Research on the Path of Talent Cultivation Model for New Engineering Disciplines in the Era of Artificial Intelligence

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Abstract: The application of artificial intelligence (AI) in new engineering education can optimize course content and educational methods. AI provides personalized learning paths, adjusts teaching strategies, and improves teaching management through real-time feedback. Despite its potential, challenges remain in balancing technology use with educational philosophies, ensuring fairness, and preventing over-reliance on technology. The integration of AI should focus on fostering critical thinking and problem-solving skills in students. By improving technical literacy and resource allocation, AI can enhance educational efficiency. However, to effectively implement AI, it requires deep integration with educational content, increased policy support, and continued collaboration between industries and academia.

Keywords: Artificial intelligence; New engineering education; Talent cultivation; Educational reform; Policy support

1. Introduction

In today's era, artificial intelligence (AI), as a key technology driving the Fourth Industrial Revolution, is profoundly changing the way various industries operate, and the education sector is no exception. Particularly in the process of building the new engineering disciplines, the introduction of AI has provided a fresh perspective and methods for reforming talent cultivation models. The new engineering education aims to nurture interdisciplinary, composite talents, and AI is a powerful tool for achieving this goal. Through AI technology, education can become more personalized, efficient, and intelligent, thereby better meeting society's demand for innovative and practical talents [1].

However, despite the immense potential of AI applications, traditional education systems and talent cultivation models still face numerous challenges. Especially in the field of new engineering disciplines, how to effectively integrate AI technology with traditional educational models and how to improve educational quality while avoiding excessive reliance on technology are critical issues to be addressed. Therefore, this paper aims

to explore the pathways for talent cultivation in the new engineering disciplines in the age of AI, analyze the transformations brought about by AI on educational models, and examine the impact and role of related policies in promoting new engineering education [2].

In this context, the application of AI technology not only drives innovation in course content but also enhances educational quality and efficiency through intelligent teaching management and personalized learning path designs. However, balancing the application of technology with the deep integration of educational philosophy and ensuring the fairness and comprehensiveness of education remains a challenge faced by current educational reforms.

2. Impact of AI on talent cultivation in new engineering disciplines

2.1. Transformation of educational methods driven by AI

The rapid development of AI technology has not only transformed industrial production and economic management but has also driven profound changes in the form of education. With the in-depth application of AI technology, traditional "digital" education is gradually transitioning into "intelligent" education. This shift promotes the optimization of educational resources, the personalization of learning methods, and the precision of learning assessments, thereby comprehensively enhancing the quality of education [3].

In traditional educational models, teaching content and learning progress are often fixed, neglecting students' individual differences and needs. AI, on the other hand, can leverage technologies such as big data analysis and machine learning to provide personalized teaching content and learning paths based on students' learning characteristics and progress. AI systems can analyze students' learning behaviors in real time, predict learning difficulties, and offer targeted tutoring. This not only enhances teaching efficiency but also increases students' initiative in learning, promoting the personalization and customization of education [4].

Moreover, the application of AI in classroom teaching has also driven changes in teaching methods. Through technologies like virtual reality (VR) and augmented reality (AR), teachers can offer students a more intuitive and interactive learning experience. Particularly in new engineering education, AI can assist students in performing complex experimental operations and engineering simulations, enhancing students' practical and innovative abilities.

2.2. Challenges in the talent cultivation model for new engineering disciplines

However, the impact of AI on the talent cultivation model for new engineering disciplines is not entirely positive. Despite the immense potential that AI technology offers in education, the existing education system and cultivation models still face significant challenges. First, there is an urgent need to improve teachers' technical literacy and teaching methods. Although AI can assist in teaching, teachers must possess certain technical abilities and data analysis skills to effectively use AI tools to enhance the teaching process [5]. This requires educators to continuously update their knowledge systems, learn new teaching tools and methods, and adapt to the changes brought about by AI.

Second, there is an imbalance in the distribution of educational resources and the popularization of technology. While universities in large cities are gradually taking the lead in applying AI technology, schools in remote areas still face significant challenges in terms of hardware facilities, software resources, and teaching staff. The application of AI requires substantial computing resources and technical support, making the uneven distribution of educational resources one of the bottlenecks restricting the reform of new engineering education.

Furthermore, the introduction of AI may also lead to the issue of "technology dependence" in education.

Some students may become overly reliant on AI tools to complete learning tasks, neglecting the cultivation of independent thinking and creative problem-solving skills. This is a potential risk, especially for new engineering education, which emphasizes innovation and practice in engineering disciplines. Therefore, while promoting the application of AI, finding a balance between technological dependence and independent learning, as well as using AI to foster students' critical thinking and problem-solving abilities, remains a critical issue to be addressed.

3. Pathways for empowering new engineering education reform with AI

3.1. Deep integration of AI with educational content

In the educational system of new engineering disciplines, the introduction of AI can not only optimize course content but also drive the transformation of educational methods. New engineering programs typically involve the integration of multiple disciplines, and AI is a key tool for breaking down disciplinary barriers and promoting interdisciplinary knowledge integration. Through AI, teaching content can be dynamically adjusted according to industry demands, ensuring that course materials and specialized knowledge keep pace with the times. For example, AI can analyze industry development trends and update teaching content in real time, ensuring that students are learning the latest industry technologies and knowledge, thereby cultivating their ability to adapt to rapid changes.

Specifically, AI technology can assist teachers in providing customized learning paths for students by analyzing their interests, learning progress, and challenges through machine learning models. Teaching strategies can be adjusted accordingly to ensure that each student learns efficiently on the most suitable learning path. This personalized teaching approach not only improves students' learning efficiency but also maximizes each student's potential, fostering their innovation abilities and critical thinking.

At the same time, AI can introduce more efficient experimental and practical teaching into new engineering courses. Through virtual simulation technologies, students can perform complex engineering experiments without the constraints of actual hardware conditions. This simulated environment provides more opportunities for experimentation, cultivating students' hands-on abilities and problem-solving skills.

3.2. Enhancing teaching efficiency and personalized learning

AI can effectively enhance teaching efficiency through automation technology, especially in areas such as teaching management and assessment feedback. Traditional teaching assessments often rely on manual processes, resulting in long feedback cycles and being susceptible to subjective factors. AI technology, on the other hand, can collect and analyze students' learning data in real time, providing timely feedback through intelligent analysis. For example, AI systems can automatically grade assignments after students complete them and offer targeted suggestions for improvement, helping students quickly understand their learning status.

More importantly, AI can provide personalized learning recommendations based on students' individual learning characteristics. This means that AI can dynamically adjust learning content and difficulty during the teaching process based on each student's progress and needs, ensuring that students stay motivated and engaged with appropriate challenges. This personalized learning approach not only enhances students' autonomous learning capabilities but also helps them overcome learning bottlenecks inherent in traditional educational models.

Moreover, AI can innovate teaching methods within courses. For example, intelligent education platforms can recommend suitable learning resources, such as reading materials, supplementary videos, case studies, etc.,

based on students' historical learning data, further improving students' learning efficiency.

3.3. Deepening industry-academia-research collaboration

A key goal of new engineering education is to cultivate interdisciplinary talents who can adapt to industry needs. The introduction of AI provides more possibilities for collaboration between schools and enterprises. By establishing industry-academia collaboration platforms, schools can integrate the latest industry demands and technological development trends with course content, ensuring that students are exposed to real-world industry problems and solutions during their learning process.

The rapid development of AI technology has expanded educational models beyond traditional classroom teaching. Schools can collaborate with businesses to design project-based teaching and internships, allowing students to participate in real engineering projects and develop their professional skills while solving problems. The application of AI in enterprises provides students with more authentic and diverse practical opportunities, which is crucial for cultivating students' innovative spirit and practical abilities.

Through in-depth industry-academia-research collaboration, schools can not only improve the quality of teaching but also help students integrate better into society and the industry, enhancing their employability. Additionally, AI technology, through enterprise involvement, can promote the sharing of teaching resources, enabling students to receive a more comprehensive education in a diverse learning environment.

4. Policy support and development trends in empowering education with AI

4.1. Educational intelligence under policy support

In recent years, with the rapid development of AI technology, the Chinese government has introduced a series of policies to promote the application and popularization of AI in the education sector. In particular, the Ministry of Education's policies in "new engineering" construction and AI innovation applications have provided essential policy support for higher education reform. For example, the Ministry of Education's "AI Innovation Action Plan for Higher Education" clearly proposes the promotion of the deep integration of AI technology with education, optimizing talent cultivation programs, and enhancing the intelligence level of higher education.

Under this policy support, more and more universities are integrating AI technology, building intelligent teaching, management, and service systems. The application of AI not only changes traditional teaching methods but also improves the configuration and management of educational resources, promoting the construction of smart campuses. Through the combination of big data and AI, schools can achieve precise teaching assessments and resource allocation, thereby improving educational quality and management efficiency.

At the same time, the policy push has also encouraged the deep integration of industry-academia-research collaboration. The government encourages universities to collaborate with enterprises on AI-related research projects, cultivating interdisciplinary talents that meet market demands. This collaboration model closely aligns the educational system with industry needs, enhancing students' employability and promoting the practical application of AI technologies in education.

4.2. Future development trends and challenges

As AI technology continues to evolve, the talent cultivation model in new engineering disciplines will become more intelligent and personalized. The application of AI will extend beyond teaching to encompass education management, assessment feedback, and educational services. This development trend means that higher education will usher in more intelligent and flexible teaching management models, providing students with a

more diverse learning experience.

However, despite the enormous development potential that AI brings to education, there are still many challenges. First, the scope and depth of technological application vary across regions, particularly in remote areas where a lack of educational resources and technological infrastructure has caused delays in the intelligent transformation of education. Moreover, both teachers' and students' technical literacy needs to be improved. How to effectively train teachers to use AI tools and enhance students' self-directed learning abilities remain key challenges to address.

In the future, AI will play an increasingly important role in education, especially in the cultivation of interdisciplinary, composite talents. AI will foster the integration and application of knowledge across different disciplines, promoting the overall enhancement of students' innovation capabilities. However, balancing the guidance of technology with educational philosophies and ensuring that technological applications do not lead to over-dependence, while preserving the humanistic spirit of education and fostering innovative thinking, will be the focal points of future higher education reform.

4.3. Further improvement and innovation of policies

To better implement policies that empower education with AI, the government needs to improve the related policy framework. On one hand, investment in technical training for educational institutions and teachers should be increased to ensure that educators are proficient in AI tools and can flexibly use these technologies to enhance teaching quality. On the other hand, there should be strengthened monitoring and evaluation of policies to ensure that AI applications in education result in substantial improvements and that imbalances and inequalities in technology application are avoided.

In terms of policy innovation, future efforts should focus on intelligent resource sharing in education, particularly in remote and resource-scarce areas. How to provide equal educational opportunities through internet and cloud computing technologies should be a key area of focus. Additionally, policies should emphasize supporting the cultivation of interdisciplinary, composite talents, especially in fields like AI, big data, and cloud computing, to drive the innovative development of new engineering education.

5. Conclusion

With the continuous development of AI technology, the education sector is undergoing a profound transformation. Especially in the context of new engineering education, AI has not only provided strong support for the updating of educational content and the innovation of teaching methods but has also played an increasingly important role in educational management and services. AI technology, through providing personalized learning paths, optimizing teaching resource allocation, and improving teaching efficiency, has brought unprecedented opportunities to the talent cultivation model in new engineering disciplines.

However, the widespread application of AI also presents many challenges. Firstly, the imbalance in the distribution of educational resources, teachers' insufficient technical literacy, and students' dependency on technology may all become obstacles to the advancement of AI-powered education. Furthermore, while policy support is gradually increasing, there is still a need to further improve the technical training mechanisms, promote the popularization of intelligent educational tools, and strengthen interdisciplinary collaboration.

To address these challenges, the future reform of new engineering education must focus on the integration of technology with educational philosophy. It is essential to leverage AI to enhance educational efficiency while

ensuring that it always serves the comprehensive development of students. Educational policies should be further improved, particularly focusing on the equitable distribution of resources, the enhancement of teachers' and students' technological literacy, and the balance between technology application and humanistic care.

In conclusion, the talent cultivation model for new engineering disciplines empowered by AI has tremendous potential and development prospects. With continuous technological advancements and policy improvements, AI will play an increasingly important role in future education, providing strong support for the cultivation of innovative and practical interdisciplinary engineering talents. However, how to ensure fairness and humanistic care in education while promoting technological innovation will be a key issue in future educational reforms.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Qian L, Cao W, Chen L, 2025, Influence of AI on Higher Education Reform and Talent Cultivation in the Digital Intelligence Era. Scientific Reports, 15(1): 6047.

[2] Liu Z, Li J, Wang W, 2022, Exploration on the Construction Reform of Geology Specialty with Deep Integration of Artificial Intelligence under the New Engineering Background. Curriculum and Teaching Methodology, 5(3).

[3] Qiu YW, Wang AX, Li J, et al., 2025, Research on the Empowerment of Artificial Intelligence in the Intelligent Development of Higher Education. Journal of Harbin College, 46(02): 124–126.

[4] Huang CC, Lu CF, Tian YY, 2025, Policy Evolution and Prospects of AI Empowerment in Higher Education: A Three-Dimensional Analytical Framework Based on "Theme-Tool-Evaluation." Higher Education Exploration, (01): 48–59.

[5] Chen H, Yu Y, Li XL, 2024, Research on the Integration of Generative AI into College Education and Teaching. Journal of Huainan Vocational and Technical College, 24(06): 79–81.