Intelligence-Driven Change in Higher Education in the Age of Digital Intelligence



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**Abstracts:** The arrival of the age of digital intelligence signifies the increasingly important role of artificial intelligence (AI) in driving change in higher education. The incorporation of AI technology improves the efficiency of teaching and learning and facilitates fundamental changes in the mode, content, and management of education. This paper discusses the application of AI in personalized learning path design, intelligent tutoring systems, virtual labs, and course content development, and analyzes the challenges and countermeasures of technology access and equality, data privacy and security, education quality and AI dependency, and resistance to changing the traditional education system.

**Keywords:** digitization; artificial intelligence; higher education; change

## Introduction

The era of digital intellectualization refers to a new era in which digital technology is core to promote fundamental changes in the socio-economic structure and human lifestyles through the wide application and integration of advanced technologies such as big data, cloud computing, artificial intelligence (AI), and the Internet of Things (IoT), etc., where data has become an important resource and asset, and the application of intelligence has penetrated every aspect of work, study, and life, improving efficiency, convenience and personalization levels. The main features of the era of digital intelligence include: data-driven, emphasizing the analysis and application of data in the decision-making process to achieve more scientific and precise management and decision-making; intelligent services, realizing the personalization and intelligence of services through AI and other technologies to meet the diversified needs of users; networked collaboration, utilizing cloud computing, the Internet of Things and other technologies to realize the efficient allocation of resources and remote collaboration, and to promote globalization and cooperation; innovation-driven

development, with technological innovation permeating every aspect of work, study and life, enhancing the level of efficiency, convenience and convenience. communication; innovation-driven development, technological innovation has become the key force driving social development, and new industrial forms and business models are constantly being bred. The era of digital intelligence has put forward new requirements for individual ability, enterprise competitiveness, and national governance ability, and pushes the society to develop in the direction of smarter, more efficient, and greener.

## 1. Application of Artificial Intelligence in Higher Education

### 1.1 Teaching and learning

In the era of digital intelligence, the application of Artificial Intelligence (AI) in higher education has become a key driving force to promote teaching and learning innovation. The design of personalized learning paths is a major application highlight of AI in education. Relying on big data analysis and machine learning technology, customized learning plans and resources are provided based on students' learning habits, ability level, and knowledge mastery, which enhances students' learning motivation and efficiency, and also promotes in-depth mastery of

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knowledge and the cultivation of innovation ability. Intelligent tutoring systems, on the other hand, make use of natural language processing (NLP) and cognitive computing technologies to provide students with immediate and efficient learning support, simulate the guidance of human teachers, understand students' questions, provide targeted answers and feedback, and continuously optimize their tutoring strategies through continuous interactive learning to adapt to students' personalized needs, broadening the boundaries of teaching and learning and making high-quality educational resources free from the time and space constraints and more equitably benefit every student (Nan & Zhang, 2018). Meanwhile, the development of virtual laboratories and simulation environments is another major innovative application of AI technology in higher education. Through highly realistic 3D simulation technology and interactive learning platforms, students can perform experimental operations and scene simulations in virtual environments, which not only enable them to repeat experiments an unlimited number of times, find problems and optimize solutions, and perform risky experimental operations without having to worry about safety, enriching students' practical experience and improving the efficiency and safety of experimental teaching, but also providing strong technical support for distance education and interdisciplinary It also provides strong technical support for distance education and interdisciplinary learning.

### 1.2 Course and content development

Automated course content generation utilizes machine learning and natural language processing technologies to automatically generate course materials, including lecture notes, exercises, and case studies, according to the syllabus, and quickly update course content according to the latest academic research results and real-time industry dynamics to ensure the timeliness and cutting-edge of teaching materials. An intelligent recommendation system, on the other hand, analyzes students' learning history, interest preferences, and ability level to recommend the most suitable courses and learning resources for them, adopting complex algorithmic models, such as collaborative filtering and deep learning, to accurately predict students' learning needs and improve the relevance and efficiency of learning. The application of intelligent recommendation systems

helps students explore their potential interests and talents, guides them to interdisciplinary learning, and broadens their knowledge horizons. The development of interactive learning materials is another important application of AI technology in education content innovation, which integrates multimedia elements and interactive design, such as video, animation, simulation experiments, etc., to provide an attractive learning experience technology can adjust the way and difficulty of content display in real-time according to the interactive behavior and learning effect of the students, to make the learning process more flexible and personalized, and to enhance students' learning interest and participation, deepen understanding and memory, and promote the cultivation of critical thinking and innovation (Wu et al., 2023).

### 1.3 Assessment and feedback

The application of Artificial Intelligence (AI) in higher education is gradually penetrating the assessment and feedback process, which includes real-time learning assessment, automated assignment correction, and intelligent feedback systems. Real-time learning assessment continuously monitors and analyzes students' learning process through AI technologies, such as machine learning and data mining, assesses students' learning status and effectiveness in real-time, identifies difficulties encountered by students in their learning, realizes the true student-centered teaching mode, improves the timeliness and accuracy of assessment, and does so through continuous monitoring and adjustment. The automated homework correction system utilizes natural language processing (NLP) technology and machine learning algorithms to automatically assess students' homework and test answers, which reduces teachers' workload, ensures the objectivity and consistency of the assessment, and helps students understand their learning promptly, correct errors and deficiencies, deepen their learning understanding and improve their learning efficiency (Ji & He, 2020). An intelligent feedback system, on the other hand, uses AI technology, based on big data analysis, to provide students with personalized learning feedback and suggestions, improve the relevance and effectiveness of feedback, help students build the ability to self-regulate their learning, and promote the development of deep learning and critical thinking (Yang & Liu, 2023).

#### 1.4 Management and operation

In the field of higher education, the application of Artificial Intelligence (AI) has been extended to all aspects of management and operation, with intelligent campus management, optimization of student recruitment and admission process, and resource allocation and optimization becoming important application areas. Intelligent campus management integrates Internet of Things (IoT) technology, big data analytics, and AI algorithms to achieve intelligent monitoring and maintenance of campus facilities, optimization of energy management, and automation of security systems, which monitor the campus environment in real-time, predicts maintenance needs, improves energy efficiency, and ensures campus safety, reduces the cost of manpower and materials, and improves the level of intelligence and automation in campus management (Xiang & Chen, 2023). In the process of student recruitment and admission, AI technology provides data support and decision-making advice to the admissions team by analyzing historical admissions data, student application information, and market trends to optimize the recruitment strategy and admission process. Machine learning algorithms can predict the probability of enrollment and future performance of applicants, helping educational institutions to more accurately identify and attract potentially excellent students, and achieve the optimal allocation of enrollment resources (Mao, 2023). In terms of resource allocation and optimization, AI technology provides educational institutions with scientific resource allocation plans, including the allocation of teaching resources, the optimization of course scheduling, and the rational planning of infrastructure through demand prediction, the analysis of the use efficiency, and the assessment of cost-effectiveness of educational resources, which improves the efficiency and effectiveness of the use of resources, and makes dynamic adjustments based on the feedback of students and teachers to ensure that the educational resources can meet the changes in teaching and learning needs, and promote the continuous improvement of education quality.

## 2. Key Factors for Artificial Intelligence-driven Changes in Higher Education

### 2.1 Synergistic evolution of technology and education policy

The change of higher education driven by artificial intelligence not only depends on the development of technology, but is also closely related to the synergistic evolution of education policy, and the interaction between technological innovation and policymaking promotes the overall optimization and continuous progress of the education system. To realize this co-evolution, education policymakers need to work closely with technology developers to ensure that education policy responds promptly to the latest trends in technological development, while at the same time guiding technological innovations to meet the practical needs and ethical standards of the education sector. Educational policymaking needs to take into account the potential and limitations of AI technology, develop a practical policy framework to promote the effective application of the technology in education and formulate a clear policy guidance and regulatory mechanism to provide a stable environment for the innovative application of AI technology in education, while guarding against the potential risks posed by technological misuse (Chen, 2021). Educational policies should encourage interdisciplinary research and cooperation, promote the integration of knowledge from multiple disciplinary fields such as pedagogy, psychology, computer science, etc., promote the in-depth application and innovation of AI technology in education, promote the innovation of technological solutions, ensure the consistency between technological innovation and educational goals, and establish an effective mechanism to monitor and evaluate the effectiveness of the application of AI technology in education, and make timely adjustments to the policy direction and focus to promote the continuous improvement of education quality and the realization of education equity (Peng et al., 2023).

### 2.2 Skill enhancement of teachers and students

Teachers' skill enhancement should strengthen their understanding and mastery of AI and related technologies to effectively integrate AI technologies into teaching design and practice to improve teaching efficiency and quality. In addition, teachers need to develop data analysis skills, use student learning data for teaching reflection and adjustment, and achieve accurate teaching and personalized learning support. Teachers should be equipped with the ability to guide

students to think critically and innovate, and develop the key skills needed to cope with the rapidly changing social and work environments. Students' skill enhancement, on the other hand, focuses on developing the ability to interact with AI technologies and utilize AI resources for independent learning, including digital literacy, information retrieval and processing skills, and skills to use AI tools for learning, and students also need to develop critical thinking and innovation skills for effective information assessment, knowledge construction, and problem-solving in AI-assisted learning environments (Kang et al., 2023). In addition, the development of lifelong learning skills is crucial for students, requiring them to be able to proactively adapt to technological changes and continuously update their knowledge and skills to meet the challenges of their future careers. To achieve the enhancement of teachers' and students' skills, higher education institutions need to develop systematic training programs and support strategies to provide professional development opportunities and resources, including workshops, online courses, and hands-on projects.

### **3. Problems and Countermeasures Facing AI-driven Changes in Higher Education in the Era of Digitization**

#### **3.1 Data privacy and security issues**

Although artificial intelligence (AI)-driven change in higher education brings many potential advantages, it also faces data privacy and security issues, involving the protection of students' and teachers' personal information, as well as the safe management of sensitive information such as learning data and research results. With the wide application of big data and AI technologies in education, how to effectively protect data privacy and ensure data security has become an urgent issue. Higher education institutions need to establish a strict data governance system, clarify the norms and procedures for data collection, storage, processing, and sharing, formulate meticulous data classification standards, distinguish between sensitive and non-sensitive data, and take corresponding protection measures. They should strengthen the application of data encryption technology, and protect the data in transmission through technical means such as Advanced Encryption Standard (AES) and Transport

Layer Security protocol (TLS) and storage processes (Li et al., 2022). In addition, higher education institutions need to implement access control and authentication mechanisms to ensure that only authorized users can access sensitive data. This requires the use of strategies such as multi-factor authentication (MFA) and role-based access control (RBAC) to limit the scope of data access with the least-privilege principle, and institutions should conduct regular data security training and awareness-raising activities to enhance the knowledge of faculty and students about data privacy protection and cybersecurity. At the policy and regulation level, higher education institutions should actively respond to the requirements of national and regional data protection laws and regulations, such as the EU's General Data Protection Regulation (GDPR) and the U.S.'s Family Educational Rights and Privacy Act (FERPA), to ensure that their educational activities are legally compliant, and they should work closely with data protection agencies and cybersecurity organizations to keep up-to-date with the latest data protection policies and technological trends, and to perfect the data protection measures.

#### **3.2 Technology access and equality issues**

The issue of technology access and equality faced by artificial intelligence (AI)-driven changes in higher education in the age of digitalization reveals the contradiction between technology diffusion and unequal distribution of resources, which relates to the degree of diffusion of technological infrastructure, and also involves the fairness and accessibility of educational resources, especially in remote and economically underdeveloped areas. To this end, infrastructure should be strengthened to ensure broadband Internet coverage and universal access to high-quality network services. Governments and educational institutions should cooperate in investing in information and communications technology (ICT) infrastructure, lowering the threshold of access to learning technologies, providing equal learning opportunities for a wide range of teachers and students, enhancing the availability and affordability of educational technologies, and alleviating the financial burden on remote areas and low-income families through measures such as policy support and financial subsidies, to ensure that every student has access to the necessary learning equipment and resources. In addition, higher education institutions

should carry out customized educational technology training programs to enhance the digital literacy and technology application capabilities of students and faculty, especially for marginalized groups, to narrow the skills gap, and educational content and resources should be designed with a focus on diversity and inclusiveness, to ensure that educational resources meet the needs of students from different backgrounds and to promote the equitable dissemination of knowledge. At the policy level, there is a need to formulate and implement inclusive educational technology policies that encourage the innovative development of educational technology while paying attention to its social impact and preventing technological advances from exacerbating educational inequality (Shi & Zhuang, 2023). Policymakers should take into account the needs of multiple stakeholders and build a framework for the development and application of educational technology that involves the whole society.

### **3.3 Education quality and artificial intelligence dependence**

Currently, the issue of education quality and AI dependency is becoming more and more prominent. Over-reliance on AI technology may lead to a weakening of the humanized elements of the education process, and the learning experience becomes mechanized, affecting the depth and quality of education, and an over-reliance on AI may also neglect the core value of education - the cultivation of students' critical thinking, innovation ability, and humanistic literacy. In response, there is a need to ensure the auxiliary positioning of AI technology and emphasize the irreplaceability of teachers in the education process. Educational institutions should strengthen the training of teachers' technical application skills through professional development programs, while reinforcing their roles as knowledge transmitters and value guides, and develop and implement a blended learning model that effectively combines AI technology and traditional educational methods, using AI technology to improve the accessibility and personalization of educational resources while retaining the advantages of face-to-face communication and teacher-student interaction as a means of ensuring the quality of education. Educational institutions should establish a continuous evaluation mechanism for the application of AI education, and monitor the effect of AI

technology application through regular teaching evaluation and learning outcome analysis to ensure that the quality of education is not affected. In the face of the problem of educational dependency brought about by the rapid development of AI technology, there is a need to reflect and adjust at the level of educational philosophy and policymaking, clarify the auxiliary and service roles of technology in education, formulate a comprehensive policy on educational technology, promote educational fairness, and ensure that all students can have a high-quality learning experience in an AI-enhanced educational environment.

### **3.4 Resistance to changing traditional education systems**

The notable resistance from the traditional education system stems mainly from the low acceptance of new technologies and methods within the education system, as well as the adherence to existing teaching practices, culture, and values. While the traditional education system emphasizes teacher-led teaching models and fixed curriculum structures, the introduction of AI technologies has facilitated a paradigm shift toward student-centered, personalized learning, a shift that has touched off existing educational perceptions and power structures. Countermeasures to this resistance involve, first and foremost, deepening the reform of educational culture, establishing an open, inclusive, and innovative educational culture, and encouraging acceptance and support for change within the educational system. For teachers, their fear and anxiety of technological change should be alleviated, the supporting role of technology in teaching should be emphasized, the leading role of teachers in the educational process should be ensured, and their initiative and motivation for change should be enhanced. Effective communication should also be carried out with teachers, students, parents, and all sectors of the community to understand and address their concerns and expectations of educational change, and to build a consensus that will lead to the formation of a synergy for change. Use forums, seminars, and other platforms to collect feedback, regularly assess the process and effectiveness of change, make timely adjustments to the change strategy, implement the strategy of phased and pilot projects to gradually promote educational change, pilot the program first in specific areas or courses,

collect empirical data and successful cases, demonstrate the potential of AI technology to improve the quality and efficiency of education, and gradually broaden the acceptance and impact of the change.

### Conclusion

In summary, in the era of digital intelligence, the application of AI technology can achieve the optimal allocation of higher education resources and the demand for personalized learning, improve educational fairness, protect data privacy, ensure educational quality, and adapt to the changes in the traditional education system. To give full play to the potential of AI in higher education, it requires close cooperation among educational policymakers, technology developers, and educational practitioners to build a supportive framework to facilitate the development of the integration of technology and education to make higher education smarter, more personalized and flexible to meet the needs of society and student development.

### Conflict of Interest

The author declares that she has no conflicts of interest to this work.

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