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Research on Training Strategies of Innovative Talents for Mechanical Engineering Majors in Colleges and Universities

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Abstract: With the rapid development of science and technology and the deep adjustment of industrial structure, the society's demand for innovative talents in the field of mechanical engineering is increasingly urgent. This study focuses on mechanical engineering majors in colleges and universities, and discusses the effective strategies for cultivating innovative talents. Firstly, the research analyzes the current development trend and the characteristics of talent demand in the field of mechanical engineering, and points out the shortcomings of the traditional training mode in the aspects of innovation ability, practical ability and interdisciplinary integration [1].

Keywords: Mechanical engineering; University talents; Training strategy; Digital transformation

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1. Introduction

The major of mechanical design and manufacturing in colleges covers several key areas, such as mechanical design and manufacturing, digital design and manufacturing technology, as well as mechanical manufacturing and automation. These fall under the broader category of equipment manufacturing disciplines. Every year, these programs cultivate and deliver a significant number of skilled talents to the nation, forming a core pillar for the manufacturing industry. In the midst of digital transformation and industrial upgrading, this field not only encounters crucial missions and opportunities but also confronts serious challenges [2]. Therefore, it is of great theoretical and practical significance to deeply study the impact of digital transformation on mechanical design and manufacturing majors in colleges and universities, give targeted solutions, and promote the closer combination of professional education and industry needs for improving the quality of education and training innovative talents to adapt to the requirements of the digital age.

2. The importance of training innovative talents

The manufacturing sector serves as the backbone of the national economy. To align with and guide the new wave of technological and industrial revolutions, it is crucial to facilitate the transformation and upgrading of traditional manufacturing, enabling a shift from lower-end to mid-to-high-end production [3]. The core of driving industrial upgrading resides in fostering innovative talent, whose creative and practical capabilities act as the catalyst for industrial evolution. By continuously exploring and practicing innovation, these talents can propel advancements in industrial technology, enhance product value, and strengthen market competitiveness. Optimizing industrial structures represents a key component of industrial transformation, and innovative talents can leverage their expertise and skills to significantly support structural adjustments within industries.

At the school level, fostering innovative talent plays a vital role in promoting the deeper development of the profession. It also helps to define and reinforce distinctive educational traits, ultimately becoming a critical factor in attracting students, parents, and employers. Serving as the school's brand ambassadors, these innovative individuals can enhance the institution's reputation through their outstanding achievements. This not only advances professional development but also emphasizes the unique qualities of the school while elevating its overall prestige [4]. As far as students are concerned, the cultivation of innovative ability is also an important starting point to improve their comprehensive literacy. By learning new knowledge and skills, students can continuously improve and enhance their knowledge system, laying a solid foundation for their future career development.

3. The current situation and dilemma of innovative talent training

3.1. The curriculum system needs to be optimized

First, the structure of the curriculum requires improvement. In contemporary Chinese universities, the content of mechanical design and manufacturing courses remains centered on traditional disciplinary knowledge, with insufficient emphasis on practical components that are closely tied to real-world production processes. This type of course organization hinders students' ability to effectively integrate theoretical knowledge with practical skills during their studies, thereby negatively impacting the development of their innovative capabilities. Second, the course material is not up-to-date. Given the rapid advancements in science and technology, the technology within the field of mechanical design and manufacturing continues to evolve. However, university curricula often fail to keep pace with industry developments, making it challenging for students to engage with the latest technological advancements and concepts during their learning journey. This shortfall also affects the enhancement of students' innovative abilities [5].

3.2. Single teaching method

At present, the major of mechanical design and manufacturing in Chinese colleges and universities is still dominated by the traditional lecturing teaching method. This teaching method is teacher-centered, which leads students to be in a passive learning state and lacks the opportunity to think actively and cultivate critical thinking, which is not conducive to stimulating students' learning enthusiasm and exploration spirit. At the same time, this method also lacks personalized teaching and differentiated guidance, resulting in heterogeneous students losing interest in learning. In addition, teachers also neglect the integration of interdisciplinary knowledge, which leads to a serious fragmentation of knowledge. Students cannot apply what they have learned, feel that knowledge is useless, and will lose their motivation to learn.

3.3. Practice teaching links are weak

Practice serves as a crucial method for developing the innovative capabilities of college students. However, the practical teaching component in mechanical design and manufacturing programs at Chinese universities remains relatively underdeveloped. Key issues include a lack of practical teaching resources, such as equipment, facilities, and funding, as well as outdated teaching content that does not align with industry trends or real-world demands [6]. These challenges hinder students from gaining adequate practical experience and acquiring truly valuable knowledge and skills, which in turn negatively impacts the development of their innovative abilities.

3.4. The construction of teaching staff lags behind

Some educators lack hands-on experience in enterprise settings, making it challenging for them to keep up with the latest industry developments. This also hinders their ability to incorporate emerging technologies, standards, and methodologies into their regular teaching activities, leading to obsolete instructional materials. Additionally, in certain institutions, there is a relatively low percentage of faculty members holding advanced professional titles. Many instructors struggle to simplify and convey complex concepts effectively to students, which negatively impacts teaching quality and diminishes student learning outcomes. Consequently, this limits the development of innovative talent. To enhance educators' competencies, both educational authorities and academic institutions have collaboratively implemented multi-level teacher development programs [7]. However, in general, the content and methods of teacher training are still relatively simple, lacking pertinence and effectiveness, which makes it difficult for teachers to achieve significant improvement in the training process, and thus affects the teaching effect.

4. Innovative talent training strategies

4.1. Update the concept of personnel training and clarify the training objectives

First, there is a need to shift the educational paradigm from conventional technical education to an emphasis on holistic capability development. In the digital age, educating students in mechanical design and manufacturing should extend beyond merely imparting specialized skills. Greater focus should be placed on fostering students' capacity for innovation, their ability to collaborate in teams, their skills in communication and coordination, as well as their proficiency in project management and other integrated competencies. This approach ensures that graduates are equipped to engage in cross-disciplinary and cross-domain collaborations necessary for applying digital technologies and can keep pace with the swift evolution of society. Second, it is essential to transition from a singular skill-based training model to an interdisciplinary educational framework [8]. With the development of digital technology, the field of mechanical design and manufacturing is increasingly integrated with other disciplines. Therefore, higher education should break the traditional disciplinary boundaries and realize interdisciplinary education and teaching. For example, students majoring in mechanical design and manufacturing should take courses such as programming, data analysis, and artificial intelligence so that they can better apply digital technologies in their future work.

4.2. Optimize the curriculum system and integrate digital knowledge

During the curriculum development process, students should remain at the core, with their interests, needs, and developmental potential given full consideration while aligning with career goals and employment

requirements. Additionally, emphasis should be placed on fostering students' self-directed learning skills, teamwork capabilities, and innovative thinking, encouraging them to actively engage in the teaching process, think critically, and practice boldly. To nurture individuals with cross-disciplinary competencies, higher education institutions should consolidate both internal and external course resources, integrate diverse educational materials, promote interdisciplinary instruction, transcend conventional subject limitations, and establish a comprehensive cross-disciplinary curriculum framework [9]. To address the industrial upgrading and digital transformation in manufacturing, schools can incorporate the instruction of various technologies that are currently in high demand but in short supply in enterprises. These include 3D printing, mechanical digital design and manufacturing, digital quality inspection and control, intelligent production line integration and simulation, industrial robot programming and application, as well as Internet of Things technology [10].

4.3. Strengthen the construction of teaching staff and improve the level of digital technology of teachers

Schools ought to incorporate professionals who possess enterprise work experience and digital expertise into their faculty teams. This will diversify the teaching staff and enhance its overall structure. Educators with practical industry backgrounds can offer students up-to-date, cutting-edge knowledge and skills while integrating real-world experiences into their lessons. This approach ensures that teaching content aligns more closely with actual production processes, thereby improving educational quality and fostering greater student engagement and curiosity in learning [11]. Furthermore, institutions should facilitate and motivate teachers to engage in regular internships and training programs within industry enterprises. These opportunities allow educators to stay informed about the latest industry trends, acquire contemporary knowledge and skills, refine their teaching capabilities, and elevate their professional competence. Consequently, they can deliver higher-quality education to their students [12]. Additionally, organizing periodic training sessions focused on educational digitization is essential. Such initiatives assist teachers in mastering advanced technologies like virtual reality, enhancing their instructional methods, and boosting their digital teaching proficiency. Establishing a robust school-enterprise collaboration framework is also crucial. By leveraging enterprise resources and platforms for teacher development and sharing, schools can invite industry experts to conduct lectures or short courses. These activities acquaint teachers with emerging technologies, standards, and innovations within the field. Collaborative scientific research projects with enterprises further strengthen teachers' research capabilities, which ultimately feed back positively into their teaching practices [13].

5. Summary

In the context of educational digital transformation and the upgrading and transformation of the manufacturing industry, there is an urgent need to cultivate innovative mechanical design talents in higher vocational colleges [14]. This paper conducts a detailed analysis of the significance, current state, and challenges associated with fostering such innovative talents, along with corresponding strategies. It also proposes a set of recommendations and reflections aimed at helping mechanical design and manufacturing programs train individuals who meet industry demands and possess a strong innovative spirit and capabilities amidst the wave of digital transformation [15]. As a critical platform for nurturing innovative technical talents, higher vocational colleges must align with contemporary trends, continuously explore and implement new models and methods, and offer solid talent support for the advancement of China's manufacturing sector and the sustainable growth of its economy.

Disclosure statement

The authors declare no conflict of interest.

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