

# Exploration on Teaching Reform of Mechanical Design Course under OBE Concept

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**Abstract:** The concept of OBE emphasizes the results of learning and students' practical ability, and regards students' knowledge, skills and qualities as the core of evaluation, not just the mastery of curriculum content. Under this concept, the teaching of mechanical design course is no longer limited to imparting theoretical knowledge, but pays more attention to cultivating students' comprehensive quality, innovative ability and practical experience. Based on this, this paper explores the teaching reform of mechanical design course under OBE concept, analyzes the significance of teaching reform of mechanical design course under OBE concept, expounds the teaching reform of mechanical design course under OBE concept, and gives the teaching reform strategy of mechanical design course under OBE concept, with a view to promoting the forward step of mechanical design education through this research.

**Keywords:** OBE concept; Mechanical design; Teaching reform

## 1. Introduction

As a core discipline in engineering field, mechanical design bears the mission of training engineers. However, with the continuous development of science and technology and social changes, the traditional mechanical design course is facing many challenges in meeting the needs of students and social challenges. In order to meet the needs of the new era, the educational circles pay more and more attention to how to improve the course of mechanical design, so as to make it more targeted and practical application value. Under this background, OBE concept emerged and became a powerful driving force to lead the teaching reform of mechanical design course.

## 2. The significance of teaching reform of mechanical design course under OBE concept

The significance of teaching reform of mechanical design course under OBE concept is embodied in the following aspects:

### 2.1. Improving students' comprehensive quality.

The concept of OBE focuses on cultivating students' comprehensive quality, emphasizing the practical application of learning and the ability to solve problems. In the course of mechanical design, students not only need to master theoretical knowledge, but also need to be able to apply the knowledge to practical engineering projects. Through the teaching reform of OBE concept, students will easily acquire interdisciplinary knowledge, such as mathematics, physics, materials science, etc., so as to better solve complex mechanical design problems.

### 2.2. Cultivate innovative ability.

The field of mechanical design needs constant innovation to meet the changing needs and challenges. The course of mechanical design under the OBE concept emphasizes the cultivation of students' innovative ability and encourages them to put forward new design schemes and solutions. This will help foster creative thinking and enable students to become agents of innovation in their future careers.

### ***2.3. Strengthen practical experience.***

The concept of OBE emphasizes the practical application of learning, and mechanical design courses can achieve this by providing more practical experience. Students can participate in projects, experiments and internships, so as to gain real-world experience. This will not only help students transform theoretical knowledge into practical skills, but also enhance their professional competitiveness.

### ***2.4. Enhance the ability of autonomous learning.***

The concept of OBE encourages students to actively participate in the learning process and cultivate their autonomous learning ability. In the course of mechanical design, students can be asked to make study plans, research projects independently, and solve problems by themselves. This will help them develop the habit of active learning and lay the foundation for lifelong learning.

### ***2.5. Improve the quality of teachers' education.***

The concept of OBE requires teachers to make clear their learning objectives, evaluation methods and teaching strategies. This will force teachers to constantly improve teaching methods to ensure that the curriculum is consistent with learning objectives. At the same time, teachers will pay more attention to students' learning process, give timely feedback and help students solve problems, and improve the quality of education.

### ***2.6. Enhance social influence.***

The teaching reform of mechanical design course not only affects students and teachers, but also has a positive impact on society. Cultivating engineers with comprehensive qualities and innovative abilities will help solve various challenges facing society, such as sustainable development, energy efficiency and environmental protection. This will create more value for society and promote scientific and technological progress and economic development.

## **3. The teaching reform of mechanical design course under OBE concept**

### ***3.1 The guidance of learning methods is not in place***

Under the concept of OBE, the teaching of mechanical design course pays attention to the output effect, which requires students not only to understand the theories, but also to be able to use these theories to carry out practical mechanical design. However, "the guidance of learning methods is not in place" is a problem that can not be ignored under this teaching mode. On the one hand, the guidance of learning methods is directly related to students' autonomous learning ability. In the traditional teaching mode, students often rely on teachers' teaching, while under the OBE concept, students need to study independently and exploratively. If teachers fail to provide effective guidance on learning methods, students may fall into blind and aimless learning state, resulting in low learning efficiency and difficult to achieve the expected learning effect. On the other hand, without proper learning methods, students may lack strategies and methods to solve problems when they encounter difficulties, which leads to low learning morale and even fear of difficulties in mechanical design [1].

### ***3.2 The integration of practical links is not in-depth***

At present, "the integration of practice links is not deep" in the teaching process has become an important bottleneck restricting the quality of students' training. This problem is mainly manifested in the following aspects. First, the isolation between practice and theoretical teaching has not been effectively broken. In many teaching situations, theoretical teaching and practical operation are carried out separately. This teaching mode makes it difficult for students to apply knowledge to practical operation immediately after theoretical study, which leads to students often feeling "knowing what they want but not knowing why" in practice. Secondly, there is a lack of real engineering background in practical teaching. Mechanical design is not only a simple drawing or model operation, but also needs to be carried out in the real engineering background. The current practice teaching often stays in the simple simulation operation, lacks the excavation and the solution to the real engineering problem, causes the student to

appear to be unable in the face of the real engineering problem. Thirdly, the lack of resources input in practice is also a problem that cannot be ignored. High-quality practical teaching needs sufficient hardware resources and software support. However, in reality, due to various reasons, many teaching units cannot provide enough resources to support practical teaching, which leads to students often facing problems such as insufficient equipment and incomplete data in practice.

### ***3.3 The feedback link does not respond quickly***

Under the framework of OBE, feedback is regarded as an important link to measure teaching achievements and guide students' autonomous learning. However, "the feedback link does not respond quickly" has gradually become the obvious crux of this mode. This problem is mainly reflected in the following aspects. First of all, compared with the traditional teaching mode, OBE pays attention to students' learning achievements, which requires teachers to give feedback to students' learning performance in time to help them find their own shortcomings and make improvements. However, in real teaching, due to heavy teaching tasks, large number of students and other reasons, it is difficult for teachers to provide detailed and targeted feedback for each student in a short time, which leads to students being unclear about their learning state for a long time. Secondly, "the feedback link does not respond quickly" may also lead to the decline of students' learning motivation. Under OBE mode, students' learning depends more on autonomy and initiative. If students encounter confusion in learning, but they can't get answers for a long time, then students' interest and motivation in learning will probably be hit, resulting in poor learning effect. Finally, timely feedback is not only a guide to students, but also a test of teachers' teaching methods. If students' feedback is not received for a long time, it is difficult for teachers to adjust their teaching strategies, which leads to the disconnection between teaching methods and students' needs and affects the overall teaching effect. "Feedback link does not respond quickly" has become an important obstacle in the teaching of mechanical design course under OBE concept. In order to give full play to the role of feedback, educators and teaching units need to reflect and optimize the feedback mechanism in depth to ensure that feedback can really guide and promote learning.

### ***3.4 The evaluation mechanism is unreasonable***

In the teaching of mechanical design course, "unreasonable setting of evaluation mechanism" gradually emerges as a prominent problem, which has an influence on the overall teaching effect that cannot be ignored. The embodiment and consequences of this problem are quite obvious. First, the traditional evaluation mechanism relies too much on the final exam results, and this single evaluation model is difficult to comprehensively and accurately reflect the students' real learning achievements in the mechanical design course. Mechanical design involves not only theoretical knowledge, but also practical operation and the cultivation of innovative ability. It is difficult to cover these diversified contents by simple written test evaluation method, which easily leads to students' emphasis on rote memorization of theoretical knowledge and neglect the cultivation of practical operation and innovative thinking. Secondly, the current evaluation mechanism lacks the evaluation of students' teamwork, communication and ability to solve practical problems. In the field of mechanical design, teamwork and communication skills are often as important as personal professional skills, but they are often marginalized in evaluation, which leads to students' poor cooperation with teams and insufficient communication skills in practical work. Third, the assessment mechanism of students' practical operation ability and innovative design is not enough, which directly leads to students' attention to these contents in the learning process. The core of mechanical design lies in innovation, and without the evaluation of innovation ability, it is difficult to cultivate students' core literacy. Fourthly, the unreasonable setting of evaluation mechanism may also lead to the damage of students' learning motivation. If students feel that they have made great efforts in a certain area but have not been evaluated accordingly, they may feel frustrated in their study in this area, thus affecting their overall learning enthusiasm.

## **4. The teaching reform strategy of mechanical design course under OBE concept**

### ***4.1 Extension Training of Reinforcement Learning Strategies***

In the process of promoting teaching reform, strengthening the popularization and training of learning strategies has become a key link. This is because the traditional teaching mode is often unable to meet the diversified and practical requirements of the current mechanical design field. The promotion and training of learning strategies aims to help teachers and students cope with this change more efficiently. To

achieve this goal, educational institutions can organize professional seminars and invite experts and scholars with rich OBE teaching experience to share their successful experiences and strategies. Through in-depth discussion and communication, teachers can understand the latest teaching concepts, methods and tools, so as to better adjust their teaching strategies. In addition, digital and networked resources also provide a broad space for the promotion and training of learning strategies. Educational institutions can develop special online courses to show and explain various effective learning strategies. This not only allows teachers to learn anytime and anywhere, but also provides a platform for them to communicate and share with their peers. Combining on-site training with online learning, educational institutions can provide teachers with continuous professional development opportunities. In this way, teachers can not only constantly update their knowledge system, but also integrate learning strategies into daily teaching, so as to better serve students and promote the teaching reform of mechanical design course under the OBE concept.

#### ***4.2 Enhance the combination of practice and theory***

The combination of practice and theory is the core requirement in the course of mechanical design, and every educator should think deeply about it. In teaching methods, teachers can adopt the project-oriented teaching mode, and introduce real engineering problems into the classroom, so that students can deeply understand and master the basic theory of mechanical design in the process of solving specific problems. In addition, the course content can also be regularly communicated with industry experts to ensure that the theoretical knowledge taught is consistent with the actual needs of the current industry. In order to enable students to experience the application value of theoretical knowledge in actual operation, educational institutions should increase investment in laboratories and experimental equipment, build a first-class experimental environment, and regularly update experimental equipment and tools to ensure that students can practice in advanced experimental environment. At the same time, educational institutions can also establish close cooperative relations with enterprises, carry out school-enterprise cooperation projects, and provide students with internship and practice opportunities. Teachers should also make full use of digital and networked tools in the teaching process, such as virtual simulation, three-dimensional modeling and other technologies, so that students can carry out practical operation without physical objects. This can not only help students understand the complex principles of mechanical design more intuitively, but also cultivate their innovative thinking and ability to solve practical problems. In order to ensure that students can truly realize the combination of practice and theory in the curriculum, educational units should also strengthen the examination and evaluation of students. Besides the traditional written test and report, they can also add evaluation methods such as practical operation, design competition and team cooperation project to ensure that students can truly apply the theoretical knowledge they have learned in practice.

#### ***4.3 Improve the real-time performance of feedback mechanism***

Teaching feedback is not only the evaluation of students' mastery of knowledge, but also the communication bridge between teachers and students. Real-time feedback can help students find their own shortcomings in time and adjust their learning strategies; At the same time, it can also provide teachers with direct feedback on teaching effect and guide them to adjust teaching methods. To achieve this goal, educational institutions can introduce modern information technology means, such as intelligent teaching management system, online evaluation platform and so on. These tools can provide teachers with timely analysis of students' learning data, so that they can more intuitively understand each student's learning progress and confusion, thus providing more personalized and targeted teaching guidance. In addition, educational institutions can also organize regular teaching feedback meetings to encourage students, teachers and education administrators to participate together [2]. At the meeting, students can directly reflect their confusion and needs in the learning process, and teachers can also know the effect of their teaching methods in time, so as to adjust their teaching strategies. Equally important, educational institutions should encourage students to actively participate in the process of teaching feedback, and cultivate their habit of actively seeking feedback and actively communicating with teachers. For example, study groups can be set up, and each group regularly shares and feeds back to encourage students to learn from each other and communicate with each other. Improving the real-time performance of feedback mechanism is a comprehensive problem involving many factors, which requires the joint efforts and exploration of educational institutions, teachers and students. However, as long as the feedback is real-time and effective, it can provide strong support for the teaching reform of mechanical design course, promote the teaching methods to keep pace with the times, and cultivate more excellent students [3].

#### 4.4 Optimize the formulation standard of evaluation system

In the teaching reform strategy of mechanical design course under the concept of OBE, it is very important to optimize the formulation standard of evaluation system. An accurate, fair and forward-looking evaluation system can better reflect students' learning progress, skill mastery and practical application ability, thus providing educators with more accurate teaching feedback and guidance. The formulation of evaluation system should first consider its fit with OBE teaching objectives. Under the guidance of OBE concept, the teaching goal of mechanical design course should focus on students' practical ability and application skills, not just the mastery of theoretical knowledge. Therefore, when formulating the evaluation system, we should pay attention to the evaluation of students' practical operation, design thinking and innovative ability. New technologies and new ideas continue to emerge in the field of modern mechanical design, and the evaluation system should have certain flexibility and be able to adapt to the changes of technological development and industry needs. For example, the latest design software application, the selection and application of new materials can be introduced into the evaluation to ensure that students master the most cutting-edge design skills. Similarly, the formulation of the evaluation system should fully consider the diversity and individual differences of students. Different students may stand out in different aspects. The evaluation system should provide diversified evaluation criteria, which can not only assess students' basic skills and knowledge, but also highlight students' advantages and specialties in specific fields. In order to ensure the fairness of the evaluation system, a third-party evaluation mechanism can be introduced. This can eliminate the subjective components in teacher evaluation and improve the objectivity and accuracy of evaluation. At the same time, the evaluation system is regularly checked and revised to ensure that it is always consistent with the teaching objectives and industry development. When formulating the evaluation system, it is particularly critical to cooperate with the industry. Inviting industry experts to participate in the formulation of evaluation criteria can ensure that students' skills and knowledge match the needs of the industry and increase their employment competitiveness after graduation. Optimizing the standard of evaluation system needs many considerations and efforts. Only in this way can the evaluation system truly reflect students' learning achievements and provide strong support for the teaching reform of mechanical design course [4].

#### 5. Conclusion

The teaching reform of mechanical design course under the OBE concept is an important exploration for training more competitive and adaptable engineers. It is not only related to the quality of education, but also related to the development and progress of society. Through unremitting efforts, we can give full play to the advantages of OBE concept, inject new vitality into mechanical design education, train more engineering innovators and promote the sustainable development of engineering field. The success of this exploration will pave the way for the future mechanical design education, make it more suitable for the needs of the times, and create more value for students and society.

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