
Reform of personnel training Mode of Mechanical Design, Manufacturing and Automation Specialty for Innovation and Entrepreneurship Education

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Citation: Yi M., Wang Z., Zhang J., and Xu C. (2022) Reform of personnel training Mode of Mechanical Design, Manufacturing and Automation Specialty for Innovation and Entrepreneurship Education, *International Journal of Education, Learning and Development*, Vol. 10, No.11, pp.44-52

ABSTRACT: *Under the condition of new economy, how to implement and promote the new education and teaching concept of "student-centered, achievement-oriented and continuous improvement" in the professional certification of engineering education in China, training high-quality talents to meet the needs of the industry and society is the primary issue of the new engineering reform of traditional engineering majors. Under the background of engineering education certification, the mechanical design, manufacturing and automation major of Qilu University of Technology is oriented to the innovation and reform of the professional training mode of innovation and entrepreneurship education. Its experience can provide reference for the development of traditional engineering majors under the background of new engineering construction.*

KEYWORDS: innovation and entrepreneurship; talent training mode; engineering certification; curriculum reform

INTRODUCTION

Research status at home and abroad

Students are the foundation of the survival and development of colleges and universities, and the development of colleges and universities depends on the development of students. The implementation of the educational concept of "student-oriented" accords with the law of modern education and the law of talent growth [1]. It is the promotion of Marxist thought of "man's free and all-round development" and the call of higher education reform in the new era.

With the new wave of scientific and technological and industrial revolution sweeping the world, the new economic form characterized by new technology, new industry, new business type and new model poses a new challenge to the traditional engineering professional education. At the same time, the new economic form also depends on the

transformation and upgrading of traditional engineering majors and the innovative development of engineering education. Therefore, the teaching concepts, teaching contents, teaching standards and teaching methods of traditional engineering majors need to be updated and reformed in order to train new engineering science and technology talents with innovative and entrepreneurial ability and cross-border integration ability to provide power for economic development and prosperity. The major of mechanical design, manufacturing and automation is a typical traditional engineering major, which is the main force supporting the development of national high-end equipment manufacturing industry. In the face of the future development and the needs of related industries, we need to constantly innovate, develop and improve the construction of professional system [2,3,4]. Under the background of new engineering construction, how to reconstruct the educational concept, talent training mode, content system, platform construction and operation mechanism of mechanical design, manufacturing and automation major is an important mission of the current mechanical professional higher education workers.

A large number of colleges and universities specializing in mechanical design, manufacturing and automation have trained a large number of high-quality engineering and technical personnel over the years, which have effectively supported the demand for talents in China's equipment manufacturing industry. But with the rapid development of the new economy, new technologies, new industries, new business type and new models emerge one after another. Mechanical design and manufacturing and automation education are generally faced with the following problems and challenges.

The generality of traditional professional education and teaching ideas for innovation and entrepreneurship education is slow to update.

The existing education and teaching are still teacher-centered, students passively accept knowledge, ignoring the ability of knowledge application in analyzing and solving practical problems [5,6]. The concept of "results-oriented" education is based on the core idea of "output" and focuses on what students have learned rather than what teachers have taught, which cannot be achieved in traditional professional education [7]. This concept has a profound impact on the university education reform in the United States, Japan and other countries, and is recognized as "a correct direction in the pursuit of educational excellence and an educational reform idea worth using for reference". It is also one of the core ideas of engineering education professional certification in China.

As the first major to pass the certification of engineering education in Qilu University of Technology, the major of mechanical design, manufacturing and automation has always insisted on updating the concept of modern education in the long-term process

of running a school. The traditional teaching mode of "content-oriented" and positive design teaching content is gradually transferred to students' "achievement output" as the center. However, the "student-oriented" and "results-oriented" education and teaching concepts are mostly in a single curriculum or teaching link, lack of a systematic way to achieve.

There is no established paradigm for the transformation of new engineering talent training mode for innovation and entrepreneurship education.

The specialty of mechanical design, manufacturing and automation has a long history, the inertia of the traditional professional education mode is large, the exploration time of new engineering construction is still short, and there is no established talent training mode, which will inevitably lead to the lack of innovative talents training in a short period of time. It is difficult to meet the social demand for new scientific and technological talents. In addition, the technological changes represented by intelligent manufacturing technology have profoundly affected and changed the production, organization and management of high-end equipment manufacturing industry. As a result, the contradiction between the demand for new mechanical design, manufacturing and automation professionals and the training of professional innovative talents continues to deepen. How to explore the effective mode and realization way of the new engineering transformation of mechanical design and manufacturing and automation major, and then adapt to and lead the innovative development of emerging industries and technologies has become an important challenge for educators in colleges and universities.

The cooperation mechanism of talent training mode for innovation and entrepreneurship is not systematic.

In the teaching reform of mechanical design, manufacturing and automation, it is more a single reform of a certain link of teaching, ignoring the synergy among the elements that affect the quality of personnel training, and lack of integrity and maneuverability. Talent training is a systematic project. The teaching reform with a single theme, such as course teaching, practical teaching, laboratory construction, learning effect evaluation or ideological and political education, ignores the multi-factors and complexity of talent training, and the effect of the reform is not obvious. In addition, all kinds of systems and platforms of talent training go their own way, the focus of the operating mechanism deviates from the students, there is a lack of coordination and communication mechanism, the level of cooperation needs to be deepened [8,9], and there is a lack of continuous improvement mechanism for the implementation results. According to the current development trend, the mechanical specialty should establish a modern engineering concept of systematicness, ecology and sustainability, better coordinate the relationship between man, nature and society, and sublimate the training

mode of new engineering talents with the concept of modern engineering. Respect the law of talent growth, absorb and learn from advanced educational experience, promote the reform of innovative and entrepreneurial education, and put innovative and entrepreneurial education through the whole process of personnel training. Then the knowledge structure of talents will be changed from specialized, refined, deep to accessible, broad and broad, so as to enhance the social adaptability of talents [10]. How to strengthen the top-level design and promote all-element collaborative education in the teaching and non-teaching processes related to talent training, such as system construction, platform construction and mechanism construction, the establishment of a process tracking, effect feedback supervision and continuous improvement mechanism based on cultivating the ability to solve complex problems is the key issue for the innovation and development of mechanical design, manufacturing and automation.

Thoughts on the Reform of Talent training Mode.

The research content of this project is the main work to achieve the research goal, which is mainly to create a trinity model of "curriculum + training + competition". The prerequisite for its realization is that in the 2022 training plan for the major of mechanical design, manufacturing and automation, the training mode of mechanical design, manufacturing and automation is designed for the teaching of mechanical drawing course, creative training of innovative entrepreneurial practice-creative three-dimensional model, and comprehensive practice of mechanical innovative design and production. This talent training model is beneficial to:

(1) The coordination and unity of traditional majors and cross-disciplines. As a traditional major, we should strengthen the cross-integration with management, control, artificial intelligence and other disciplines, focus on the frontiers of science and technology, broaden academic horizons [11,12], improve the ability of original innovation, and deeply integrate with industry enterprises to jointly improve the ability of independent innovation.

(2) The coordination and unity of professional standardization and innovation. The standardization and rigor of engineering determine that standardization must be taken as the basic premise for the training of engineering talents. On this basis, we should fully respect students' individual differences and creative thinking, and realize the coordination and unity of standardization and innovation.

(3) The coordination and unity of professional inheritance and innovative development. The profound accumulation of traditional specialties and the huge inertia of professional development should be combined with the modern engineering concept,

examine the professional training mode, promote the reform of innovation and entrepreneurship education, and put innovation and entrepreneurship education through the whole process of talent training.



Figure 1. Thoughts on the Reform of Talent Training Mode.

3. Reform plan of talent training mode.

(1) The first and second semester, basic knowledge teaching session, "Mechanical drawing" (80 theory + 32 on the computer).

The domestic industrial design software is introduced into the traditional mechanical drawing teaching, and the case-based engineering problems and software learning are used to deepen students' understanding of drawing, expand students' thinking, and stimulate learning interest and innovative ability [13]. As the basic knowledge and preliminary application link for solving complex engineering problems.

Carry out the reform of the integrated course of mechanical drawing and industrial software technology, explain the theoretical knowledge and software application together, after the teacher's lecture, students operate the software on the computer independently, and solve the abstract problems in mechanical teaching through modern technology, which can not only achieve the combination of theory and application, but also digest and absorb the knowledge points more deeply. In addition, the gradual deepening of case study can also gradually cultivate students' understanding of complex engineering problems.

(2) The third semester, the training of creative thinking, "creative 3D model" (32 on the computer + 16 practice).

Taking the actual complex engineering problems as the teaching object, we use a variety of digital modeling and virtual simulation software to establish and express the basic model, fully respect the creativity of the students, and refer to the competition mode. through modeling, selection, team formation and cultivation, students are used as the

basic model establishment and performance link to solve complex engineering problems.

The focus of this link is to introduce mechanical design cases with distinctive industry characteristics, stimulate students' interest in the field of this discipline, and help students cultivate the thinking needed to solve complex engineering problems. For example, while teaching knowledge points, the case and the corresponding knowledge of parts manufacturing process, 2D design performance and computer-aided modeling are introduced to help students establish an engineering language environment in a short time and create an engineering language learning atmosphere. Try out "team type, project type, promotion type" learning style to improve students' successful experience and arouse students' enthusiasm for learning.

(3) the fourth semester, comprehensive application, "comprehensive practice of mechanical innovative design and production" (1-3 weeks).

Optimize the original course into a comprehensive practice link, make use of the existing professional competition platforms such as "Hui Yu", "Beauchamp" and "Explorer" and various professional laboratories, on the basis of students' early grouping, disperse to each laboratory to team up for comprehensive practice, optimize the model, make physical objects, form a work entrepreneurial plan, and participate in the competition as a system function and innovative design link to solve complex engineering problems.

Taking the innovative and entrepreneurial competitions such as "Challenge Cup", "Chuang Youth" and "Internet +" as the leader, combined with the characteristics and advantages of mechanical majors, a sufficient number and reasonable structure of mechanical students' entry system has been formed. Give full play to the role of academic mentors, with "academic mentors + students" to form a "1+ x" team chemistry competition group, to cultivate students' innovation and team consciousness. At the same time, we should improve the organization mode of the event, realize the combination of competition and training, promote training by competition, give birth to excellent projects and achievements, and enhance students' comprehensive application and integrated innovation ability of innovative and entrepreneurial knowledge.

(4) Application and limitation evaluation in the fourth semester and after.

In addition to teaching tasks, the laboratory is open to students all the year round, and continue to optimize works and innovative entrepreneurship according to the study of professional courses and innovative entrepreneurial thinking courses. And establish a process tracking, effect feedback supervision and continuous improvement mechanism

based on training the ability to solve complex problems, as a link of model design analysis, application and limitation evaluation to solve complex engineering problems. The links of application and limitation evaluation pay more attention to the effect of students' learning, that is, pay more attention to the evaluation of output, focus on the comprehensive use of knowledge to analyze and solve problems, and explore flexible and various open assessment methods. Gradually realize the transformation from the final evaluation to the process evaluation, from the assessment knowledge to the assessment ability, from a single assessment mode to a variety of assessment methods, from a single standard answer question to a non-standard answer question.

Based on this model, we can overcome the fixed thinking brought by the teaching of traditional knowledge through pre-innovative courses and competitions, and realize "learning by doing and doing while learning" to improve students' ability to understand knowledge and technology. The use of competition to promote students to find problems, sum up problems, concise problems, and fully understand the differences between "knowing" and "cannot be used", "can" and "can be solved". The systematic design of innovative entrepreneurial links and evaluation links can also enable students to fully understand the diversity of technological environment and the impact and requirements of application development and technological progress on knowledge and ability.

This talent training model can further strengthen the professional construction of mechanical design, manufacturing and automation, improve the quality of personnel training, implement and promote the new education and teaching concept of "student-centered, achievement-oriented, continuous improvement" in the professional certification of engineering education in China. Improve the output-oriented talent training system under the background of engineering education certification, and strengthen students' ability to deal with complex engineering problems and non-technical elements [14,15]. Train high-quality talents who can meet the needs of the industry and society.

In addition, the mechanical design, manufacturing and automation major is oriented to the innovation and development of the professional training mode of innovation and entrepreneurship education, and its experience can provide reference for the development of traditional engineering majors under the background of new engineering construction. It has high popularization and application value.

CONCLUSION

To establish the trinity competition practice of "Mechanical drawing" course teaching

+ "innovative Entrepreneurship Practice-Creative 3D Model" Creative training + "Comprehensive practice of Mechanical Innovative Design and production". Mechanical design and manufacturing and automation professional training mode for innovative and entrepreneurial education.

To establish the supervision and continuous improvement mechanism of full-cycle process tracking and effect feedback of talent training based on cultivating the ability to solve complex problems.

Systematic design, innovation, entrepreneurship and evaluation can also enable students to fully understand the diversity of technological environment and the impact and requirements of application development and technological progress on knowledge and ability.

Acknowledgments

This work was supported by the Teaching Research Project of Qilu University of Technology (Shandong Academy of Sciences) (P202209, 2022JX7d018, 2021zd13, 2020ZD28), the Shandong Undergraduate Teaching Reform Research Project (Z2021142, Z2021011),.

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