

The Teaching Method of Theoretical Mechanics Course Based on OBE Concept

Xiaomin Shan*

*College of Engineering, Inner Mongolia Minzu University, Tongliao 028000, Inner Mongolia,
China*

135351125@qq.com

**corresponding author*

Keywords: OBE Concept, Theoretical Mechanics Course, Teaching Method, Ability Improvement

Abstract: The traditional teaching method of theoretical mechanics course pays too much attention to knowledge transfer and does not pay attention to the students' learning experience, which makes the students' creative thinking not developed. Therefore, the teaching based on the OBE concept in this article is to improve the shortcomings of previous education and implement a student-centered teaching method for the development of social talents for the overall development of students' abilities. In a school, using this teaching method to conduct progressive interviews with students teaching theoretical mechanics, it was found that 75.44% of the students believed that the teaching method could expand their knowledge of theoretical mechanics, 73.68% of the students thought it could improve their expressive skills, and 85.96% of the students thought It can promote cooperative learning among students, etc., which shows that the teaching method of theoretical mechanics based on the OBE concept can promote the improvement of students' ability.

1. Introduction

The theoretical mechanics course teaching based on the OBE concept is a new type of teaching method, which redefines the position of teachers in the teaching process. Teachers should be the leaders of students' learning, guide students to think independently, solve problems, and help students develop autonomy Learning habits, so as to achieve the best learning effect.

Many scholars at home and abroad have conducted in-depth research on the teaching methods of theoretical mechanics based on the OBE concept, and have achieved good research results. For example, in terms of the construction of theoretical mechanics courses, a scholar conducts in-depth thinking based on the OBE concept, and through the "reverse design" of the courses, it is clear that the expected effects of each course and each lesson are achieved in the final learning output. The degree of contribution made. At the same time, in the course design, the content of professional

ethics education, autonomy and self-discipline education, etc. are integrated into the theoretical mechanics curriculum, and the humanistic literacy is cultivated on the basis of emphasizing professional skills [1]. A scholar uses the OBE concept to carry out the study evaluation design of theoretical mechanics courses. The course design based on the OBE concept focuses on training students' comprehensive coordination ability and engineering practice ability, and improves the multi-faceted ability of high-efficiency students to promote their comprehensive development [2]. Although the performance library of the theoretical mechanics course teaching method based on the OBE concept has achieved good results, colleges and universities have not generally used this theory for teaching.

This article describes an overview of the OBE concept, emphasizing the student-centered teaching process, and then discusses the teaching method of theoretical mechanics based on the OBE concept, and then implements the theoretical mechanics based on the OBE concept in a college electromechanical major through interviews. Curriculum teaching conducted a teaching effectiveness survey to prove that the OBE concept can help students develop in all aspects in theoretical mechanics teaching.

2. OBE Concept and Teaching Method of Theoretical Mechanics Course

2.1 Concept and Characteristics of OBE Concept

The ultimate goal of OBE theory is to improve learning outcomes. In order to promote student learning, teaching evaluation standards have been inverted so that teachers can optimize and reorganize teaching content, and change the way to assess the impact of students' learning to improve the quality of learning [3]. Traditional education focuses on how teachers impart knowledge to students, which will inevitably affect the effectiveness of teaching. It is difficult for the talents that emerge in the end to adapt to the ever-changing environment of social industries. OBE's educational philosophy solves the shortcomings of traditional education, but focuses on students' experience in the learning process [4]. Focus on the analysis from the following points:

(1) Compared with the current stage, pay more attention to the future. OBE's educational philosophy is more about the cultivation of the quality of future students, rather than the skill level that students acquire at this stage. Theoretical mechanics education requires graduates to be able to adapt to the needs of social development. When the social industrial model changes, theoretical mechanics education can respond quickly, continuously adjust to meet the needs of the industry, and better develop high-tech that meets social needs [5].

(2) Reserve flexible space. If the OBE model does not become an anti-creative and anti-humanitarian production line, then it is necessary to find that students are not limited by characteristics, and not only deal with quality issues. The purpose of pre-determined learning results should be regarded as the minimum standard that learners must meet. Based on this, students can play to their strengths and create greater room for improvement [6]. Only by setting goals step by step, rather than blindly improving, can we leave room for students to play at will. , Use knowledge as a means to understand skill acquisition problems in a flexible and controllable way, and can grasp the control of the relationship between presupposition and generation.

(3) Improve teachers' quality. The reason for improving the quality of teachers is that, compared with the traditional education system, the OBE model requires teachers to have a higher level of knowledge, skills and teaching efficiency, so that the education can be carried out smoothly [7]. Under the OBE model, teachers should be able to set functional and detailed goals based on past learning achievements, rationally use different teaching resources, create various teaching

assessments, and fully understand the development of students.

(4) Promote sustainable development. If schools want to continue to actively promote the OBE model, they must rely on the highest ability of teachers with higher internal motivation, which is a strong pillar of the sustainable operation of the OBE system [8]. In order to increase the enthusiasm of teachers, it is necessary to create a cultural atmosphere that supports teaching and reform the evaluation of teachers' work in the system to completely correct the phenomenon of "enlightenment teaching, emphasis on teaching".

2.2 The Teaching Method of Theoretical Mechanics Based on OBE Concept

(1) Heuristic teaching method

This teaching method is that teachers effectively ask questions according to instructions and inspire students to think. Therefore, students can think about problems on their own and express their opinions, which can increase student communication and collaboration. But this method is a test of teachers' abilities, and teachers need to choose questions wisely to inspire students. That is to say, the problem of teacher selection should be around how to achieve the goal of the next cycle under the current situation, and it should be resolved by the students after discussion. To solve these problems, students should think through discussions with teachers and classmates, and finally find a way to solve the problem.

(2) Inquiry teaching method

Exploratory teaching method is a new method. In this kind of educational activities, the teacher is only a guide, without any educational theoretical explanation, only practical guidance. Let students realize independent learning through reading literature, careful observation or experimentation, and finally understand the essence or principle of things. The basic idea of this teaching method is that teachers should not only be as simple as teaching, but also be the guides of students. In addition, teachers should provide students with the required amount of materials or laboratory equipment. We all know that the proposed inquiry-based teaching method is the earliest initiative to reform the teaching method into an inquiry-based teaching method. In the inquiry-based teaching theory, it is clearly pointed out that it must be combined with scientific research methods for learning. It's far from enough, and can't let students really learn through. Students must discover problems by themselves, think about and analyze them, solve problems through experiments or consulting related materials, and finally summarize conclusions and form their own opinions [9-10].

(3) Cooperative learning teaching method

Cooperative learning teaching method is a method of collaborative learning in order to achieve specific learning goals. In collaborative learning, the teacher reasonably divides all students into groups, and in principle divides them according to gender, grades, practical ability, and theoretical knowledge mastery, so that the average level of each group is basically the same. Each group member communicates with each other, accumulates experience, and shares Study skills. In terms of assessment methods, teachers should not use individual modules as the assessment basis, but should use the group as the assessment basis to encourage mutual help among students in the class [11].

(4) Replay teaching method

The teaching method of historical reproduction is the most intuitive and simple. Through historical reproduction, students can see the past literati exploring it, review the conditions and environment at that time, and summarize in the same story. In the process of repeating it, students will not directly obtain the whole process of the scientist's exploration, nor will they repeat the

whole process of the scientist's exploration, but will experience the most critical, important, and most important steps of scientific thought and method in the scientist's exploration of things. And you can experience the clear thinking of scientists in the historical environment at that time, come up with methods of scientific inquiry, enhance confidence in scientific inquiry, and cultivate interest in scientific inquiry [12].

(5) Discuss teaching methods

The discussion teaching method is that the teacher divides the class into groups and conducts unlimited discussions on a specific topic. After the discussion within the allotted time, send a student representative to explain his or her point of view to the group. Students are generally in the position of passive receivers of knowledge and do not enjoy autonomy. According to this method, students can independently express their views on the problem. Students' thinking is no longer as limited as before. They have more opportunities and at the same time express their opinions and opinions more actively. It can be seen from this that the discussion of teaching methods makes students more proactive, more enthusiastic about learning, and more interested in acquiring knowledge.

2.3 Interview Reliability and Validity Analysis

In the process of designing interview questions, in order to ensure the reliability and validity of the results of the interview survey, relevant research was consulted to provide ideas for the design of the interview questions.

Regarding the reliability of the interview results, the Cronbach coefficient method is used. Generally, the research coefficient is above 0.6, which is considered credible. The calculation formula is as follows:

$$\alpha = \frac{M}{M-1} \left(1 - \frac{\sum_{i=1}^M \sigma_{Y_i}^2}{\sigma_X^2} \right) \quad (1)$$

Among them, X and Y are samples, σ is the standard deviation, and M is the parameter. The content validity ratio is a commonly used index of content validity. The formula is:

$$CVR = (ni - N/2)/(N/2) \quad (2)$$

CVR represents the content validity ratio, ni represents the degree of representativeness of a certain item among the participants, and N represents the total number of people participating in the evaluation.

3. Teaching Research on Theoretical Mechanics Based on OBE Concept

3.1 Research Purpose

This paper mainly investigates the teaching method of theoretical mechanics based on the OBE concept, and proves that the teaching method can satisfy the students' learning and development needs.

3.2 Research Methods

Interview method: Since the theoretical mechanics course belongs to the field of

electromechanics, 57 students from a school major in electromechanics were interviewed to conduct a satisfaction survey on the teaching method of theoretical mechanics based on the OBE concept implemented by the school.

4. Students' Investigation and Analysis of the Teaching Methods of Theoretical Mechanics Based on the OBE Concept

4.1 Basic Situation Analysis

(1) Distribution of interview samples

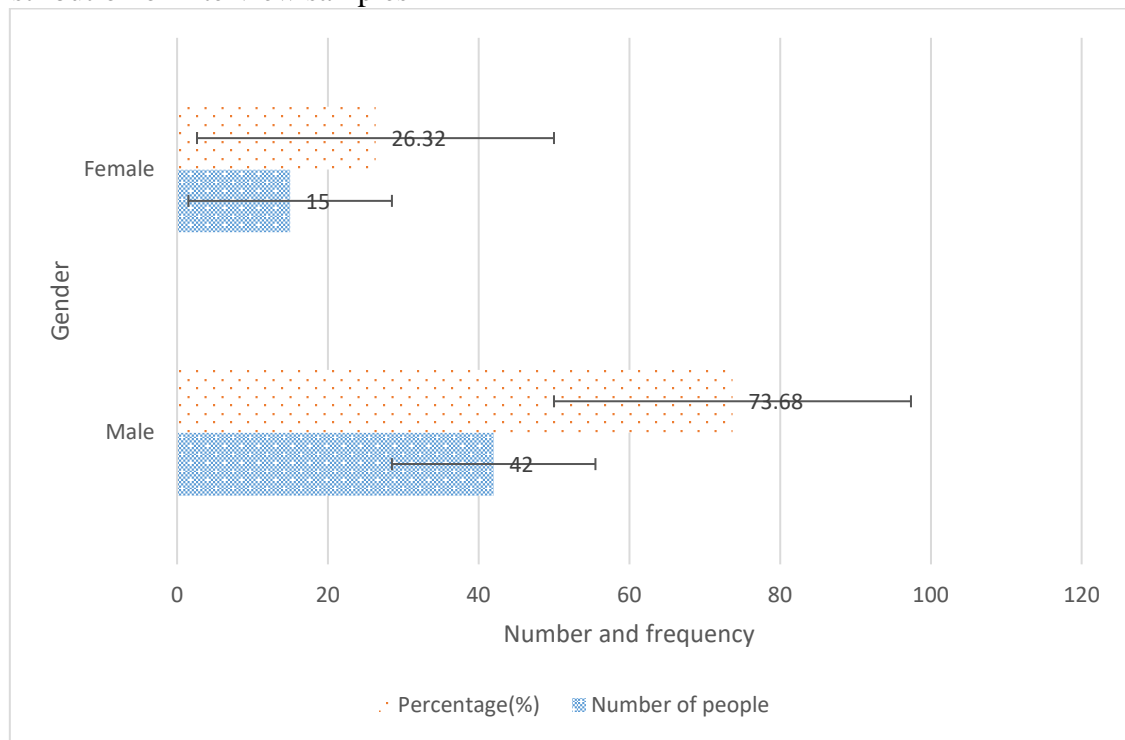


Figure 1: The number of men and women in the sample and their frequency distribution

Interviewed 57 students majoring in mechanical and electrical engineering at the school, and their gender distribution is shown in Figure 1. 42 boys accounted for 73.68% of the total number, 15 girls accounted for 26.32% of the total number. The number of boys is nearly three times the number of girls, indicating that boys love the profession more.

(2) Reliability and validity analysis of interview results

Table 1: Reliability and validity calculation results

	Reliability	Validity
Actual value	0.724	0.68
Minimum Standards	0.6	0.5

Table 1 shows the reliability and validity calculations of the interview results. The reliability value is 0.724, which exceeds the minimum standard of 0.6, indicating that the interview results have a good reliability level. The validity value is 0.68. Above the minimum standard, it shows that it has a certain degree of validity and can fully and actually reflect the results of the interview.

4.2 Achievement of Learning Effectiveness

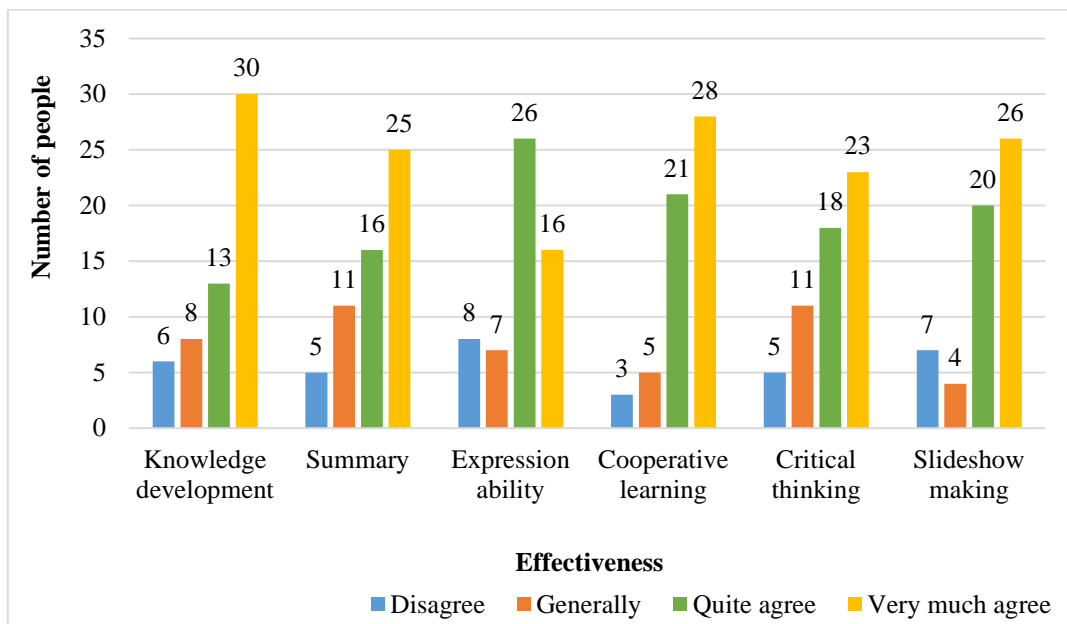


Figure 2: Analysis of the effectiveness of theoretical mechanics teaching based on the OBE concept

Figure 2 shows the achievement of 57 students on the learning effectiveness of the theoretical mechanics course teaching based on the OBE concept. In the interviews on the achievement of learning effectiveness, most students indicated that the learning effectiveness of the theoretical mechanics course can be basically achieved. Judging from the degree of recognition of the theoretical mechanics course teaching method based on the OBE concept by the students who agree and strongly agree, 75.44% of the students think that the teaching method can expand the knowledge of theoretical mechanics, 71.93% and 73.68% of the students think the teaching method can improve their ability to summarize, summarize and express. 85.96% of the students believe that the teaching method can promote cooperative learning between students, and 71.93% and 80.70% of the students believe that the teaching method can improve critical thinking skills and slide production ability. Generally speaking, the teaching method is student-centered and has achieved the promotion effect of improving students' various abilities.

5. Conclusion

Theoretical knowledge is the basis for students to learn mechanics and the theoretical basis for scientifically understanding mechanics phenomena. Students learn the concept of mechanics not only to improve their imagination and thinking ability, but also to provide a basis for students to obtain solutions to problems, which can be transferred to students to learn other knowledge. The theoretical mechanics course teaching method based on the OBE concept takes students as the main body of study. Through this form of teaching, students can improve their hands-on ability, expression ability, etc., so that students can obtain better learning results.

Acknowledgements

This work was supported by Higher Education Research Project Fund of Inner Mongolia Minzu

University.

References

- [1] Liu Feng, Shi Yongjun. *Teaching Research and Practice of Mechanical Innovation Design Practice Course under OBE Concept*[J]. *Laboratory research and exploration*, 2018, 037(010):196-200.
- [2] Qiao Z P, Gong M L, Chao H, et al. *The Content Choice and Teaching Methodology of Basic Inorganic Chemistry Course* [J]. *University Chemistry*, 2017, 32(5):7-10.
- [3] ZHONG, Xinping. *Preliminary Discussion on Application of "3W" Teaching Method in Architectural Design Course*[J]. *Journal of Landscape Research*, 2019, v.11(05):152-154.
- [4] Liu Y. *Teaching method of visual C++ programming course based on professional background*[J]. *Journal of Geomatics*, 2017, 42(5):122-126.
- [5] Saxby D J, Lloyd D G . *Osteoarthritis year in review 2016: mechanics*[J]. *Osteoarthritis & Cartilage*, 2017, 25(2):190-198.
- [6] Boudh-Hir M E, Mansoori G A. *Statistical Mechanics Basis of Macleod Formula*[J]. *The Journal of Physical Chemistry B*, 2017, 94(21):8362-8364.
- [7] Mcmeeking R M, Johnson R E. *On the Mechanics of Surging Glaciers*[J]. *Journal of Glaciology*, 2017, 32(110):120-132.
- [8] Grabowska K, Marcin Zajac. *The Tulczyjew triple in mechanics on a Lie group*[J]. *Journal of Geometric Mechanics*, 2017, 8(4):413-435.
- [9] Zhang L, Han J, Wang H , et al. *Deep Potential Molecular Dynamics: A Scalable Model with the Accuracy of Quantum Mechanics*[J]. *Physical Review Letters*, 2018, 120(14): 143001.1-143001.6.
- [10] Harry, Hilton H. *Elastic and Viscoelastic Poisson's Ratios: The Theoretical Mechanics Perspective*[J]. *Materials sciences and applications*, 2017, 8(4):291-332.
- [11] Fuji H , Qi F , Qu L , et al. *Prediction of Ligand Binding Affinity to Target Proteins by Molecular Mechanics Theoretical Calculation*[J]. *Chemical & Pharmaceutical Bulletin*, 2017, 65(5):461-468.
- [12] Miyoshi S, Kajikawa Y . *Statistical-Mechanics Approach to Theoretical Analysis of the FXLMS Algorithm*[J]. *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, 2018, 101(12):2419-2433.