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Research on the Integrated Teaching-Research-Application Training Model for Mechanical Application-Oriented Technical Talents

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Abstract: With the rapid development and intelligent transformation of the manufacturing industry, the demand for mechanical application-oriented technical talents is increasing. However, traditional training models for mechanical talents often suffer from a disconnection between theory and practice, insufficient innovation capabilities, and other issues, making it difficult to meet the modern manufacturing industry's demand for versatile and application-oriented talents. This paper proposes an integrated teaching-research-application training model for mechanical application-oriented technical talents, aiming to cultivate talents with solid theoretical foundations, strong practical abilities, and innovative spirit through the deep integration of teaching, research, and practice. This paper first analyzes the current research status and existing problems in the training of mechanical application-oriented technical talents both domestically and internationally. It then elaborates on the connotation, characteristics, construction principles, and specific construction methods of the integrated teaching-research-application training model, including curriculum system design, school-enterprise cooperation mechanisms, the introduction of research projects, and the construction of practical teaching platforms. Finally, the paper summarizes the implementation path and effects of this model, demonstrating that it can effectively enhance students' practical abilities, innovation capabilities, and employability, while deepening school-enterprise cooperation and promoting the integration of industry, academia, and research. This research provides theoretical support and practical guidance for the training of mechanical application-oriented technical talents.

Keywords: Integrated Teaching-Research-Application; Mechanical Application-Oriented Talents; Talent Training Model; School-Enterprise Cooperation; Research Projects; Practical Teaching.

1. Introduction

As a vital pillar of the national economy, the mechanical industry has an urgent demand for high-quality technical talents due to its technological advancements and industrial upgrading. However, traditional training models for mechanical talents often suffer from a disconnection between theory and practice, insufficient innovation capabilities, and other issues, making it difficult to meet the modern manufacturing industry's demand for versatile and application-oriented talents.

In foreign countries, especially in manufacturing powerhouses such as Germany, the United States, and Japan, the training of mechanical application-oriented technical talents started earlier and has formed relatively mature talent training systems. For example, Germany's "dual system" education model, the United States' "Cooperative Education" (Co-op) model, and Japan's emphasis on "industry-academia collaboration" are all representative examples [1-2].

In China, there have also been active explorations in the training of mechanical application-oriented technical talents. In recent years, with the advancement of the "New Engineering Education" initiative, many universities have begun to integrate teaching, research, and practice to explore new models for cultivating application-oriented talents. For instance, some universities have strengthened students' practical abilities through school-enterprise cooperation, joint laboratory construction, and collaborative training. Additionally, the Ministry of Education has introduced a series of policies to encourage cooperation between universities and enterprises, promoting the deep integration of industry, academia, and research [3].

Despite the progress made in the training of mechanical application-oriented technical talents both domestically and internationally, there are still issues such as the disconnection between theory and practice, insufficient depth in school-enterprise cooperation, inadequate cultivation of innovation capabilities, and insufficient teaching resources [4].

To address these issues, this paper proposes an integrated teaching-research-application training model for mechanical application-oriented technical talents. This model aims to cultivate talents with solid theoretical foundations, strong practical abilities, and innovative spirit through the deep integration of teaching, research, and practice.

2. Construction Methods of the Integrated Teaching-Research-Application Training Model for Mechanical Application-Oriented Technical Talents

2.1. Connotation and Characteristics of Integrated Teaching-Research-Application

The integrated teaching-research-application model is a talent training approach that closely combines teaching, research, and practical application. It aims to cultivate application-oriented technical talents with solid theoretical foundations, strong practical abilities, and innovative spirit through the mutual integration of theoretical teaching, research projects, and practical operations. Its core connotation lies in breaking the boundaries between theory and practice, research and application, forming an organic whole that allows students to apply theoretical knowledge to

solve practical problems while enhancing their innovation capabilities and professional qualities through research projects and practical operations.

Main characteristics include:

(1) Integration of Theory and Practice: By combining theoretical teaching with practical operations, students' practical abilities and problem-solving skills are enhanced. While learning theoretical knowledge, students can apply theory to solve practical problems through experiments, training, and internships.

(2) Integration of Research and Teaching: Introducing research projects into the teaching process cultivates students' research abilities and innovative spirit. Through participation in research projects, students can access cutting-edge technologies and improve their ability to solve complex engineering problems [5].

(3) Deep School-Enterprise Cooperation: Through school-enterprise cooperation, resource sharing is achieved, enhancing students' professional qualities and employability. Enterprises participate in the talent training process, providing practical opportunities and industry resources to help students better adapt to industry demands [6].

2.2. Construction Principles of the Training Model

When constructing the integrated teaching-research-application training model for mechanical application-oriented technical talents, the following principles should be followed:

Student-Centered Approach: The design of the training model should focus on enhancing students' abilities, emphasizing personalized development. Diversified teaching methods and practical opportunities should be provided to meet the learning needs of different students.

Balancing Theory and Practice: While emphasizing the teaching of theoretical knowledge, practical abilities should be strengthened. Through experiments, training, and internships, students' hands-on abilities and problem-solving skills should be improved.

Deep Integration of Industry, Academia, and Research: Through school-enterprise cooperation and research projects, the deep integration of industry, academia, and research should be achieved. Enterprises, universities, and research institutions should jointly participate in the talent training process, forming a resource-sharing and complementary cooperation mechanism.

Continuous Improvement and Optimization: The training model should be continuously optimized and adjusted based on industry demands and student feedback. Regular evaluation and feedback mechanisms should be established to ensure the model adapts to industry developments and student needs.

2.3. Specific Construction Methods of the Training Model

2.3.1. Curriculum System Design

The curriculum system is the core component of the talent training model. In the integrated teaching-research-application training model, the curriculum system should emphasize the integration of theory and practice, increasing the proportion of practical courses and research projects to form a curriculum system that combines theory and practice.

In the design of theoretical courses, the systematic and cutting-edge nature of foundational knowledge should be emphasized. By introducing industry cases and practical problems, the practicality and relevance of theoretical courses can be enhanced.

In practical sessions, the proportion of practical courses should be increased, with experiments, training, and internships designed to improve students' hands-on abilities and problem-solving skills. Practical courses should be closely integrated with theoretical courses, forming a "theory-practice-theory" virtuous cycle.

Research projects should be introduced into the curriculum system, encouraging students to participate in research activities. Through research projects, students can access cutting-edge technologies and improve their ability to solve complex engineering problems.

2.3.2. School-Enterprise Cooperation Mechanism

School-enterprise cooperation is an important support for the integrated teaching-research-application training model. Through school-enterprise cooperation, resource sharing can be achieved, enhancing students' practical abilities and professional qualities.

In terms of joint laboratory construction, universities and enterprises can jointly build laboratories, providing students with advanced experimental equipment and practical opportunities. Through the construction and operation of laboratories, students can access cutting-edge technologies and improve their practical abilities.

In terms of collaborative training, enterprises can participate in the talent training process through school-enterprise joint training, providing practical opportunities and industry resources. Students can intern at enterprises, participate in actual projects, and enhance their professional qualities and employability.

In terms of the dual-mentor system, a dual-mentor system can be implemented, with university teachers and enterprise engineers jointly guiding students. University teachers are responsible for theoretical guidance, while enterprise engineers provide practical guidance, forming a teaching model that integrates theory and practice.

2.3.3. Introduction of Research Projects

Research projects are an important way to cultivate students' innovation abilities and research literacy. In the integrated teaching-research-application training model, research projects should be introduced into the teaching process, encouraging students to participate in research activities.

In terms of research project selection, research projects closely related to industry demands should be chosen to ensure their practicality and cutting-edge nature. Through research projects, students can access cutting-edge technologies and improve their ability to solve complex engineering problems.

In terms of research team building, research teams composed of university teachers, enterprise engineers, and students should be formed, creating a resource-sharing and complementary cooperation mechanism. Through the construction of research teams, students can participate in the entire process of research projects, improving their research abilities and teamwork skills.

In terms of research achievement transformation, students should be encouraged to transform research achievements into practical applications, enhancing the practicality and social value of research outcomes. Through the transformation of research achievements, students can better understand the significance and value of research, improving

their innovation abilities and professional qualities.

2.3.4. Construction of Practical Teaching Platforms

Practical teaching platforms are an important guarantee for improving students' practical abilities. In the integrated teaching-research-application training model, the construction of practical teaching platforms should be strengthened to provide students with more practical opportunities.

In terms of laboratory construction, laboratory construction should be strengthened, providing advanced experimental equipment and practical opportunities. Through the construction and operation of laboratories, students can access cutting-edge technologies and improve their practical abilities.

In terms of training base construction, training bases should be built to provide real practical environments and opportunities. Through the construction of training bases, students can participate in actual projects, improving their hands-on abilities and problem-solving skills.

In terms of internship base construction, universities should cooperate with enterprises to build internship bases, providing internship opportunities and industry resources. Through the construction of internship bases, students can better adapt to industry demands and improve their professional qualities and employability.

2.4. Implementation Guarantees for the Training Model

To ensure the smooth implementation of the integrated teaching-research-application training model, corresponding guarantee mechanisms need to be established.

In terms of policy support, governments and universities should introduce relevant policies to support the implementation of the integrated teaching-research-application training model. Through policy support, the smooth implementation and continuous improvement of the training model can be ensured.

In terms of resource investment, resource investment should be increased to ensure the smooth implementation of practical teaching platforms and research projects. Through resource investment, the quality and effectiveness of practical teaching and research projects can be improved.

In terms of faculty team building, the construction of faculty teams should be strengthened to improve teachers' practical abilities and research capabilities. Through faculty team building, it can be ensured that teachers are capable of teaching and guiding in the integrated teaching-research-application training model.

In terms of evaluation and feedback mechanisms, evaluation and feedback mechanisms should be established to regularly evaluate the effectiveness of the training model and optimize and adjust it based on evaluation results. Through evaluation and feedback mechanisms, it can be ensured that the training model adapts to industry developments and student needs.

3. Implementation Effects of the Talent Training Model

Through the implementation of the integrated teaching-research-application training model for mechanical application-oriented technical talents, the following effects have been achieved:

Significant Improvement in Students' Practical Abilities: In terms of hands-on abilities, through experiments, training, and internships, students' hands-on abilities have been significantly improved, enabling them to proficiently operate various mechanical equipment and tools. In terms of problem-solving abilities, through participation in actual projects and research activities, students' problem-solving abilities have been significantly improved, enabling them to independently analyze and solve complex engineering problems. In terms of professional qualities, through school-enterprise cooperation and internship opportunities, students' professional qualities have been significantly improved, enabling them to better adapt to job requirements.

Significant Enhancement of Innovation Capabilities: In terms of research abilities, through participation in research projects, students' research abilities have been significantly improved, enabling them to independently conduct research design and experimental operations. In terms of cultivating an innovative spirit, through the implementation of research projects and the transformation of research achievements, students' innovative spirit has been significantly cultivated, enabling them to propose innovative solutions and design ideas. In terms of teamwork abilities, through the construction of research teams, students' teamwork abilities have been significantly improved, enabling them to closely collaborate with team members to complete research tasks.

Significant Improvement in Employability: In terms of employment rates, through school-enterprise cooperation and internship opportunities, students' employment rates have been significantly improved, enabling them to smoothly enter the mechanical industry. In terms of employment quality, through the improvement of practical abilities and innovation capabilities, students' employment quality has been significantly improved, enabling them to enter well-known enterprises and high-end positions. In terms of career development prospects, through the integrated teaching-research-application training model, students' career development prospects have been significantly improved, enabling them to grow and develop rapidly in the mechanical industry.

4. Conclusion

The integrated teaching-research-application training model for mechanical application-oriented technical talents achieves the deep integration of teaching, research, and practice through curriculum system reform, deepening school-enterprise cooperation, introducing research projects, and constructing practical teaching platforms. The implementation path of this model is clear, and its effects are significant. It can effectively enhance students' practical abilities, innovation capabilities, and employability, while deepening school-enterprise cooperation and promoting the integration of industry, academia, and research. In the future, with the further development of the manufacturing industry, the integrated teaching-research-application training model will play an even more important role in cultivating high-quality application-oriented technical talents for the mechanical industry.

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