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Exploring the Path of AI Technology's Empowerment of New Developments in Higher Education

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Abstract: As the core driving force leading the new round of technological revolution and industrial transformation, artificial intelligence is profoundly reshaping the higher education ecosystem. Based on the background of artificial intelligence development, this paper expounds the value of AI technology in promoting the innovative development of higher education, explores the specific paths of AI technology empowering the innovative development of higher education from three dimensions of talent training, scientific research, and governance, and puts forward the required guarantee conditions. It aims to promote the in-depth integration of artificial intelligence and higher education, profoundly change the form of higher education, lead higher education towards a more personalized, precise, and intelligent development path, and provide reference for solving a series of problems encountered in the current development of higher education.

Keywords: Artificial intelligence; AI technology; Higher education; Development; Path

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1. Introduction

Under the background of new-quality productive forces, a new generation of artificial intelligence has gradually swept the world, becoming a powerful engine leading industrial transformation and technological revolution. China vigorously promotes the extensive integration of artificial intelligence with various fields of society. With the advancement of a series of policies such as the "New Generation Artificial Intelligence Development Plan", the "Interim Measures for the Administration of Generative Artificial Intelligence Services", and the "Guidelines for the Construction of a Comprehensive Standardization System for the National Artificial Intelligence Industry (2024 Edition)", large AI models have entered a new stage of large-scale application pilots, showing enormous application potential in the education sector. In the field of higher education, the application of artificial intelligence has transitioned from the stage of logical reasoning and expert systems to the stage of machine learning, evolving from a mere "auxiliary tool" to an "empowerer" [1]. The development and promotion of artificial intelligence technology (hereinafter referred to as "AI technology") have impacted higher education

models, scientific research environments, and teaching environments [2]. Institutions of higher learning are the main positions for cultivating innovative talents. How to conform to the development trend of "AI + education", take AI technology as the core engine, explore and expand the application scenarios of this technology, and at the same time drive the all-round leapfrog development of the higher education system from connotation to extension, empowering the innovation of all links and processes of higher education talent training is imperative.

2. The value of AI technology in promoting the innovative development of higher education

The integration of AI technology into the field of higher education is not a simple technical superimposition, but a systematic empowerment of the educational ecosystem. Its core value is reflected in the following three aspects:

2.1. Empower precise talent training and solve the dilemma of homogenization

Traditional higher education mostly adopts a standardized teaching model, arranging teaching content uniformly, which is difficult to adapt to students' personalized growth needs [3]. Through multi-dimensional learning situation data collection and intelligent analysis, AI technology constructs personalized knowledge and ability maps, realizes "one thousand people, one thousand faces" precise teaching push, promotes the transformation of educational goals from knowledge imparting to the compound training of "higher-order thinking + innovative ability + digital literacy", and accurately meets the needs of cultivating top-notch innovative talents.

2.2. Drive scientific research innovation and reshape research paradigms

With the advantages of large-scale data processing and complex system modeling, AI technology can accelerate the process of academic research. According to automated execution instructions, it can complete data collection, literature review collation, code writing, experimental scheme design, text translation and revision, simplifying teachers' scientific research processes and improving research efficiency [4]. Intelligent scientific research tools can intelligently track domestic and foreign research trends according to researchers' research interests and directions, construct large-scale scientific research theme datasets, conduct virtual experiment verification and error correction, accelerate the scientific research process, and help obtain results that are difficult to find with traditional research methods [5].

2.3. Optimize management level and ensure high-quality development

Higher education management involves a series of layouts and services for teachers and students. Through data collection, automatic analysis, and scientific decision-making systems, AI technology reintegrates data on education and teaching, teaching management, and scientific research services, reshapes the school-running and governance pattern, promotes the transformation of education management from "experience-extensive" to "data-precise", and improves comprehensive management efficiency [6]. At the same time, through large models and intelligent facilities, AI technology can scientifically plan the upgrading direction of campus infrastructure, serve the construction of interdisciplinary and cross-regional scientific research platforms, promote the construction of a ubiquitous intelligent interconnected learning environment, and open a new chapter in the open and lifelong development of higher education [7].

3. Paths of AI technology empowering the innovation and high-quality development of higher education

3.1. Focus on the core of talent training and build an AI-driven personalized training system

Talent training is the fundamental task of higher education. AI technology provides precise solutions for breaking traditional talent training bottlenecks and improving training quality. The specific paths are as follows:

3.1.1. Build an intelligent adaptive learning system to realize large-scale teaching students in accordance with their aptitude

Construct a full-process closed-loop ecosystem. Relying on large AI education models, build an adaptive system covering "pre-class–in-class–after-class" to realize a closed loop of "active prediction - precise push - dynamic optimization".

Multi-dimensional data collection and analysis. Collect explicit and implicit data such as learning habits, cognitive load, and classroom responses, and establish dynamic learning portraits and knowledge ability maps [8].

Personalized resource push. Customize Q&A, exercises, and extended resources for students with different foundations, such as pushing cutting-edge literature for students with spare capacity and strengthening core knowledge points for students with weak foundations.

3.1.2. Promote the digital upgrade of the curriculum system to adapt to future industrial needs

Build an interdisciplinary knowledge graph engine. Construct a three-dimensional network of "core knowledge - ability requirements - industrial needs" to form modular interdisciplinary course groups such as "AI + biomedicine".

Establish a dynamic iteration mechanism. Track the technological trends of future industries, integrate cutting-edge content such as large model applications and AI security into courses to ensure that courses resonate with industries [9].

Develop intelligent resources. Use AI to produce interactive digital textbooks and virtual simulation courseware, and realize precise push through the National Smart Education Platform.

Innovate general education course forms. Offer courses such as "AI and Human Civilization", and adopt the "project-based learning + human-machine collaborative creation" model to improve students' AI literacy.

3.1.3. Innovate teaching organization forms and explore new human-machine collaborative models

Build "AI + education meta-universe" scenarios. Relying on VR/AR and AI to create immersive learning environments such as virtual classrooms and virtual laboratories to help students improve practical application abilities [10].

Construct a tripartite collaborative mechanism. Intelligent teaching assistants take on basic work such as Q&A and grading, teachers focus on curriculum design and value guidance, and students carry out independent collaborative learning with the help of AI.

Promote the normalization of blended learning. Realize intelligent matching of learning groups through "AI learning partners", and promote the widespread implementation of online-offline integrated autonomous learning models [11].

3.2. Empower scientific research innovation and build an AI-driven cross-domain collaborative system

AI technology promotes the transformation of scientific research paradigms and injects new momentum into scientific research innovation in higher education. The specific paths are as follows:

3.2.1. Promote the intelligent transformation of scientific research paradigms and improve innovation efficiency

Full-process automation of data processing. Use AI to realize the full-process automation of scientific research data "cleaning - analysis - modeling - prediction", greatly shorten the R&D cycle of scientific research projects, and improve the accuracy and efficiency of data processing.

Build a dual-track scientific research model. Establish a collaborative scientific research model of "AI virtual simulation + real experiments", which can effectively reduce the cost investment and potential risks in the scientific research process and optimize the experimental scheme design process.

Build a cross-domain collaborative platform. Through knowledge graph technology, construct interdisciplinary and cross-domain scientific research achievement maps, providing favorable conditions for carrying out interdisciplinary scientific research innovation to solve cutting-edge problems [12].

3.2.2. Promote interdisciplinary integration and cultivate new disciplinary growth points

Attach importance to the cross-integration development of traditional disciplines. Use AI technology to break the research boundaries of traditional disciplines and establish a research system of "artificial intelligence + traditional disciplines". For example, realize the reconstruction of historical scenes and the simulation of social operation laws in the field of humanities and social sciences, and optimize breeding schemes and production regulation logic in the field of agriculture.

Build a growth empowerment system. Relying on AI technology to establish a disciplinary development trend prediction model, establish an integrated mechanism of "discipline–scientific research–industry", and accelerate the transformation of scientific research achievements into real productive forces.

3.2.3. Build intelligent scientific research platforms and strengthen resource sharing

Construct an independent and controllable large model system. Develop a hierarchical scientific research large model system of "general basic large model + discipline-specific fine-tuning model" to improve the intelligent support capacity of the entire scientific research process.

Build an innovation testbed. Focus on basic scientific research and key core technology research, develop forward-looking scientific research tools and experimental platforms, and provide technical support for cutting-edge scientific research innovation [13].

Promote the intelligent upgrading of equipment. Construct an intelligent laboratory network of "IoT perception + AI analysis" to realize remote control of experimental equipment and automatic data collection and analysis; build an interdisciplinary scientific research data sharing platform to break data silos.

3.3. Optimize governance efficiency and build an AI-driven precise governance system

AI technology provides new ideas for the reform of higher education governance and promotes the modernization of governance capacity. The specific paths are as follows:

3.3.1. Build an "educational digital map" to empower scientific decision-making

Construct a digital twin system. Realize dynamic monitoring, precise prediction, and scientific decision-making of higher education development.

Build a discipline update system. Integrate data on industry development, post changes, professional settings, and discipline construction to construct a dynamic discipline update system oriented to industrial needs, providing a basis for the school's professional settings and curriculum development.

Build a talent supply-demand matching platform. Use data analysis and AI algorithms to construct talent supply-demand prediction models for traditional and emerging industries, adjust enrollment scales and professional layouts according to demand changes, and build high-quality talent training highlands.

Optimize resource allocation. Use AI algorithms to optimize the allocation plan of faculty, teaching facilities, and funding investment, and improve the efficiency of educational resource utilization.

3.3.2. Promote the digitization of management services and improve administrative efficiency

Upgrade "AI + one-stop service". Integrate data from various management systems such as academic affairs, scientific research, finance, and personnel to realize full-process automated approval of high-frequency businesses; build an intelligent consulting service system through generative AI to provide personalized and real-time consulting services for teachers and students.

Construct a smart campus operation and maintenance system. With the help of big data, sensors, and intelligent facilities, establish an integrated intelligent connection system covering on-campus venues such as classrooms, laboratories, libraries, stadiums, and canteens, integrate all campus resources, spaces, and services, and provide an operation and maintenance environment with automatic perception, intelligent evaluation, and intelligent upgrading [14].

3.3.3. Optimize faculty management and support teacher development

Establish a digital literacy improvement system. AI evaluates teachers' abilities, formulates personalized training plans, and builds a teaching innovation community.

Construct a precise evaluation system. Collect multi-dimensional data to establish an evaluation model, generate development reports, and provide personalized guidance on teaching and scientific research.

Innovate recruitment and training models. AI constructs a national talent database and assigns "AI mentors" to young teachers to accelerate their growth.

3.4. Consolidate the guarantee foundation and build an AI-empowered support and guarantee system

The in-depth integration of AI and higher education requires the support of improved guarantee mechanisms. The specific paths are as follows:

3.4.1. Update educational concepts and build consensus on integration

Carry out concept innovation actions. Through cutting-edge theoretical seminars, technical development interpretations, and future education scenario deductions, guide teachers and students to deeply understand the subversive impact of AI technology on higher education, and establish a correct cognition of "technology empowerment rather than replacement" [15].

Build an innovative cultural ecosystem. Set up special innovation funds to encourage teachers and students

to carry out AI education innovation practices and research; hold interdisciplinary academic salons, technological innovation forums and other activities to create a campus cultural atmosphere of courage to explore and innovate.

Incorporate into top-level design. Establish a leading group for the integrated development of "AI + education" led by school leaders and involving cross-departmental participation, clarify development goals, key tasks, and implementation paths; strengthen inter-school and school-enterprise cooperation, introduce advanced theoretical achievements and technical resources, and promote integrated innovation and development.

3.4.2. Improve system construction and strengthen policy support

Formulate application management methods. Clarify application norms, responsibility division, and assessment standards in teaching, scientific research, management and other fields.

Establish an incentive mechanism. Set up special funds and reward projects to encourage teachers to carry out AI teaching and scientific research innovation.

Establish a cross-departmental collaborative mechanism. Break barriers and form an efficient collaborative work system with clear division of labor.

3.4.3. Strengthen data governance and ensure data security

Establish a standardization system. Formulate full-process data specifications and use AI to improve data quality.

Strengthen technical protection. Construct an "AI + data security" system, adopt encryption, anonymization and other technologies to ensure security, and strictly protect student information.

Establish a long-term mechanism. Set up a special institution, conduct regular training and drill, and establish an audit and accountability mechanism.

3.4.4. Standardize ethical guidelines and prevent technical risks

Formulate ethical guidelines. Clarify ethical bottom lines, regulate the application of generative AI, and prevent academic misconduct.

Establish an intelligent review mechanism. Set up an interdisciplinary committee and use AI tools to conduct full-process ethical evaluation and risk early warning.

Strengthen ethical education. Incorporate AI ethics into courses and training, and encourage teachers and students to participate in the formulation of norms.

4. Conclusion

In summary, driven by AI technology, we should actively integrate and apply new technologies, integrate AI technology into the entire process of higher education teaching practice, strictly control the transparency and security of AI applications, give full play to the positive role of new technologies, further realize students' personalized learning, improve teachers' teaching and research levels and school governance efficiency, and promote the high-quality development of higher education.

In the future, higher education is expected to achieve comprehensive and in-depth systematic transformation. First, the talent training model will shift from "standardized supply" to "personalized adaptation". AI technology will break the form of standardized resource supply, objectively evaluate and feedback learning progress through data analysis systems, personalized recommendation functions, and intelligent evaluation tools, provide tailor-made learning plans and resources for each student, and promote the transformation of the talent training model

from focusing on achieving educational goals to meeting students' personalized learning needs. Second, the scientific research paradigm will shift from "experience-theory driven" to "data-intelligence driven". By building an intelligent scientific research system of "data collection–analysis–modeling–prediction", AI technology will carry out virtual experiment design and research in conjunction with VR technology, promote the upgrading of scientific research from "hypothesis verification" to "data discovery", and improve the efficiency of scientific research innovation and the quality of achievement transformation. Third, the governance form will shift from "passive response" to "active intervention". By connecting data systems of multiple departments such as academic affairs, student affairs, and finance, AI technology will establish a dynamic perception-monitoring-early warning system for teachers and students, which can predict risks in advance, realize optimal resource allocation, accurately prevent and control risks, promote the transformation from human passive response to AI precise intervention, and realize the modernization of governance capacity.

Disclosure statement

The author declares no conflict of interest.

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