

Inter-school Teaching Exploration and Practice of Material Power Based on OBE Concept

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Abstract

Under the background of COVID-19 's epidemic situation, it is necessary to carry out online inter-school teaching of material mechanics in civil engineering. Taking OBE educational idea as the guiding ideology, the exploration and practice from the aspects of online teaching form, teaching strategy, teaching design, teaching mode, examination method and so on show that the result-oriented education concept and runs through the teaching process will effectively improve the teaching effect of material mechanics.

Keywords

OBE teaching; Online intercollegiate teaching; Ideological and political teaching; Material mechanics.

1. Introduction

Introduction under the background of COVID-19 's epidemic situation, the Ministry of Education issued the guidance of the Office of the leading Group on dealing with novel coronavirus's pneumonia epidemic on doing a good job in the organization and management of online teaching in ordinary colleges and universities during the prevention and control of the epidemic. It is required to achieve the goal of "non-stop teaching and non-stop learning". To this end, colleges and universities have carried out large-scale online teaching. Material mechanics is not only an important core course of civil engineering major in colleges and universities, but also a compulsory subject for graduate entrance examination of civil engineering first-tier discipline in many colleges and universities. Under the background of home-based learning, how to effectively realize the online teaching of material mechanics based on the Internet is a great challenge to both teachers and students. Under the premise that the teaching platform and live broadcast tools are guaranteed, colleges and universities are encouraged to adopt online inter-school association, school and social association and other ways to build high-quality resource sharing courses and realize curriculum co-construction and sharing. The author believes that the intercollegiate joint teaching based on the concept of OBE can better contribute to the cultivation of learning talents who serve the society in this severe period.

2. OBE Educational Concept

Outcome-Based Education (OBE) is also known as "competency-based education, goal-based education, or needs-based education". Conceptually, OBE is a "student-centered" philosophy of education. In practice, OBE is a "learning output-based" training model that emphasizes student-centered instructional design, implementation, and evaluation with the intended learning output as the goal. Based on the OBE concept, teachers need to focus on the students, aim at the final learning outcomes, focus on the cultivation of students' abilities and qualities, and stimulate students' enthusiasm and initiative. In teaching activities, teachers need to find appropriate teaching processes, teaching designs, teaching methods, and teaching evaluations

to ensure that students achieve the desired goals [1]. OBE is a student-centered concept that allows students to learn online courses on their own and opens up a modern teaching model that is numerical, networked, and three-dimensional, which promotes the development of education and teaching reform.

3. Exploration and Implementation of Structural Mechanics Teaching Based on OBE Concept

3.1. Teaching platform and teaching method

Since all teaching activities of online teaching need to be realized through the Internet, selecting an appropriate teaching platform is the first step of online teaching. The courses of material mechanics for civil engineering majors in our school are divided into Mechanics of Materials 1 and Mechanics of Materials 2, 64 class hours each. Among them, there are 32 times of classroom teaching of Mechanics of Materials 1 this semester. According to the actual situation of the online open course of material mechanics in our school, the online teaching activities between schools can be realized through the Superstar platform. Mechanics of Materials provides students with rich teaching resources on this platform, enabling students to independently carry out inter school learning through the platform, including excellent teaching materials, quality courseware, teaching resource library, innovative experimental teaching videos and other teaching documents, to guide students to check and fill gaps and improve themselves. In addition, the advanced Internet technology can be saved in the cloud for students to watch and study repeatedly [2].

3.2. Teaching Design and Implementation

The course of Mechanics of Materials (1) is based on the practical exploration of the intercollegiate sharing teaching mode of Mechanics of Materials guided by multiple innovation (the project of Liaoning Province undergraduate teaching reform and research on high-quality teaching resources construction and sharing), and adopts the online intercollegiate teaching mode to comprehensively examine students' learning effects at all stages before, during and after class

On the basis of combining the characteristics of the material mechanics course, the assessment and evaluation method focuses on exploring the evaluation system of the reform of the assessment method of this course by means of multi-dimensional material construction, the transformation of the "teaching and learning" mode, and multi index comprehensive evaluation, and comprehensively evaluating the students' mastery of this course, that is, the distribution ratio of the usual scores, final exam scores, and experimental scores is set to 5:4:1. Among them, the evaluation links such as SPOC, classroom test, case discussion, homework after class, module test and so on are set for the ordinary performance [3]. The examination of the experimental results adopts practical and virtual two-way examination as an important evaluation index for the final examination. The new evaluation method pays more attention to the assessment of students' learning process, so that students can maintain the timeliness and purpose of learning throughout the course learning process, optimize innovative thinking, and achieve students' enthusiasm for learning material mechanics and the teaching objectives of material mechanics. The evaluation links and objectives of score distribution and assessment are shown in Table 1.

Table 1. Assessment Steps and Objectives of Each Part

Evaluation items	Evaluation link	Evaluation contents and objectives
Normal performance (40 points)	Self study SPOC before class; Classroom test and case discussion; After class assignments and module tests	<p>1. The assessment of the independent learning part before class to test the effect of offline independent learning of students. The main contents include the frequency and quality of offline observation courses, the completion of task points, pre class preview and pre test of courses.</p> <p>2. The assessment of classroom performance, including classroom tests, discussions, etc., comprehensively assesses students' on-site listening effect, problem-solving ability, classroom reaction speed, knowledge application ability, etc. The basic ideas of case discussion include research contents, mechanical principles adopted, analysis ideas, analysis process, formula derivation, numerical calculation, conclusions, etc. The subject of case analysis is open and free, and students can consult and complete the data in any way, so as to fully exercise students' ability to collect data and apply mechanical knowledge. Classroom tests and case discussions account for 5% of the total scores respectively.</p> <p>3. The assessment of homework and module test after class to test the effect of staged learning, including the comprehensive assessment of completion degree and quality according to the scoring standard. The content of material mechanics is classified into tension, compression and shear modules, bending and torsion modules, strength theory modules and other modules, and a test is organized after each module is finished. The module assessment aims to test the students' mastery of the learned modules and reflect the problems they encounter in the learning of this module. The results of homework and module test each account for 10% of the total score.</p>
Final exam (50 points)	Closed book examination	Examining students' comprehensive application of knowledge points in each chapter is a comprehensive examination of the course, which is arranged in the final examination stage.
Experiment score (10 points)	Experiment Operation Experiment Report	<p>The course of mechanics of materials includes three experiments, including the tensile compression experiment of low carbon steel, the compression bar stability experiment, and the pure bending experiment of steel beam. The consolidation of students' theoretical knowledge, practical operation and training of experimental skills are examined, and the derivation of the theoretical system of material mechanics knowledge, the verification of formulas, and the scientificity and reliability of the measurement of material properties are verified from the perspective of experiments</p> <p>The test results will be comprehensively evaluated according to the completion, accuracy, drawing standards, format requirements and other aspects of the test project. The examination content includes explaining the experimental principle, experimental content, experimental purpose and completing the entire experimental operation process. In addition to practical operation, virtual experiment of material mechanics is also available (https://lx-lab.tongji.edu.cn/vlab/vlab.oms?omsv=list&cid=2)/</p>

3.3. Ideological and political education

Based on the online teaching mode, this time explored the ideological and political teaching process of Mechanics of Materials, and found that the teaching effect of value shaping, knowledge teaching and ability training has been achieved.

Value building. In the process of mixed teaching, the ideological and political elements related to the discipline of Mechanics of Materials, such as Chinese traditional cultural elements, national major project construction and the spirit of scientists' exploration, were integrated, which strengthened the connection between the knowledge of Mechanics of Materials and socialist core values [4]. In this way, patriotism, professional ethics, scientist spirit, craftsmanship spirit, etc. are integrated into the knowledge learning to improve the character.

Knowledge transfer. Combined with the characteristics of the course "Mechanics of Materials", we explored the ideological and political elements through various ways and completed the plan of ideological and political education [5]. In the process of classroom teaching, we should adhere to the student-centered approach, use CBL PBL and other teaching methods, through teacher-student interaction, student student interaction and other teaching methods,

organically integrate ideological and political elements into professional knowledge, conduct engineer literacy education and patriotic education in an invisible way, correct students' three perspectives, and enhance students' cultural self-confidence and professional self-confidence. Ability development. Based on the mixed teaching concept, the fundamental goal is to improve students' ability to solve complex problems and innovation ability. Through flipped classroom, discussion between teachers and students and other ways of analyzing relevant engineering cases, we should combine knowledge learning and engineering application to fully open the students' internal potential. In the process of case analysis, we consciously introduced the ideological and political education and practice of the curriculum, insisted on establishing morality and cultivating people, and cultivated high-quality, morally, intellectually, physically, artistically and comprehensively developed talents with a solid foundation, a broad caliber and a sense of social responsibility.

4. Teaching Effect of Structural Mechanics Teaching Based on OBE Concept

The evaluation of achievement degree of learning achievements is to quantify students' performance and progress in knowledge, ability and learning behavior by collecting, statistics and analyzing information such as the increase of students' relevant knowledge and skills and the change of learning input, so as to prove students' learning achievements.

The teaching plan of material mechanics focuses on the improvement of the assessment effect in the usual learning process, and presents the learning results. It has rich assessment methods and promotes the timeliness and purpose of the teaching process. Students' interaction in the classroom is more active and specific. It can achieve the teaching objectives of the course, reflect the teaching ideas of the course, and form a material mechanics course assessment method (Figure 1) that combines teaching and learning inside and outside the class, theory and practice, teaching and research, practical operation and virtual operation, and combines internal and external interaction, upper and lower integration, virtual and real combination, so as to stimulate students' learning motivation and professional interest [6].

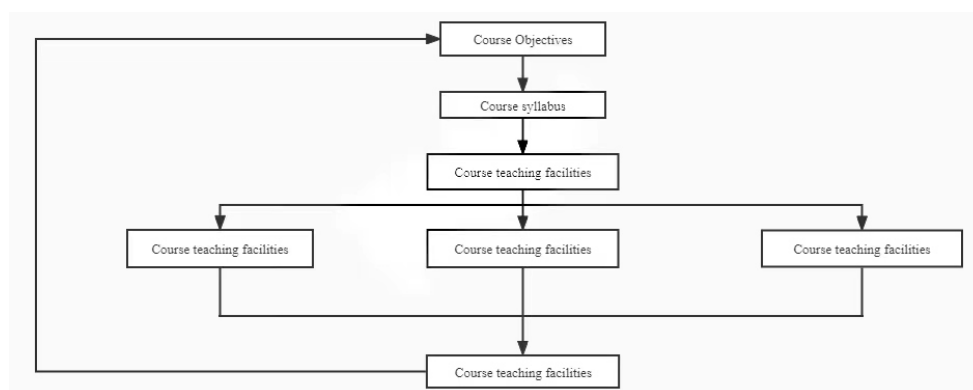


Figure 1. Closed loop curriculum quality assurance system

Compared with the teaching of Civil Engineering 2019 (the second semester of 2020-2021) and the teaching of Civil Engineering 2020 (the second semester of 2021-2022), the online inter school teaching exploration and practice of this course of material mechanics has improved to a certain extent in terms of the average score of the teaching class, the degree of achieving the course objectives and other aspects. The reform of the course assessment method has achieved remarkable results. See Table 2 for the comparison of course results and achievement of course objectives in the two academic years.

Table 2. Comparison of Course Achievements and Objective

Evaluation items	Grade 2019 2020-2021 (II)	Grade 2020 2021-2022 (II)	Increasing ratio
Average grade of teaching class	62.6	75.8	21%↑
Achieving degree of course objective 1	0.52	0.72	38%↑
Achievement of course objective 2	0.72	0.79	10%↑
Achieving degree of course objective 3	0.65	0.75	15%↑

5. Summary

The exploration and practice of inter school teaching of mechanics of materials based on OBE concept advocates to carry out curriculum teaching activities around significant goals, reform the assessment and evaluation standards, so that students' interaction in the classroom is more positive and specific, can reflect the teaching ideas of the curriculum, form the results of teaching and learning that combine in class and out of class, theory and practice, teaching and research, practice and virtual, and effectively play the dynamic role of students as the main body of learning, Improve the interaction between teachers and students, and significantly improve students' learning autonomy and learning efficiency.

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2021 Research on the Undergraduate Teaching Reform of General Higher Education in Liaoning Province Quality Teaching Resources Construction and Sharing Project.

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