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Analysis of Engineering Education Reform in the Context of Artificial Intelligence and New Engineering Disciplines

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Abstract: In recent years, societal development has entered a more critical stage, with continuous improvements in artificial intelligence technology. The integration of engineering disciplines with various fields has led to a trend of collaborative development. Consequently, the current education background of new engineering disciplines faces the challenge of interdisciplinary integration. This paper explores the development path of engineering education reform based on the dual contexts of artificial intelligence and core engineering disciplines, aiming to cultivate a cohort of high-quality engineering talents with creative thinking.

Keywords: Artificial intelligence; New engineering disciplines; Engineering education reform

Introduction

For a long time, the teaching mechanism has been more focused on theoretical instruction, with less attention to practical application and the cultivation of students' hands-on abilities. This teaching model has not been instrumental in the growth of engineering professionals. After entering the workforce, students often require a significant period to adapt to their job roles. Nowadays, under the dual contexts of artificial intelligence and new engineering disciplines, higher requirements are imposed on engineering education reform. There is a need to establish a more modernized engineering education system to achieve talent cultivation goals.

1. Analysis of the Necessity for Engineering Education Reform in the Dual Contexts of Artificial Intelligence and New Engineering Disciplines

Under the strategic influence of the transformation and development of higher education institutions, new engineering disciplines have introduced updated requirements and new directions for the construction of engineering programs. The introduction of new engineering concepts presents both significant challenges and key opportunities for engineering education development. Higher education institutions must proactively adjust their professional structures and compositions, reasonably plan engineering program content to align with emerging industries, and promote the transformation and upgrading of engineering disciplines. This involves optimizing engineering talent training programs and models, adopting innovative methods and educational resources in engineering teaching, and constructing pioneering and innovative teaching models. In the dual contexts of artificial intelligence and core engineering disciplines, implementing reforms in engineering education is the future development trend, offering promising and extensive prospects.

2. Measures for Engineering Education Reform in the Context of Artificial Intelligence and New Engineering Disciplines

2.1 Establishing an Integrated Theoretical and Practical Teaching Model

In the past, some engineering educators have placed greater emphasis on theoretical knowledge, often neglecting practical teaching. Student assessments have typically relied on closed-book theoretical exams, which fail to highlight the active role of students. This approach limits teachers' understanding of their students, making it difficult to provide targeted guidance and offering limited development opportunities for students. To improve the quality of engineering education, equip students with essential skills, and foster their innovative capabilities, educators need to adopt an integrated theoretical and practical teaching model. This includes increasing the proportion of practical courses, creating rich practical learning opportunities, and enhancing students' practical and innovative abilities within a high-quality, reliable teaching environment.

Teachers should consciously promote the integration of theoretical and experimental teaching, guiding students through experimental processes, collecting feedback, and providing timely guidance and necessary assistance based on student performance. This teaching model

helps students better understand the goals and requirements of engineering education, laying a foundation for them to flexibly apply their knowledge to solve real-world problems. The experimental content should cover foundational experiments, comprehensive experiments, and innovative experiments in a progressively advanced teaching structure. This approach aligns with the goals of engineering education under the dual contexts, facilitating smoother talent cultivation and helping students comprehend specific steps, principles, and essential concepts.

2.2 Curriculum System of Innovation Platforms and Modular Integration

Advancing engineering education reform requires the establishment of a modern curriculum system that integrates platforms and modules. Leveraging artificial intelligence technology to understand students' needs and preferences, educators can gather critical information about students to build more effective teaching platforms. These platforms should offer rich and high-quality educational resources, guiding students through various experimental environments to gain relevant experiences and insights. AI-based advanced curriculum platforms enhance students' overall competencies. Teachers can use these platforms to assign educational tasks, ensuring that students complete these processes in line with the objectives of engineering talent cultivation.

Teachers can design both general and specialized required courses. Upon completing foundational courses, students can choose personalized courses for further studies based on their interests, maximizing their proactive learning. Additionally, schools can offer customized course modules aligned with current engineering job requirements, providing elective content that enriches students' learning resources. This teaching approach better meets students' individual needs and career plans, making the knowledge and skills they acquire vital assets for their future development, thus creating a unique talent development path for each student. Innovatively integrating platforms and modules in the curriculum system breaks down the boundaries between engineering disciplines, allowing students to continuously enhance and improve themselves during the learning process. Teachers need to carefully plan and design course modules, monitor students' learning progress, and ensure that diverse development needs are met, cultivating highly qualified, application-oriented talents in higher education.

2.3 Enhancing Coordinated Design and Development of Teaching Content

Integrating AI technology with engineering education can enhance teaching outcomes, necessitating that teachers strengthen their efforts in curriculum content research and design to provide students with better and more comprehensive learning experiences. A thorough assessment of engineering students' acceptance levels is essential to understand the challenges and deficiencies they face during their studies. Recognizing the main characteristics of the student body enables the development of more detailed and thorough talent cultivation plans.

Subsequently, the design and development of curriculum content can proceed, a process that often requires considerable time and the inclusion of diverse factors and elements. The Ministry of Education should align textbook content with the requirements for application-oriented engineering professionals, structuring fundamental and advanced theoretical knowledge in a progressively deeper sequence. This approach helps students build a solid foundation while expanding and extending their thinking abilities. Coordinated design and development of teaching content must integrate both theory and practice. The theoretical knowledge sections can be supplemented with explanatory images and charts to deepen students' understanding. In practical design segments, schools and teachers should collaboratively plan, arranging content progressively based on its difficulty.

Colleges must increase investment to create conducive teaching environments, improve teaching conditions, and promote the implementation of teaching activities. Teachers can also use robotic projects to explain related knowledge, enabling students to independently explore reliable problem-solving methods. Additionally, fostering close cooperation and exchanges between different schools can further optimize the quality of educational videos, enriching the vital channels through which students access resources and information.

3. Conclusion

In the dual contexts of artificial intelligence and new engineering disciplines, strengthening the cultivation of application-oriented engineering talents is of utmost necessity. However, the construction and improvement of engineering education systems themselves are highly complex tasks. It requires teachers to conduct extensive research and exploration, adhering to the principle of student-centeredness to develop more comprehensive engineering teaching models and cultivate high-quality talents.

References

[1] Deng Muqing, Wang Yanjiao, Huang Yonghui. Teaching Reform and Practice of Artificial Intelligence Course in IoT Engineering under the Background of New Engineering [J] Forum on Education Informatization, 2023, (11): 57-59

[2] Luo Shengping, Guo Yu, He Kerong. Research on the Teaching Reform of Artificial Intelligence Curriculum Based on CDIO+Course Ideology and Politics in the Context of New Engineering [J] China Education Technology Equipment, 2023, (20): 111-113

[3] Fan Jinhui, An Guoqing, Hao Chongqing, Liu Huixian, Song Xueling, Wu Xiaojing. Exploration of the Construction and Teaching Reform of Artificial Intelligence Majors in Local Universities under the Background of New Engineering [J] Technology Wind, 2023, (23): 142-144

[4] Zhang Xiaotwin, He Miao, Wang Xifeng, Li Yafeng, Zhang Wenbo. Exploring the Teaching Reform of Practical Courses in Artificial Intelligence under the Background of New Engineering [J] Computer Knowledge and Technology, 2023, 19 (23): 36-38

[5] Cui Qimei, Liu Yiming, Qin Xiaoqi, Hu Zheng. The reform and practice of ideological and political education in artificial intelligence courses in wireless communication under the background of new engineering disciplines [J] Higher Education Journal, 2023, 9 (21): 37-40

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