

# Exploration of professional practice teaching reform in local application-oriented universities——Taking mechanical engineering as an example

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**Abstract.** With the increasing demand for teaching quality and personnel training of higher education in China, it has become the goal of application-oriented universities to cultivate high-quality composite application talents with innovative ability, practical ability and entrepreneurial spirit. Innovative professional practice teaching reform is an important way for higher education to better achieve the goal of talent training and improve teaching quality. Firstly, the necessity and significance of professional practice teaching reform is expounded in combination with the current situation of the mechanical engineering and education. Then, the content of teaching reform is explored in the light of the present practical teaching situation of mechanical engineering specialty. Finally, based on the current situation and development goals of the application-oriented universities, some safeguards measures are put forward to ensure the smooth development of practical teaching reform and achieve effective results.

## 1 Introduction

In 2021, the Education Ministry of China announced that "Suggestions on Accelerating the Construction of High-level Applied Universities". It supports the development of local application-oriented universities and focuses on the cultivation of innovative and compound application-oriented talents. Moreover, it improves the teaching quality of higher education and ability of servicing the regional economic and social development [1, 2]. Professional practice teaching is an important way for higher education to achieve the goal of cultivating innovative and compound talents and improve teaching quality and college influence [3-5]. Combining the advantageous of mechanical equipment industry in Zaozhuang and the goal of Zaozhuang University to build a first-class application-oriented college in China, it is of great practical significance and application value to carry out the practical teaching reform of mechanical engineering specialty and build an innovative practical teaching and evaluation system. This paper deeply analyses the internal demand of the mechanical engineering development and the talents cultivation in universities under the background of new engineering disciplines. Moreover, this paper explores the reform and innovation of the practical teaching system and the construction of the security system. It aims to innovate the training mode, practical teaching curriculum resources and improve the students' comprehensive professional quality to meet the needs of industry and enterprise talents and provide effective ways to solve the

problems of the mismatch between the talent training structure and the requirements of the current industrial upgrading.

## 2 Necessity and significance of the practical teaching reform

### 2.1 Inherent demand for the innovative development of machinery industry

With the transformation of new and old kinetic energy in Shandong Province and the strategic promotion of "strengthening the city by industry and revitalizing the city by industry" in Zaozhuang, the mechanical industry, as an important part of the "6+3" industrial development system, needs talents and technology for the innovative development. The traditional machinery industry gives the impression that the labour intensity is high, the production process is extensive and the working environment is uneven etc. It directly leads to the current machinery industry, especially the enterprises in the third-tier cities, generate many problems such as difficult recruitment, large personnel flow, etc [6-8]. Therefore, it is of positive significance and great value to carry out practical teaching to provide students with the opportunity to get close contact with the mechanical industry, so that they can understand the current situation and development prospects of the mechanical industry. And it can inspire the enthusiasm to engage in machinery related industries, lay a good foundation for enterprises to cultivate technical talents and solve the

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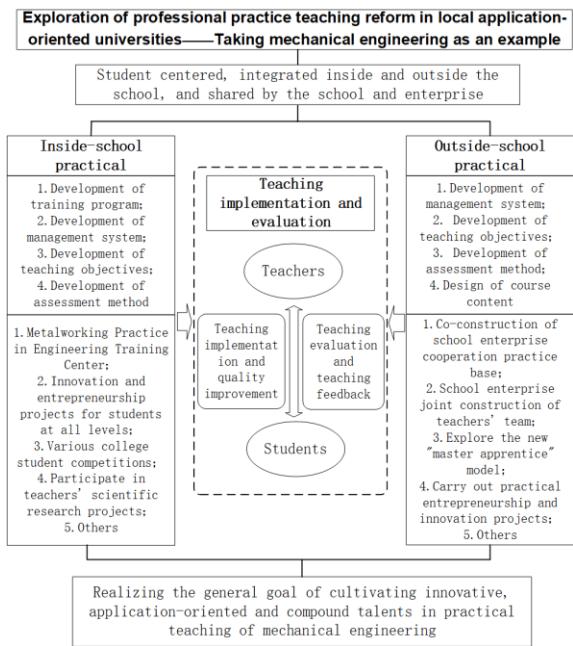
difficult employment. In addition, the development of practical teaching can pull the distance between enterprises and universities, effectively integrate the equipment, talents and technology resources and quickly solve the enterprise development problems. At the same time, it is of great significance to gather and exercise scientific research strength, develop new products, improve product performance, and improve product added value and market competitiveness.

## 2.2 Internal requirements for the development of mechanical engineering

The practical teaching of mechanical engineering specialty is an effective way for application-oriented universities to cultivate professional talents, serve the development of the industry, and improve education quality. Traditional classroom teaching methods are difficult to cultivate students' ability to solve practical engineering problems [9-12]. It leads to the polarization of "learning" and "using" and there are shortcomings in the cultivation of students' comprehensive quality. Secondly, students in practical teaching can better contact the engineering practice, test their professional knowledge level, exercise their engineering practical experience, cultivate their professional comprehensive quality. Thirdly, practical teaching provides an opportunity for applied universities to overtake at curves. Under the background of new engineering disciplines, it can create disciplines and specialties with distinctive characteristics of "refined, specialized, special and new", refine discipline characteristics and innovative talent training mode, and create a new highland and vane for application-oriented universities in local areas and even in the country. Finally, practical teaching can effectively promote the breadth and depth of scientific research in universities, refine research directions and form characteristics and advantages. And it can help to take a good path of innovation driven development, better serve local economic and social development. Therefore, it is of great significance and imperative to carry out practical teaching reform of mechanical engineering specialty.

## 3 Implementation of Practice Teaching Reform

The implementation route of practical teaching reform of mechanical engineering specialty is shown in Fig. 1. The idea of student-centred is embodied in the route. The road, which integrates between inside and outside the school and co-construction and sharing both of the universities and enterprises, is adopted. Moreover, the training scheme, management system, teaching objectives, assessment methods, etc. is established. Secondly, the practical teaching mode with various forms, novel approaches and rich contents can be explored. Thirdly, the teaching evaluation and feedback mode can be innovated and the quality of practical teaching can be improved. The specific practical teaching reform measures are as follows.



**Fig. 1.** Implementation chart of practical teaching reform of mechanical engineering.

### 3.1 Reform of practical teaching content

#### 3.1.1 Reform of experimental practical teaching

The experimental practical teaching is mainly used to provide students with ways to deeply understand theoretical knowledge, explore new ideas and verify self-doubt. Therefore, the content of the experimental practical teaching reform mainly focuses on deepening students' understanding of classroom knowledge, improving students' professional knowledge level and building a theoretical knowledge system. The main reform contents include: (1) design a practical teaching plan through combining classroom teaching and students' knowledge level. (2) design and improve online practice curriculum resources by using the modern virtual simulation technology and equipment. (3) provide students with tools and methods to verify textbook knowledge by fully using the numerical simulation platform such as Solidworks, Creo, Ansys, Adams, etc. (4) establish student contest training and competition mode and form echelon management. (5) explore the mode of students' participation in teacher teams to increase students' achievement and personal satisfaction.

#### 3.1.2 Reform of applied practice teaching

Applied practical teaching is mainly used to provide students with ways to go deep into engineering practice, grasp the industrial scene, and improve the ability to solve practical problems. Therefore, the content of applied practical teaching reform mainly focuses on improving students' professional skills and their ability to solve practical engineering problems. The main reform contents include: (1) based on students' knowledge level and career planning, the practical

teaching scheme is designed to complement and integrate with the experimental practical teaching reform. (2) based on R&D and production resources of enterprise, enrich practical course, especially industrial field cases. (3) strengthen the depth of industry university research cooperation and explore a new "master apprentice" mode. (4) utilizing the resources of senior engineers in enterprises, explore the complementary teaching mode inside and outside the school. (5) taking problems as guidance and projects as means, innovate and reform practical teaching and evaluation mode.

### *3.1.3 Reform of professional quality practice teaching*

Professional quality practice teaching is mainly used to provide students with ways to cultivate modern design awareness, pay attention to environment, safety, ethics, etc. Therefore, the reform of professional quality practice teaching mainly focuses on improving students' comprehensive professional quality. The main reform contents include: (1) integrates the ideological and political elements in practical teaching, cultivates the students' feelings of family and country. (2) carry out professional courses of modern design concept, guiding students to pay attention to environment, people's livelihood, ethics, etc. in actual design work. (3) conduct modern corporate culture lectures to enhance students' understanding of the modern enterprises development and improve their cultural identity and integration sense.

## **3.2 Reform of practical teaching approach**

### *3.2.1 Reform approach of experimental practical teaching*

The experimental practice teaching is mainly carried out inside school. Firstly, it should conduct the construction of the engineering training centre, connect the latest experimental theories, equipment and methods at home and abroad, broaden the horizon to improve the awareness of standards and academic literacy. In addition, expand and enrich the practical teaching mode, provide opportunities for students to integrate into the teacher team to cultivate research habits and academic quality. Finally, provide students with the opportunity to practice their own ideas and show their abilities, and participate in various competitions to promote teaching and learning through competitions.

### *3.2.2 Reform approach of applied practical teaching*

Applied teaching is mainly practiced outside school. Its reform needs industrial field resources, so universities should strengthen the practice bases construction jointly built by universities and enterprises to make full use of enterprise resources, provide students with industrial field practice sites, deeply understand all production links, processes, elements, etc. and improve the ability to solve practical engineering problems. Secondly, the

talents advantages of universities and enterprises should be integrated to build a teacher team, enrich the content of practical teaching, and improve the quality of practical teaching. Thirdly, according to the students' career planning, targeted enterprise practice should be organized to explore a new "master apprentice" mode and effectively cultivate students' engineering practice ability. Finally, a new mode of industry university research cooperation should be established with demand as the guide, innovation as the driving force, service as the purpose, and problems as the starting point. Moreover, schools and enterprises should jointly set up projects to carry out practical entrepreneurship and innovation projects, encourage students to innovate and start businesses, integrate into the industry, and contribute to the development of the industry.

### *3.2.3 Reform approach of professional quality practice teaching*

The cultivation and promotion of professional quality should be integrated into experimental and applied practical teaching, but it also needs to be conducted independently. According to the training objectives and requirements for innovative, universities and enterprises cooperate to gather the resources of university teachers and enterprise senior engineers and carry out professional quality improvement courses. It not only shapes the students' concept of family and country, strengthens the awareness and concept of environmental protection, energy conservation, safety and efficiency from a macro perspective. But also from a micro perspective, it focuses on the development needs of the mechanical industry, solve the problems in mechanical engineering, and help the transformation and upgrading of the mechanical industry and high-quality development.

## **3.3 Reform of practical teaching evaluation**

The reform mechanism of practical teaching evaluation of mechanical engineering specialty is shown in Fig. 2. Combined with the current environment and the characteristics of mechanical engineering specialty, the practice teaching evaluation implements a multi-dimensional and multi-subject evaluation mechanism. The evaluation subjects include universities, enterprises, and the integration of the two to comprehensively and reasonably evaluate students' practical teaching quality. The evaluation of practical teaching highlights the engineering and practice application and the enterprise occupies the main evaluation position. At the same time, the evaluation of practical teaching highlights the leading position of professional quality supplemented by the theoretical nature. According to the content and characteristics of practical teaching, each assessment subject independently establishes assessment scoring points, highlights the student central position and conducts comprehensive evaluation on students to guide students to have a clear understanding of their knowledge level, practical ability and comprehensive

professional quality, and provide meaningful reference for their academic, career and life planning.

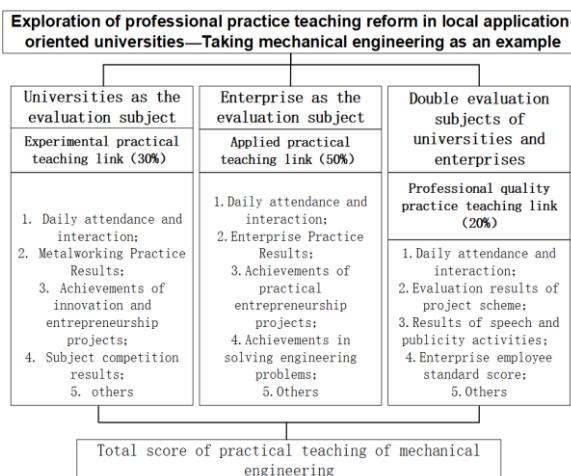


Fig. 2. Reform of practical teaching evaluation for mechanical engineering.

## 4 Safeguards measures for the practical teaching reform

### 4.1 Strengthen the guidance of colleges and universities and build a quality supervision guarantee system

Adhering to the student-centred principle and taking the main responsibility of universities, a multi-dimensional and dynamic quality supervision and guarantee system for practical teaching should be built. The quality supervision guarantee system mainly includes organization and management mechanism, training scheme, assessment mechanism, curriculum resources, teachers, practice resources, etc. At the same time, a dynamic optimization mechanism should be established to give full play to the guidance, supervision, regulation and incentive effects of the quality supervision and security system, and effectively improve the comprehensive professional ability and quality of students. Finally, the quality supervision and guarantee system should be formulated to ensure that the quality supervision and guarantee system is effectively implemented and the application effect is fed back in real time. That can furtherly ensure that the quality supervision and guarantee system is suitable for practical teaching.

### 4.2 Deepen the mode of industry university research cooperation, enrich and improve practical teaching resources

Using the relevant policies of governments at all levels, local application-oriented universities should formulate positive policies to promote industry-university cooperation. And it can let enterprises come in and teachers go out to improve teachers' scientific research level and research ability. In turn, it can feed back

teaching and improve teaching quality. At the same time, the practical engineering cases are integrated into the practical teaching system to build rich teaching resources. In addition, universities can encourage enterprises to establish an industry-university-research cooperation practice base for reforming the student practice teaching mode. And research education projects can be set up to promote the focus and support of industry-university-research cooperation on learning and help cultivate qualified application-oriented talents for mechanical engineering.

### 4.3 Based on the epidemic situation environment, build an online training system for practical teaching

Based on the current epidemic situation environment, it is urgent to explore a new mode of teaching and learning for practical teaching. With the application of virtual reality technology in teaching, virtual simulation platform established by college-enterprise cooperation can be utilized to build an online training system. By using the professional knowledge (such as 3D modelling technology, computer network technology, VR technology, etc.), the online curriculum resources for practical teaching can be established. At the same time, students can participate in the establishment of online course elements, learn in the teaching link and improve their professional ability in the learning link. In addition, it should actively connect with external excellent resources and platforms, introduce new technologies and equipment, innovate curriculum concepts and construction models. That is beneficial to build a high-level information platform, serve practical teaching and improve teaching quality.

## 5 Conclusions

The reform of professional practice teaching is an important way to promote local application-oriented universities to achieve the goal of talent training. At the same time, it is also the internal demand for the development of mechanical industry and mechanical engineering specialty. By taking mechanical engineering as an example, the necessity and significance of practical teaching reform has been illustrated. The reform contents of practical teaching have been explored from three aspects of experiment, application and professional quality practice teaching reform. Moreover, effective measures have also been proposed to ensure the successful implementation of the practical teaching reform. This study can enrich the teaching content, broaden the teaching methods, improve the evaluation methods and optimize the safeguard measures for professional practice teaching. And it can effectively improve the quality of professional practice teaching for local application-oriented universities.

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