Teaching Reform and Practice of "Materials Mechanics" Course under the Background of Educational Teaching Evaluation

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Abstract: This paper delves into the teaching reform and practice of the "Materials Mechanics" course against the backdrop of the new round of undergraduate education and teaching evaluation. It first analyzes the context of the teaching reform, emphasizing the significance of Materials Mechanics as a compulsory technical foundation course for engineering majors and its bridging role in the educational system. Subsequently, the paper clarifies the objectives of the teaching reform, encompassing both ideological and political goals and capability targets, aiming to enhance students' innovative abilities through a "four-in-one" educational philosophy. In terms of reform measures, online teaching platforms such as Rain Classroom are adopted, implementing a full-cycle teaching model encompassing pre-class preparation, in-class interaction, and post-class consolidation, thereby strengthening students' sense of participation and learning outcomes. Practical results demonstrate that this teaching reform scheme effectively improves students' mastery of knowledge and ability to solve practical problems, aligning with the university's objectives for applied talent cultivation. Finally, the paper reflects on and outlooks the teaching reform, proposing suggestions for continuous optimization of teaching content and methods, strengthening teacher team construction, improving the teaching evaluation system, and deepening university-enterprise cooperation, with the aspiration to provide references and guidance for future teaching reforms.

Keywords: Materials Mechanics; Teaching Reform; Rain Classroom; Innovation Ability Cultivation; Applied Talent Cultivation

1. Introduction

Under the requirements of the new round of undergraduate education and teaching evaluation, adhering to the guiding ideology of "evaluation promotes construction, evaluation promotes reform, evaluation promotes change, and evaluation promotes strength," and the basic principles of "upholding moral education, advancing reform, and innovating methods," we have established a "student-centered, teacher-led" teaching reform for the "Materials Mechanics" course [1]. With the fundamental task of fostering virtue through education and the goal of providing education that satisfies the people, this paper explores how to reform the "Materials Mechanics" course in the context of educational teaching evaluation.

Materials Mechanics, as an essential branch of deformation mechanics, serves as a mandatory technical foundation course for engineering majors such as mechanical engineering and civil engineering in colleges and universities. It primarily studies the stress and deformation of members under external forces, functioning both as a foundation for subsequent courses and a technical subject capable of addressing practical engineering problems. Within the curriculum system, it bridges the gap between public foundation courses and specialized foundation courses, playing a crucial role in connecting the past and future [2-4].

2. Objectives of Teaching Reform

The "Materials Mechanics" course upholds the student-centered principle, incorporating a "four-in-one" educational philosophy that integrates value guidance, knowledge exploration, capability building, and personality cultivation, with a focus on fostering students' innovative abilities.

2.1 Ideological and Political Goals

Inspire students to aspire to contribute to the country through science and technology and

cultivate a meticulous and refined craftsmanship spirit.

Promote Chinese culture and stories, enhance cultural literacy, strengthen students' cultural confidence and national pride, and nurture patriotic sentiments.

Enhance students' confidence in theory and culture, thereby strengthening their sense of social responsibility and political awareness.

2.2 Capability Goals

Master the fundamental concepts of deformation mechanics and basic methods for analyzing and solving problems related to strength, stiffness, and stability, with the ability to calculate the strength, stiffness, and stability of members [5].

Acquire the ability to apply knowledge to propose mechanical models from practical engineering problems and establish basic mechanical models for engineering components.

Possess preliminary skills in conducting relevant tests using materials mechanics experimental methods and techniques.

Develop the ability to identify, articulate, analyze complex engineering problems, and draw effective conclusions [6].

3. Teaching Reform Measures

Before class, online teaching platforms such as Rain Classroom are utilized to push network resources and engineering examples to students via mobile slideshows, accompanied by pre-class online discussions, allowing students to understand actual engineering demands, recognize the utility of mechanics, and stimulate their learning motivation.

During class, Rain Classroom's interactive features, including classroom bullet screens, word cloud generation, instant quizzes, online submissions and voting, and random questioning, stimulate student participation, invigorate classroom atmosphere, and elevate their sense of engagement and belonging. This shifts the classroom mode from teacher-led to student-centered, incorporating interactive discussions and practical activities to clarify doubts and tackle difficulties.

After class, the Rain Classroom platform provides a full-cycle teaching data analysis encompassing pre-class, in-class, and post-class phases, comprehensively covering all aspects of the teaching process. Before class, preview slides and learning videos are promptly pushed out, allowing for immediate access. Based on students' learning data, teachers can promptly adjust their classroom designs. After class, homework task reminders are set up to facilitate timely consolidation and review. For key and difficult points, online discussions can be initiated at any time, with teachers providing answers to students' questions promptly. Finally, teachers can summarize and adjust their teaching strategies based on the final classroom data.

4. Reform Practice Achievements

In line with the school's application-oriented educational philosophy, the ultimate goal is to cultivate high-quality, versatile, and practical talents imbued with the spirit of the Great Northern Wilderness, innovation, and entrepreneurship. The curriculum objectives of this course are:

Objective 1: Enable students to utilize the fundamental concepts and internal force analysis methods of Material Mechanics, combined with calculations of strength, stiffness, and stability of bars, to establish mechanical models for actual structures, thereby fostering their abilities to solve practical problems.

Objective 2: Master the methods of calculating structural strength under complex loading conditions and possess the capability to solve statically indeterminate problems [7]. The curriculum focuses on enhancing students' abilities to analyze and solve real-world engineering problems.

A pilot reform teaching was conducted among the students of Mechanical Engineering 21, with a total of 150 students. Comprehensive evaluations were conducted based on course indicators, encompassing student achievement of overall course objectives, formative assessments of course objectives, and improvement measures [8].

4.1 Overall Achievement of Course Objectives

The primary objectives of this course are twofold. The evaluation results indicate that the evaluation values of the course-supported graduation requirements are all above 0.7, signifying an overall satisfactory performance. This suggests that students are proficient in applying basic knowledge, with test,

experiment, and homework scores averaging 0.65. However, improvements are necessary in students' hands-on skills and computational abilities, which should be emphasized in subsequent teaching rounds. Moreover, students' abilities to integrate knowledge and solve practical problems comprehensively require enhancement, necessitating enhanced practice in future sessions.

4.2 Formative Assessments of Course Objectives

To monitor students' learning progress, guide effective learning, and help them achieve course objectives, formative assessments were conducted through exercises, hands-on skills, and other teaching activities. These assessments allowed for timely adjustments to teaching methods and continuous improvement of teaching quality.

4.2.1 Assessment process

The online interactive tools of Yuketang were utilized to facilitate teaching. Students signed in via WeChat QR codes, eliminating time-consuming roll calls. The Yuketang backend continuously recorded data. Based on students' performance in exercises, hands-on skills, and other teaching activities, their learning status was evaluated in real-time, with results promptly shared. This allowed students to monitor their progress and adjust their study methods accordingly. Special attention and support were provided to struggling students, with early warning notices issued to instructors, class supervisors, and academic advisors for closer monitoring.

4.2.2 Assessment effects

Observations and formative assessments reveal that most students actively engage in classroom interactions, demonstrate autonomous learning, and complete learning tasks within the stipulated time. Their post-class assignments and practical skills are also commendable, laying a solid foundation for cultivating abilities to analyze and solve real-world mechanical engineering problems [9-10].

4.3 Improvement Measures

To enhance students' understanding and application of mechanical engineering practices, more real-world engineering examples should be integrated into teaching. Additionally, comprehensive assignments should be increased to foster students' self-learning, internet research, and data analysis skills. Furthermore, more practice in experimental operations, data processing, and result analysis is crucial for improving students' proficiency.

5. Conclusion

Under the backdrop of educational teaching audit and evaluation, a "student-centered, teacher-led" reform scheme for the Material Mechanics course has been established. Practical teaching demonstrates that integrating audit assessments with curricular innovation reforms effectively enhances students' abilities to analyze and solve real-world problems, aligning with the school's objectives for cultivating application-oriented talents. This reform serves as a valuable guide for future teaching improvements.

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