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Exploration and Reflection on the Reform of Teaching Administration Mode in Colleges for Talent Cultivation Empowered by AI

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Abstract: This study explores artificial intelligence (AI)-driven reform in teaching administration and talent cultivation at the University of Shanghai for Science and Technology. AI enhances management efficiency through automated workflows, supports personalized learning via adaptive systems, and enriches teaching with virtual simulation and interdisciplinary training. While AI addresses scalability and innovation challenges, issues like data privacy and teacher training require further attention. Collaborative efforts are essential to achieve sustainable, high-quality educational development.

Keywords: Artificial intelligence; Teaching reform; Talent cultivation; Higher education; Personalized learning

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1. Introduction

Over the past few years, artificial intelligence (AI) technology has undergone exponential advancement. Major breakthroughs in core technologies like deep learning and machine learning have driven AI to transition from laboratory-based research to real-world practical use. It has infiltrated various industries at an unprecedented pace, triggering a profound technological revolution.

1.1. AI Applications in education

Within the domain of education, the utilization of artificial intelligence is already beginning to take shape. AI can now provide teachers with data-driven decision support, develop adaptive assessment tools, build intelligent tutoring systems, and enable personalized learning systems [1]. In some scenarios, teachers simply scan and upload student assignments, and the system can quickly and accurately complete the grading. This not only significantly saves teachers' time spent on checking the homework but also provides detailed reports on students' mastery of knowledge through data analysis, facilitating targeted teaching.

1.2. Limitations of traditional models and institutional initiatives

With the comprehensive advent of the AI era, the conventional education model and the large-scale

standardized approach to talent development in higher education institutions are gradually exposing their inherent shortcomings under this new era, making it difficult to continuously adapt to societal development. Against the context of ongoing educational reform initiatives, the School of Energy and Power Engineering at the University of Shanghai for Science and Technology (USST) is proactively exploring ways to strengthen the capacity of teaching management and talent cultivation practices through AI technology to address the limitations of traditional education models. The incorporation of AI technology can not only improve the efficiency of teaching management processes but also supply educators with a wealth of teaching materials and intelligent support tools, helping them optimize teaching methods and improve teaching quality [2].

2. The significance of AI technology empowering colleges

The School of Energy and Power Engineering at the University of Shanghai for Science and Technology occupies a pivotal role in China's key domains, including energy, power, environment, and process control, functioning as a core hub for talent development and scientific inquiry. Currently, the school has 1,136 undergraduate students and 1,120 postgraduate students. There are also 151 full-time teachers who, with their profound professional knowledge and rich teaching experience, safeguard the growth and success of students. Currently, research on AI-empowered talent cultivation holds immeasurable significance, and its value is reflected in multiple key aspects.

2.1. Enhancing management: Automating academic processes

In teaching management, AI technology can achieve automated process processing, quickly analyze students' academic data and teachers' teaching data, greatly improving the efficiency of academic staff [3], and assisting colleges in optimizing academic warnings, workload assessments, and other aspects.

2.2. Empowering educators: Providing intelligent teaching tools

For teachers, AI can provide rich teaching resources and intelligent assistive tools, helping them optimize teaching methods and enhance their teaching proficiency [1]. Educators can leverage the AI-constructed teaching resource repository to refine their instructional PPTs and boost classroom engagement. AI can also recommend personalized teaching content and methods to teachers based on students' learning situations, helping teachers better meet the diverse learning needs of students [4].

2.3. Personalizing learning: Customizing student pathways

For students, the "AI+" model makes use of technologies like big data analytics and machine learning, delivering customized learning routes and materials to every student and realizing truly personalized teaching. Artificial intelligence is capable of analyzing a student's learning advancement, interests, and existing knowledge, adjusting learning plans automatically, and creating tailored teaching methods and progress speeds for different students. Additionally, it can keep track of students' emotional states and provide personalized emotional and psychological assistance [5].

2.4. Transforming paradigms: Fostering innovation and literacy

Regarding the teaching paradigm, AI facilitates the shift of the conventional teaching framework toward intelligent and individualized directions, making teaching content and methods more aligned with the needs of contemporary development [6]. From a macro perspective, AI helps cultivate more talent with innovative

capabilities and technological literacy. Via the implementation of AI technology, students can gain exposure to the latest technological advancements, cultivating a sense of technological innovation.

3. Key challenges currently faced by the college

The School of Energy and Power Engineering at the University of Shanghai for Science and Technology boasts a profound historical legacy, with its roots dating back to the Department of Power Engineering founded in 1960. During its evolutionary journey, the school has attained notable achievements, successfully cultivating China's first Ph.D. graduate in Refrigeration and Cryogenic Engineering. After decades of continuous progress, the school has grown into one of the key institutions in China for talent cultivation and scientific research in disciplines such as energy, power, and cryogenic medicine.

Nevertheless, the school is currently confronted with a set of challenges. In recent years, the continuous expansion of university enrollment has caused an annual rise in student populations, leading to a progressively heavier load on teaching management work. Simultaneously, with the rapid development of the times, the traditional talent cultivation model that solely focuses on knowledge imparting can no longer adapt to new demands. Quality-oriented education and education on the hard-working spirit urgently need to be integrated into a new talent cultivation model.

Currently, engineering teachers commonly face issues such as insufficient interdisciplinary knowledge reserves and a lack of ability to apply knowledge in areas like artificial intelligence. Their interdisciplinary teaching capacity needs enhancement. Furthermore, the energy and power engineering industry's demand for talent quality is increasingly high [7]. Cultivating interdisciplinary talents who deeply integrate intelligent technology with manufacturing faces significant difficulties. Therefore, it is urgent to transform the existing talent training and teaching management mode and system [8].

4. Strategies for AI-empowered teaching management in colleges

4.1. Leveraging AI to boost teaching management efficiency and alleviate staff workload

In the conventional teaching management of the School of Energy and Power Engineering, there is a considerable volume of repetitive and operational work, such as curriculum scheduling, attendance monitoring, grade compilation, and resource distribution. These tasks not only occupy a large amount of human resources but also tend to have mistakes and oversights. By using AI to summarize fixed Standard Operating Procedure (SOP) workflows, management efficiency can be enhanced [9]. For example, when scheduling laboratory courses each semester, the diverse specialized experiments involved in energy and power engineering traditionally require lab personnel to manually coordinate laboratory venue usage times and class schedules in Excel spreadsheets, which is inefficient and prone to conflicts. With the aid of AI, a reasonable laboratory course schedule can be quickly generated after inputting venue information, course requirements, and class times, remarkably enhancing scheduling effectiveness and minimizing resource conflicts [2].

4.2. Enhancing teachers' instructional capabilities and supporting major development with AI

Knowledge in the field of energy and power engineering updates rapidly. The traditional training model struggles to meet teachers' learning needs for new knowledge and technologies, somewhat constraining their growth of expertise. Furthermore, teachers trained under the traditional engineering system often lack

sufficient interdisciplinary knowledge reserves and the ability to apply AI knowledge, leading to inadequate interdisciplinary teaching capacity. Conducting a series of AI-related teaching salon trainings can effectively enhance teachers' interdisciplinary teaching abilities and promote their professional development. For instance, teaching salon activities on "AI and Energy System Optimization" can be organized, where teachers can learn how to use AI algorithms to simulate and optimize energy power systems, thereby enhancing their interdisciplinary literacy. Research conducted by Xue and Wang from Nanjing Normal University indicates that most teachers (84.4%) believe AI is helpful for professional development, significantly reduces their workload, and improves their information literacy [10].

4.3. Using AI to design teaching plans and facilitate students' personalized growth

The use of AI in the field of education is growing more and more common, and it shows great potential—particularly when it comes to personalized learning [11]. AI makes use of technologies like big data analytics and machine learning to provide each student with customized learning routes and materials, allowing for truly tailored educational experiences. It can analyze a student's learning progress, interests, and existing knowledge, adjust learning plans on its own, and create personalized teaching methods and progress speeds for different students. Additionally, AI can keep an eye on students' emotional states and offer personalized emotional and psychological help [5].

AI's application in education isn't restricted to personalized learning alone. It also covers areas like intelligent tutoring, adaptive learning systems, and suggestions for learning paths. Take AI-powered personalized learning systems as an example: they can adjust teaching content according to a student's learning style, interests, and abilities, providing a customized learning experience. Besides that, by means of data analysis and learning analytics, AI technology can assist teachers in optimizing their teaching strategies, which in turn improves both the quality and efficiency of teaching [12].

4.4. Relying on AI to optimize curriculum development and teaching models, improving teaching quality

Most traditional courses in the School of Energy and Power Engineering primarily focus on teachers lecturing theoretical knowledge, offering students limited practical opportunities, and making personalized learning based on individual progress difficult. Simultaneously, due to limited resources, the experimental and internship components cannot fully meet the needs of cultivating students' practical abilities. Leveraging AI to optimize the teaching process and adopting a hybrid online-offline teaching mode can effectively improve teaching quality.

4.4.1. Empowering experimental teaching with AI

Taking the "Engineering Fluid Mechanics" course as an example, in traditional teaching, after learning theoretical knowledge in class, students could only conduct simple fluid experiments during limited lab hours. With the aid of AI and virtual simulation experimental teaching platforms, students can familiarize themselves with experimental procedures and principles through online simulated experiments before class, perform actual operations during class, and use AI tools to analyze experimental data after class.

This method enables students to grasp knowledge more thoroughly and strengthens their learning enthusiasm and participation. Furthermore, the application of virtual simulation technology significantly improves students' comprehension of complex engineering problems. For instance, through virtual experiment

platforms, students can participate in the entire process of system adjustment and operation in a safe environment, thereby compensating for the limitations of space and equipment in traditional experimental teaching [13].

4.4.2. Driving ideological and political education in courses via AI empowerment

Ideological and political education is now indispensable, particularly when integrated with professional courses in university teaching. Using AI to build an ideological and political education case database for courses, integrating ideological and political content. Course-based ideological and political education enhanced by AI represents an innovative curriculum design idea, which calls for the thorough combination of intelligent technologies and in-course ideological and political initiatives. Through AI technology, teachers can construct immersive virtual scenarios to enhance students' understanding of historical events and social phenomena [14]. AI technology can accurately match professional course content with ideological and political elements through techniques like data mining and intelligent recommendation. This approach enables tailored ideological and political instruction. Take Dalian University of Technology as an instance: it has developed a platform for ideological and political education case databases with AI, rendering such education more targeted and customized [15].

4.4.3. Empowering internships and practical training with AI

In terms of internships and practical training, the application of AI technology is equally significant. The use of AI and virtual simulation technology in internships and practical training has undergone extensive research and real-world application. For instance, virtual simulation lessens dependence on physical locations, which allows it to tackle the difficulties of high-risk training situations and, in turn, boost both educational results and safety levels. In thermal power plant-related courses, adopting AI tools—including simulation software and online materials—has deepened students' comprehension of complex systems and reinforced their practical capabilities. Through virtual simulation, students can carry out simulated practice activities in a virtual setting, which aids in developing their hands-on skills and engineering proficiency [16]. Using AI technology to allow students to intern in virtual environments, instead of physically entering some high-risk internship workshops, can greatly enhance internship safety, reduce potential hazards, and also address challenges in teaching practical training such as things being invisible, intangible, or operations being irreversible [17].

4.4.4. Utilizing AI to address future educational challenges and cultivate innovative talents

With the growing need for innovative professionals in the energy industry, conventional teaching methods are no longer capable of satisfying future development requirements. AI can assist in fostering students' innovative mindset, critical thinking skills, and problem-solving capacities, thus tackling upcoming educational obstacles and cultivating more innovative talents that fit the era's demands.

5. Conclusion

The application of AI in the field of education has not only enhanced the efficiency and quality of teaching management but also brought revolutionary changes to teachers' professional development and students' learning experiences. Empowered by AI technology, educational management has become more intelligent, personalized, and efficient, while also providing a solid foundation for the sustainable development of future education. However, the application of AI in education also faces challenges, such as ethical issues, data

privacy, and the need to enhance teachers' digital literacy. Hence, education administrators and teaching staff ought to collaborate to advance the in-depth integration of AI and education, guaranteeing that the use of AI technologies in educational settings is both scientifically sound and rationally implemented, truly achieving high-quality educational development.

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