Curriculum and Teaching Methodology (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2023.062103
ISSN 2616-2261 Vol. 6 Num. 21

Exploration of Mechanical Engineering Higher Education Curriculum Reform Path

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Keywords: Teaching methodology; Industry-teaching-research integration; Higher education; Mechanical engineering

Abstract: With the rapid socio-economic development and the rapid changes in science and technology, higher education is facing unprecedented challenges and demands. Under such a background, the reform of higher education curriculum has become an inevitable trend. As a new education model, the integration of industry, education and research has begun to be integrated into the field of higher education in recent years. Firstly, the thesis introduces the concept and importance of the integration of industry, education and research; then the thesis analyzes the difficulties of the higher education curriculum reform based on the integration of industry, education and research; mechanical engineering, as an engineering discipline, has certain characteristics and challenges in its curriculum reform. Finally, taking mechanical engineering as an example, the paper explores the reform path of higher education courses and teaching methods based on the integration of industry, education and research, including industry-academia cooperation, practical teaching and cultivation of innovation ability, and propose some feasible promotion measures and countermeasures, aiming to provide guidance for other disciplines. Provide reference and reference for the reform of higher education curriculum and teaching methods.

1. Introduction

In today's rapidly developing society, higher education faces many challenges and opportunities. With the rapid development of science and technology and the intensification of globalization, it has become an important goal of higher education to cultivate excellent talents who can adapt to the needs of the society[1-2]. And the integration of production, teaching and research. As a new education model, the integration of industry, teaching and research has gradually become one of the key words in the methodology of higher education curriculum reform. The integration of industry, education and research emphasizes the organic combination of industry, academia and research, breaks through the traditional disciplinary boundaries, strengthens the cultivation of practical ability, and promotes the deep integration between higher education and industry. This model aims at the cultivation of applied talents, emphasizes the combination of theory and practice, and focuses on the demonstration of students' abilities in actual work. At the same time, the curriculum reform promoted by the integration of industry, education and research can also make higher education more in line with the needs of society and improve the employability and competitiveness of students.

At present, many countries and regions have begun the practice and exploration of teaching methodologies that integrate industry, education, and research with university curriculum. For example, Germany's "dual system" education model closely integrates higher education with the actual needs of enterprises, and has cultivated a large number of high-quality talents adapted to market demand[3]. China's "integration of industry and education" policy has also been implemented nationwide, promoting the in-depth cooperation between higher education and industry, and has achieved certain results. Under the current trend of economic globalization and deepening scientific and technological innovation, higher education is facing the important task of training talents to meet the needs of social transformation. The traditional education model faces the problems of theory being detached from practice and talent cultivation being detached from market demand. Therefore, the higher education curriculum reform based on the integration of industry, education and research is particularly necessary. This paper will take mechanical engineering as an example to explore the path of higher education curriculum reform based on the integration of industry, education and research[4-7]. As an engineering discipline, mechanical engineering has certain characteristics and challenges in its curriculum reform. Through relevant research and empirical case analysis, some feasible promotion measures and countermeasures are proposed, aiming to provide reference and information for higher education curriculum reform in other subject areas.

2. Difficulties in the integration of industry-teaching-research in the education of mechanical engineering courses

Mechanical engineering is an application-oriented discipline that requires students to have solid theoretical knowledge as well as practical ability. The specialized requirements of mechanical engineering include a deep understanding of basic theories such as mechanical principles, mechanics, material science, fluid mechanics, etc., as well as familiarity with and mastery of engineering practices such as mechanical design, manufacturing and automation control. Therefore, the diversity of teaching content has become a difficult point in the reform of higher education curriculum.

In mechanical engineering, the teaching content includes theoretical courses, experimental practice, engineering design and other aspects. The theoretical courses involve extensive and in-depth knowledge, which requires students to master the basic knowledge of mathematics, physics and other basic knowledge, and be able to apply this knowledge to the actual engineering design. Experimental practice is an important part of cultivating students' hands-on ability and practical skills. Through the experimental courses, students can apply the theoretical knowledge to the real world and develop the ability of experimental design and data analysis. The engineering design course, on the other hand, is to cultivate students' ability to solve practical engineering problems. Through the design project, students can learn the overall process and steps of the engineering project, and cultivate students' innovative thinking and teamwork ability.

However, there are some difficulties in the diversity of teaching content. First of all, because the knowledge system of mechanical engineering is relatively large, it is often difficult for teachers to do everything in the teaching process, which requires reasonable curriculum design and content selection. Secondly, the teaching content of mechanical engineering involves the combination of theory and practice, how to balance the ratio of the two as well as how to combine theoretical knowledge with practical operation is a problem that needs to be solved. In addition, since the teaching content of mechanical engineering majors is usually more abstract and complex, students may encounter difficulties in the learning process, and how to improve the learning effect and learning interest of students is also a difficult point to be explored and solved.

Therefore, the higher education curriculum reform based on the integration of industry, education and research is of great significance in the mechanical engineering specialty. By introducing

industrial demand into the teaching content and combining it with actual engineering projects, students can better understand and master engineering practice skills and improve their professional quality. At the same time, the application of research results to teaching can update the teaching content and improve the quality of teaching. Curriculum reform based on the integration of industry, education and research not only involves the design and selection of teaching content, but also requires teachers to actively participate in industry and research projects, and to maintain up-to-date teaching concepts and methods to adapt to the ever-changing industrial and technological development. Only through the higher education curriculum reform based on the integration of industry, teaching and research, can the mechanical engineering program better cultivate excellent talents who can adapt to the needs of the society and have the ability to innovate and practice.

3. Exploration of higher education curriculum and teaching methodology based on the integration of industry, teaching and research

3.1. Mechanical engineering course education industry-university-research integration path

Higher education curriculum reform is an important initiative to improve the level of education and cultivate high-quality talents. And the path of higher education curriculum reform based on the integration of industry-university-research is widely recognized as an effective method to promote industry-university cooperation, cultivate practical ability and meet industrial demand. Taking mechanical engineering as an example, we can design the following implementation paths and specific measures to promote the higher education curriculum reform based on the integration of industry, education and research.

3.1.1. Strengthen practical teaching

Practical teaching can help students apply theoretical knowledge to actual engineering and enhance their hands-on ability and problem-solving ability through practice. Here are some specific measures to strengthen the implementation of practical teaching.

Increase experimental links: add experimental courses in mechanical engineering courses and arrange students to carry out practical experimental operations. Through experiments, students can observe and understand mechanical principles and master relevant experimental skills.

Carry out design projects: Organize students to participate in actual mechanical engineering design projects to exercise students' design ability and teamwork ability. We can cooperate with enterprises to provide real project cases so that students can solve real problems in practice.

Internship and practical training: Cooperate with enterprises to provide students with internship and practical training opportunities. Students can go to enterprises for internships to participate in and practice the knowledge and skills they have learned. Through internship training, students can better understand the actual situation and working environment of the mechanical industry.

Virtual Simulation Technology: Virtual simulation technology is utilized to provide students with a virtual laboratory and design environment. Students can conduct experiments and designs in the virtual environment to improve their abilities and skills. Virtual simulation technology can make up for the limitations of experimental equipment and resources, allowing students to engage in hands-on learning at any time and place.

Academic Lectures and Industrial Forums: Industry experts and scholars are invited to campus to organize academic lectures and industrial forums for face-to-face interaction with students and teachers. This increases students' understanding of the latest developments and cutting-edge technologies in the industry and provides them with opportunities for communication and collaboration.

Strengthening practical teaching is a key step in the integration of industry, academia and research in mechanical engineering program education. By providing more practical opportunities and resources, students will be able to better apply their theoretical knowledge in practice and develop hands-on skills and problem-solving abilities. This will make students more adaptable to industrial development needs and provide valuable talents for industry.

3.1.2. Implementing Project Practice in Cooperation with Enterprises

In order to strengthen the integration of industry, academia and research in mechanical engineering curriculum education, we need to actively cooperate with enterprises. Such cooperation can effectively promote communication and cooperation between industry and academia, and improve the quality of education and the competitiveness of students' employment. Here are a few specific measures:

Establishment of internship and practical training bases: enterprises related to mechanical engineering can provide internship and practical training opportunities so that students can contact and apply the knowledge and skills they have learned in a real working environment. Schools can cooperate with enterprises to jointly establish internship and practical training bases to provide students with more practical opportunities and real work experience.

Carrying out University-Industry Research Programs: Schools can cooperate with enterprises to carry out University-Industry Research Programs to jointly solve practical problems and challenges. Through cooperative R&D and technology transfer, students can apply the theoretical knowledge they have learned to practical projects, and at the same time solve problems for enterprises and improve their competitiveness. This kind of cooperation can promote the communication and cooperation between academia and industry, so that the research results can be better transformed into productivity.

Employing enterprise experts as part-time teachers: Schools can employ experts and technicians from enterprises as part-time teachers, who can teach students the experience and knowledge they have accumulated in practical work. This can make education closer to the actual needs and cultivate students with more practical ability, and also enhance the connection and cooperation between schools and enterprises.

Organize enterprise visits and academic exchanges: Schools can regularly organize students to visit enterprises, so that they can understand the production process, technical equipment and management mode of enterprises. At the same time, schools can also organize academic exchanges and invite enterprise representatives and experts to schools to give lectures and share, so that students can have face-to-face exchanges and discussions with people in the enterprise sector. This can enhance the mutual understanding and cooperation between schools and enterprises.

By strengthening the cooperation with enterprises, the education of mechanical engineering courses can better match the industrial demand and improve the employability and competitiveness of students. At the same time, this integration of industry-university-research can also promote the transformation of scientific research results and the enhancement of innovation ability. Through joint efforts, we can establish a good cooperation platform for industry-university-research and make greater contributions to the development of mechanical engineering education.

3.1.3. Establishment of University-Industry-Research Cooperation Platform

Establishment of University-Industry-Research Cooperation Laboratory: The university cooperates with enterprises to jointly establish the Mechanical Engineering University-Industry-Research Cooperation Laboratory. The laboratory is equipped with advanced equipment and technology, providing a platform for students and teachers to practice and research. Enterprises can

use the laboratory to carry out product development and technological innovation, while students can gain real engineering experience through practice.

Implementation of University-Industry-Research Cooperation Programs: Establish cooperative programs between schools and enterprises to promote the deep integration of the three parties, namely, University-Industry-Research. Schools can invite enterprise representatives to give special lectures to share industry dynamics and technology development. Students can participate in actual projects of enterprises and provide solutions and innovative ideas. Enterprises can provide actual engineering problems for students to study and solve, and at the same time, they can also use the research results of teachers and students to promote the technological innovation of enterprises.

Establishment of talent cultivation base: The school cooperates with enterprises to establish a mechanical engineering talent cultivation base. The base can provide students with internship and employment opportunities, so that students can learn and grow in the actual working environment. Enterprises can provide teacher support and professional training in the base to improve students' professionalism and working ability. Schools can monitor students' learning and practice through the bases to adjust and optimize the curriculum.

Carrying out assessment of University-Industry-Research Cooperative Programs: An assessment mechanism is established to provide regular assessment and feedback on University-Industry-Research Cooperative Programs. The assessment includes the results and impacts of the program, the participation and gains of the students, the satisfaction and actual benefits of the enterprises, and so on. The assessment results can be used as a basis for improvement and adjustment to promote the sustainable development of University-Industry Cooperation.

The specific measures for industry-university-research integration in mechanical engineering course education are diverse, and the above are just some of the major initiatives. Through these measures, schools, enterprises and students can form positive interaction and cooperation, realize the integration of knowledge and practice, and provide strong support for the development of the mechanical engineering profession.

3.2. Specific measures for the reform and management of industry-academia-research fusion in mechanical engineering curriculum education

In realizing the goal of mechanical engineering curriculum reform of industry-academia-research integration, it is necessary to strengthen the organizational construction and management of industry-academia-research integration. Details about this measure will be described in detail below.

First of all, establish an organizational structure for the integration of industry-academia-research. An organization or a network of organizations is built to facilitate communication and cooperation between industry, academia and research. The organization or network should consist of representatives from educational institutions, enterprises and research institutes to ensure that all parties can participate in decision-making and planning. In addition, the organization or network should be responsible for developing specific cooperation projects and plans to facilitate the implementation of industry-university-research integration.

Second, improve the management mechanism of industry-university-research integration. An effective management mechanism is established for coordinating and supervising the progress of industry-university-research integration in curriculum reform. This mechanism should be equipped with decision-making and implementation capabilities to ensure that the interests of all parties are balanced and satisfied. At the same time, through the establishment of a scientific assessment and evaluation system, students, teachers and enterprise employees involved in the integration of industry-university-research should be evaluated, rewarded and punished, so as to form an incentive mechanism and promote the in-depth implementation of the integration of industry-university-

research.

Third, strengthen the quality management of University-Industry-Research Cooperation. A strict quality management system has been established to monitor and evaluate University-Industry-Research Cooperation projects. Ensure the quality and effect of University-Industry-Research cooperation projects by making clear cooperation agreements and project plans, and clarifying responsibilities and goals. In addition, communication meetings and evaluation activities of industry-university-research can be organized regularly to increase the transparency of the project and feedback of the effect, so as to continuously improve the quality and level of cooperation.

4. Conclusion

Higher education curriculum reform based on the integration of industry, education and research faces a series of difficulties in mechanical engineering, including the educational system, industrial demand and educational resources. In view of this, this paper proposes the paths of strengthening disciplinary integration, enhancing cooperation with industry and upgrading the teaching force and educational resources. Through the exploration and practice of these course integration methods, it can promote the effective docking between higher education curriculum and industrial demand, cultivate high-quality talents with more comprehensive ability, and promote the sustainable development of higher education. However, curriculum reform in higher education is a complex systematic project that requires the joint efforts and cooperation of the government, colleges and universities, enterprises and society to promote. Only with the joint efforts of all parties can the goal of curriculum reform in higher education be realized.

Acknowledgements

This work is supported by Handan University Education and Teaching Reform Research and Practice Project (2022xjjg006), Handan University Educational Science Research Project(J202210), Natural science research project of Handan University(2017210).

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