



Exploration on Teaching Reform of Mechanical Innovation Design based on OBE Concept

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Abstract. On the basis of analyzing the teaching status quo of "mechanical innovative design" course, based on the concept of OBE, the reform measures of this course are proposed, and the points for attention in teaching reform are pointed out, so as to guide students to learn independently and effectively, so that students can really learn to innovate ideas, and then improve their innovation ability.

Keywords: mechanical innovative design; OBE concept; Reform measures

1 Instructions

In 2015, The State Council successively issued two important policies: the Made in China 2025 Plan and the Opinions on Several Policy Measures to Vigorously Promote Mass Entrepreneurship and Innovation. The two complement each other, and the "Made in China 2025" strategy focuses on enhancing the innovation capacity of the country's manufacturing industry. Pursuing this strategy will not only make the manufacturing sector stronger, but also bring more opportunities for mass entrepreneurship and innovation. Under the promotion of the background of mass innovation and national policies, the mechanical majors of colleges and universities should focus on innovation to carry out curriculum reform, and train innovative high-skill talents to adapt to social and economic development.^[1]

As a professional basic course to cultivate students' innovative thinking and innovative ability, "Mechanical Innovation Design" has the characteristics of foundation, flexibility, practicality and innovation. The main teaching goal of the course is to cultivate students' divergent innovative design thinking, effectively understand and master the concept of innovative design, and learn and master the content of each link of mechanical innovative design with high quality. This paper aims to change the traditional teaching mode, explore a new way to train students' innovative design ability, improve students' theoretical level, practical ability and professional quality, and improve teachers' professional ability and technical level. This is of great significance for improving the whole curriculum system and improving students' innovation awareness and ability, and is also conducive to the smooth implementation of "Made in China 2025".^[2,3]

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Based on the "Washington Agreement" and engineering Education certification of OBE (Outcome Based Education), the teaching concept of "output orientation", "student-centered" and "continuous improvement" is emphasized throughout the talent training process. The OBE education model does not prescribe specific teaching or assessment methods, but emphasizes that the curriculum system, practical opportunities, and assessment methods should help students achieve defined output goals. The output-oriented OBE education model requires that every link of talent training revolves around the output goal, and every student should reach a certain goal at the end of learning.^[4]

2 Teaching status of mechanical innovation design course

2.1 The educational content of the course lags behind, students do not understand deeply, and they will not apply it after learning

Generally speaking, "Mechanical Innovation Design" is offered in the first half semester of the third year of mechanical majors. At this time, students lack engineering theory knowledge, practice experience and feel abstract about mechanical knowledge. Meanwhile, teaching hardware equipment has been aging for many years, so teachers cannot combine theory with practice well. Therefore, for most of the students in class, they think that the teaching content is too much and can not form a scientific system in their minds, leading to the phenomenon that learning is not deep and learning will not be used after learning. Therefore, the original understanding of the knowledge of the students, the enthusiasm of learning will decline rapidly, resulting in more class to play mobile phones, low head rate of the situation, it is more difficult to improve the learning effect in the long run.^[5,6]

2.2 Active teaching is the main teaching method, and less communication between teachers and students leads to poor learning effect

At present, most colleges and universities use the traditional classroom teaching method. Teachers take the initiative to teach on the platform, and students passively accept the course content. The content of the study is mainly conclusive knowledge, lack of self-thinking and innovation ability training. The teaching methods and contents of the course are basically the same, and there is no difference.

At the same time, the teaching method and system of this course are not perfect. The lack of systematic and scientific teaching resource system of mechanical innovation design course seriously restricts the effect of students' interactive learning, independent learning and inquiry learning. The traditional teaching method affects the communication between teachers and students, thus restricting the longitudinal extension and development of the mechanical innovation design discipline, and ultimately leads to the unsatisfactory improvement of students' comprehensive quality and ability.

2.3 The experimental hardware and software equipment are obsolete, and the ability training of students is limited

The teaching of mechanical innovation design in different colleges and universities according to their experimental equipment conditions leads to differences in students' learning and understanding of innovation. Due to insufficient funds or backward teaching reform ideas, some schools still use outdated experimental hardware and software equipment, making students still learn the innovative ideas and methods of more than ten years ago, unable to keep up with the pace of social development, which limits their ability cultivation and vision expansion. In addition, although the traditional curriculum teaching has many advantages, there is a big problem: the teacher-centered, ignoring the students' independent learning. Teachers usually use instillation teaching in class, and students are mostly in a passive state of acceptance and lack of opportunities to participate in teaching activities, which leads to the suppression of students' creative, critical and divergent thinking. At the same time, learning mechanical innovative design is an important link in the transition from theory to practice. However, in actual teaching, most of the content is only operated according to the instruction manual, and students still stay in the form of rote learning, without really mastering hands-on practice and innovation ability, unable to solve real engineering problems, and thus unable to comprehensively improve students' comprehensive ability. Finally, most schools still evaluate students' performance mainly through the final examination results, and the peacetime results are rarely involved, failing to introduce the assessment of innovation ability. This evaluation method can not objectively and comprehensively reflect the students' innovation level and learning attitude, and ultimately affect the enthusiasm and initiative to stimulate students' creative learning.

3 Curriculum reform measures

3.1 Comprehensively integrate teaching content, reform teaching methods, and cultivate students' innovative ability

(1)Reconstructing the course content with the work process as the orientation, so that students can get closer to the actual work scene, understand the work process and be able to practice the application.

(2)Carry out teaching activities according to the application-oriented mode, pay attention to training students' practical operation ability, and provide relevant case analysis and demonstration while learning theory.

(3)Practice teaching based on the platform of Huiyu, Explorer and tracked robot, and use project-type case teaching to help students apply the theoretical knowledge to practical projects.^[7]

(4)Combine theoretical teaching, practical teaching, enterprise projects and professional competitions in the design of teaching content. The combination of theory and practice makes the teaching content more modular, and students can choose their own course content to learn according to their interests and abilities.

(5) Change the traditional teacher-led teaching mode and guide students from passively listening to actively engaging. From information consumers to knowledge creators. Encourage students to communicate and share with each other, and change the dominant mode of "I talk" to "you talk".^[8-10]

(6) The teaching content is reconstructed according to the composition of the machine and the scheme design process of the mechanical system and the motion system, and the design process generally adopted by enterprises is introduced. To help students understand the design methods and processes commonly used in practical work.

(7) Set up application-oriented course modes in different situations, such as manually controlled machines (commonly used combinations of mechanisms), automatically controlled machines and intelligently controlled machines. Cultivate students' ability to solve different problems through the setting of different situations.

(8) Integrate on-campus, provincial and national competitions and enterprise cross-sectional topics to make the curriculum closer to practical application. Provide training on relevant competitions and topics to cultivate students' hands-on ability, practical ability, application ability and innovation ability.

3.2 Integration of multiple teaching methods

(1) Combination of theory and practice.

In order to break the conventional teaching mode and let theoretical courses enter the laboratory, we take specific projects as the carrier to guide teach. Classroom teaching will take the teacher talk → students do → students talk → teacher talk cycle mode, so that learning content step by step, ability requirements gradually improve. The specific teaching methods are as follows:

The traditional innovation lab curriculum has its limitations because the lab models are one-dimensional and disconnected from real-world equipment. In order to solve this problem, we need to integrate the teaching system, for example, the innovative linkage mechanism and the kinematics of the point into a module. Through experiments, students can not only familiarize themselves with more innovative models, but also have access to various types of mechanism equipment and apply innovative theories to the mechanical industry. This can improve the learning effect and improve the quality of students.

In order to facilitate the development of the practical training course of mechanical innovation design, the university has purchased a series of experimental equipment related to the practical training of mechanical innovation design, such as the creative combination of institutions and the dynamic parameter test bench. These devices not only allow students to physically build the designed institutions, but also are equipped with relevant simulation software, which can be simulated and constructed through virtual simulation first. Verify the rationality of the design mechanism.^[8]

(2) Do blended teaching.

Student-centered, learning-oriented, ability-oriented, and artisan spirit.

(1) Heuristic learning: Through the cases of enterprises and the "Internet + Made in China 2025" product-education integration innovation base, cultivate students' ability to consult literature and express themselves.

(2) Discussion learning: students are free to form experimental groups, choose their own projects to learn, and cultivate team cooperation ability.

(3) Open learning (second class) : students choose the teaching content and experiment time and place independently, integrate the design themes of interest groups, academic fund projects, provincial innovation training projects, and professional competitions inside and outside the school into classroom teaching, and pay attention to cultivating students' comprehensive quality and innovation ability.

(4) project-based learning: students choose appropriate course modules according to their own abilities, use modern information technology to cultivate professional abilities, and carry out hierarchical teaching through video, QQ, micro-lessons, platforms and other methods.

(5) The combination of online and offline teaching methods: according to the classification of problems in the teaching process, it adopts concentrated explanation, consolidation and improvement, summary and improvement, etc., to help students master the knowledge from simple to deep in an efficient teaching class.

Through the application of a variety of teaching methods, students' autonomy and enthusiasm are improved, which stimulates their enjoyment of learning and cultivates their learning ability to analyze, solve and pose problems.

(3) Integrate thinking and politics into the curriculum.

Integrating ideological and political elements is an inevitable requirement for cultivating talents with both morality and ability and guiding students to form correct values. This course will focus on cultivating the ideological and political elements such as the major instruments of a great country, the spirit of artisans of a great country, the spirit of science and traditional culture. At the same time, we also encourage students to pay attention to the development of science and technology, have the courage to root in basic knowledge, cultivate the spirit of craftsmanship and innovation, and stimulate students' mission of science and technology to serve the country.

3.3 Diversification of course evaluation methods

The assessment method based on OBE should be combined with the corresponding learning objectives, mainly evaluate the degree of students' learning achievement under the corresponding learning objectives, and focus on the evaluation of students' practical ability, practical ability, application ability and innovation ability. At the same time, the combination of process evaluation and summative evaluation is adopted.

(1) Teacher assessment mainly: Assessment is carried out for basic projects and application projects, and assessment elements are set by means of student reporting,

answering questions, and project presentation, so as to improve students' theoretical knowledge application, programming debugging, and innovation abilities.

(2)Project assessment mainly: Conduct assessment for comprehensive projects and extended projects, adopt the mode of independent learning, and evaluate students' ability to write experiment reports, make project PPT and report through the way of achievement presentation.

(3)Combine enterprise skills competition with course assessment. The professional skills competition named by the enterprise is combined with the classroom teaching content, and the enterprise engineers teach, preach and participate in the question, and the students participate in the competition in a team way. Finally, the results of the competition will be included in the final assessment to improve students' professional skills.

(4)Take projects as the carrier to carry out extensive extracurricular innovation practice and improve students' engineering literacy. Students are not lacking in basic theoretical knowledge and can complete the design according to theory.

Through the above multi-dimensional assessment mechanism, the students are comprehensively evaluated. Through these teaching and evaluation methods, we will ensure that every student is able to learn, apply knowledge, and improve their competitiveness in the future.

4 Points for attention in the teaching reform of Mechanical Innovation Design

The previous research has elaborated the problems in the teaching process of mechanical innovative design course and the specific reform implementation strategy. However, in order to achieve better teaching results and make students really master the knowledge of innovative ideas, we should pay attention to the following problems:

(1)Encourage teachers to dig and research deeply. At present, many universities favor scientific research and give less reward to teaching. Therefore, it is necessary to carry out system reform to organically combine course teaching with professional title evaluation and financial rewards. In this way, teachers can be guided to devote more energy to classroom teaching, which is conducive to students' knowledge learning.

(2) Cultivate students according to their interests. The current curriculum education reform tends to be fewer but more concentrated, to compress the curriculum while ensuring the quality of teaching. Students have less class time, so learning activities need to be tailored to each student's interests. Adding a variety of after-class teaching activities will help improve students' interest in learning and their ability to study independently.

(3)Strengthen the construction and development of interdisciplinary and multi-field resources. Improving students' knowledge learning in multi-disciplinary fields will help cultivate their practical ability and provide broad imagination space for the study of other courses.

5 Conclusion

In the teaching of mechanical innovative design, teachers should explore new education and teaching methods according to the industrial background and talent needs of the new era, introduce relevant innovative competitions, let students actively participate in provincial and national competitions, realize knowledge reconstruction and innovation, promote teaching reform, and improve the quality of mechanical engineering talents.

People-oriented, comprehensive training, through project-based teaching, comprehensively improve the teaching theory, model and evaluation methods, improve the level of professional construction

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