

Exploration on Teaching Reform of Engineering Mechanics Under the Training Mode of Applied Talents

Yu Dong¹

¹*School of Management Science and Engineering, Shandong Technology and Business University, Yantai, Shandong, China*

*Corresponding author. Email: dongyu1987@sdtbu.edu.cn

ABSTRACT

Taking the problems existing in the theoretical and experimental teaching of engineering mechanics in Shandong Technology and Business University as an example, this paper analyzes and studies the problems existing in the theoretical teaching and experimental teaching of engineering mechanics, which puts forward corresponding reform measures for the importance, content, teaching methods and assessment methods of Engineering Mechanics Course on the basis of closely combining with the training mode of applied talents.

Keywords: *engineering mechanics, theoretical teaching, experimental teaching, teaching reform, rain classroom*

1. INTRODUCTION

In order to cultivate high-quality talents, Shandong Technology and Business University puts forward the construction goal of cultivating high-quality applied talents, highlighting the characteristics of application-oriented talents cultivation. Engineering mechanics, as a basic course of Engineering Specialty in application-oriented universities, has strong engineering applicability [1]. And the experimental teaching is an important part of undergraduate teaching in colleges and universities. Through experimental teaching, students can better understand the theoretical knowledge of classroom teaching [2]. At the same time, it is conducive to cultivate students' innovative thinking of experimental design and improve their practical ability. In view of the problems existing in the theoretical teaching and experimental teaching of engineering mechanics, this paper puts forward the teaching reform of Engineering Mechanics aiming at cultivating applied talents.

2. PROBLEMS OF ENGINEERING MECHANICS THEORY AND EXPERIMENT TEACHING

2.1. On Ideology and Cognition

Because the course of engineering mechanics in Shandong Technology and Business University is set up in the first semester of University, the newly enrolled students do not have a whole understanding of the curriculum system of this major because they have not yet contacted the professional courses. Therefore, they do not have enough understanding of the importance of Engineering Mechanics. They think that engineering mechanics is only a basic course, which is not helpful for their major.

Due to the professional adjustment and weak foundation of science, some students think that the course of engineering mechanics is the continuation of the mechanics part of middle school physics course, and there is no fresh content. Moreover, the content of engineering mechanics course is strong in theory, with many formulas, and some definitions are abstract and difficult to understand. Therefore, students have a certain resistance to the study of Engineering Mechanics and feel that mechanics learning is necessary Boring, lost interest in learning. For teachers, some teachers think that the main content of engineering mechanics course is the theoretical knowledge of the course. Therefore, the engineering mechanics experiment teaching is not paid enough attention and the energy is insufficient. For students, it is believed that engineering mechanics experiments are confirmatory experiments prepared by teachers in advance, and the purpose of the experiment is nothing more than the relevant verification of classroom theoretical knowledge, so the experimental process is often to deal with things.

2.2. On Teaching Hours and Teaching Contents

According to the new talent training program of Shandong Technology and Business University, the total credits of each major include theoretical teaching credits and practical (experimental) teaching credits, of which science and engineering majors do not exceed 170 credits. Each credit corresponds to 16 class hours. According to the regulations, the course of engineering mechanics is adjusted to 48-64 theoretical hours and 16-32 experimental hours for different majors. Due to the relative compression of theoretical hours, although the content is somewhat simplified, compared with less theoretical hours, more knowledge points are involved, and the cohesion between the content before and after the content is strong. At the same time, in order to ensure that the theoretical knowledge of the textbook can be learned within the theoretical class hours, the theoretical part of the experimental course can only be arranged in the experimental class hours, which results in the further compression of the students' hands-on experimental time, while the number of laboratory equipment is limited, and the

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experimental time allocated to each student is further reduced when the students conduct group experiments. It also puts forward how to cultivate the students' ability of innovation and application.

2.3. On Engineering Mechanics Theory and Experimental Teaching Methods

At present, the teaching method of "ppt + blackboard writing" is basically adopted in the teaching of engineering mechanics theory course. However, there are still some deficiencies in the mobilization of students' enthusiasm in listening to the class. Teachers are still the main body in the classroom, and the teaching methods are too much and detailed. In addition, there is a lack of reflective problems for students in the course, and the time for practice is insufficient. The form of homework after class is simple, the students didn't finish it seriously. As time goes by, students are tired of learning and even give up learning the course of engineering mechanics, which leads to poor teaching effect. In addition, the experimental teaching of Engineering Mechanics pays too much attention to the explanation of experimental process and experimental steps. Teachers play a leading role in the teaching process. In the teaching process, the basic use of indoctrination teaching method, students passively accept knowledge, completely in accordance with the teacher's teaching step by step to carry out the operation, resulting in students only can imitate, not use their brains.

2.4. On Engineering Mechanics Course Assessment

At present, engineering mechanics course adopts the assessment method of "usual score + examination result", students do not pay attention to the usual results, and often take the form of temporary surprise before the examination. Because the test questions are basically the copy of the examples, the students mechanically apply the formula, which cannot combine the knowledge points of the course with the engineering practice flexibly, which deviates from the training goal of the students' application ability. And the evaluation of engineering mechanics experiment is mainly based on the submitted experimental report, which results in the bad style of "emphasizing report and neglecting process" among students. In the process of engineering mechanics experiment, the experimental operation is often perfunctory, and the experimental data are not consistent with the experimental report seriously.

3. IMPROVEMENT MEASURES OF ENGINEERING MECHANICS TEACHING UNDER THE TRAINING MODE OF APPLIED TALENTS

3.1. Improve The Ideological Understanding of Engineering Flexible pre-course learning

Strengthen the understanding of the importance of engineering mechanics. In the introduction course of engineering mechanics, students can have a comprehensive understanding of the relevant engineering mechanics courses. Combined with the application of engineering mechanics in social hot topics, students' interest in engineering mechanics is stimulated. At the same time, the relationship between engineering mechanics course and subsequent structural mechanics, fluid mechanics and other related courses is introduced, so that students can realize the importance of engineering mechanics.

In addition, teachers should change the teaching concept of "emphasizing theory and neglecting experiment" in the teaching process of engineering mechanics, and invest more energy in the experimental teaching of engineering mechanics.

Teachers should clarify the status and role of engineering mechanics experiments in the teaching process of engineering mechanics at the beginning of experimental teaching, so that students should pay attention to engineering mechanics experiments when they start learning engineering mechanics.

3.2. Update The Teaching Content of Engineering Mechanics

In the aspect of theory teaching, simplification and optimization are the foundation of statics, simplification of force system and statics balance. It focuses on the balance part of statics, such as the steel cable stress of cantilever crane beam in engineering workshop, the support problem of building structure column beam and various kinds of stress problems in real life, which aims to cultivate students' ability to solve practical problems with theoretical knowledge. For the mechanics of materials, the content is simplified and optimized as the deformation of the member, the theory of stress state and strength, and the stability of the compressed bar.

At the same time, according to the characteristics of engineering mechanics experiment content, the experimental content is updated and classified appropriately. The experiment content is mainly divided into two levels. Different experimental methods are used for different experimental contents. The first level is the verification experiment, the second level is the design experiment.

3.3. Optimize The Teaching of Engineering Mechanics

For the cultivation of applied talents, the teaching method system of engineering mechanics course should vigorously promote the advanced teaching methods such as heuristic teaching, interactive teaching, problem-based teaching and case teaching. In order to complete the experimental teaching task in limited class hours, the implementation of audio-visual teaching can solve the problem of insufficient experimental class hours. The means of audio-visual teaching include multimedia courseware, video pictures related to experiments, simulation experiments, modern experimental equipment, and so on.

Learning through pictures and sounds can enhance students' perceptual knowledge and expand their knowledge [3]. Through the realization of teachers and students in the teaching activities of engineering mechanics in the past, combined with the problems existing in the traditional teaching of engineering mechanics, the teaching activities of engineering mechanics based on the rain classroom were designed, and the teachers and students were recognized in practice. The rain classroom is a

intelligent teaching tool jointly developed by Xuetang Online and Tsinghua University Online Education Office. The purpose is to enhance the classroom teaching experience, and to make teachers and students more interactive and more convenient. The design of the teaching activities of the rain classroom is shown in Figure 1[4], and the function of the rain classroom is shown in Figure 2[4].

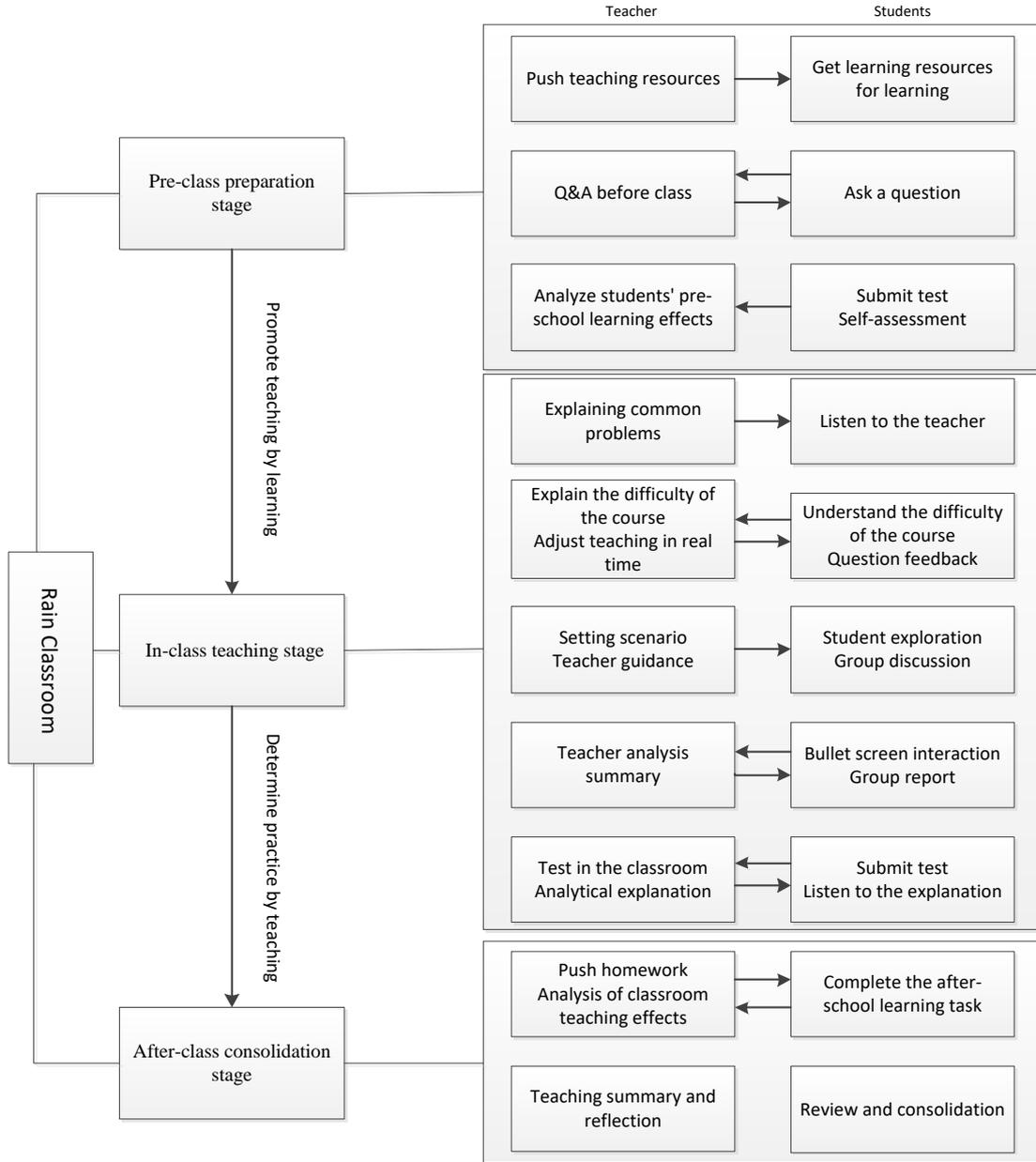


Figure 1 Teaching activity design of the rain classroom intelligent teaching tool [4]

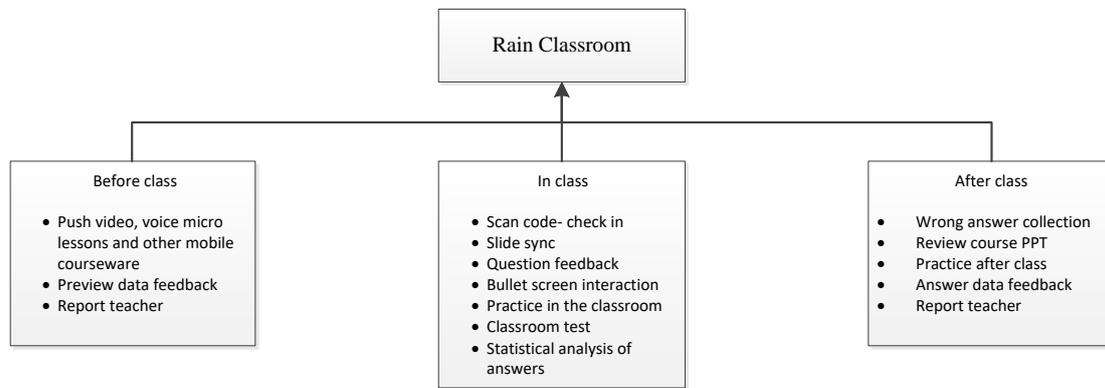


Figure 2 Schematic diagram of the rain classroom function [4]

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3.4. Optimize The Teaching of Engineering Mechanics

To promote the change of curriculum assessment from "score" to "ability"; to change students' learning from "final examination" to "learning process". We should further improve the proportion of usual performance and experimental score in the assessment and evaluation, and reduce the proportion of final examination paper score. The proportion of the three is adjusted to 30% of the usual score (attendance, classroom performance, homework test), 20% of the experimental design and operation score, and 50% of the final exam paper score.

The experimental results of reform students are composed of attendance, experimental process, hands-on operation, experimental report and so on, which are divided into usual performance and examination score [5]. This assessment method improves the students' enthusiasm for learning engineering mechanics course at ordinary times. While cultivating students' practical ability, it avoids the bad phenomena of students' temporary surprise, rote memorization and examination plagiarism.

4. CONCLUSION

Taking the problems of engineering mechanics theory and experiment teaching in Shandong Technology and Business University as an example, the corresponding reform measures are put forward in terms of the importance and the content of the course, the teaching methods, and the assessment methods on the basis of closely combining with the training mode of applied talents. Some of the reform measures have been applied to the teaching of Engineering Mechanics, which has achieved the initial results. Under the environment of the school advocating the cultivation of applied talents, the reform of engineering mechanics course still needs long-term exploration and continuous improvement, playing an important role in cultivating the required applied talents.

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