

New Teaching Model of Structural Mechanics Course for Civil Engineering Majors in the Information Age

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Abstract: In the new era of undergraduate education in China, around the purpose of cultivating first-class talents, it is necessary for the majority of educators to actively explore the deep integration of online and offline teaching. Based on the above background, the purpose of this research is to study the new teaching model of structural mechanics for civil engineering majors in the information age. This study introduces the construction of the online course of structural mechanics and the mixed teaching of structural mechanics for the structural mechanics teaching team of civil engineering majors in the university, and compares the structural mechanics of students participating in hybrid teaching with traditional teaching by statistical analysis of a large number of first-line construction data Final exam scores, compared with the final exam scores of the material mechanics course of the prerequisite course, analyze the advantages and disadvantages of mixed teaching on the improvement of students' academic performance; in addition, use various platforms to analyze the factors that affect the effect of mixed teaching, with a view to The continuous improvement of mixed teaching provides useful reference. Studies have shown that face-to-face teaching, online learning and classroom tests are the main factors that affect the effectiveness of mixed teaching. Among them, face-to-face teaching plays a key role in mixed teaching. Giving play to the guiding role of face-to-face teaching in classrooms, better completing online learning, and maintaining a good learning progress can help students better master the course learning content, which is conducive to the implementation of student-centered education concepts.

1. Introduction

Structural mechanics is a major major course in civil engineering, water conservancy engineering and other majors. The course has a wide audience and classic content. Traditional classroom teaching is difficult to meet the needs of all students due to the varying levels of students. Many students "Talking about the color change of structural mechanics", the teaching effect is not satisfactory. In recent years, with the rise and deepening of education informatization, with the help of online learning on the Internet, the autonomy of learning is given to students, which is convenient for students to personalize the study time and learning progress, which highlights the dominant position of students, but the The online learning has the disadvantage that students cannot control the key points and key knowledge points, and the hybrid teaching comes into being. Mixed teaching integrates online self-directed learning with traditional classroom teaching. It can combine the two teaching methods to complement each other and combine them in a targeted manner.

The Ministry of Education's "Education Training Program for Excellent Engineers" requires colleges and universities to cultivate a large number of high-quality engineering and technical personnel with strong innovation capabilities [1]. The essence is to require colleges and universities to cultivate high-quality innovative talents with "solid foundation, quick start, and strong ability" according to social needs [2-3]. This requires colleges and universities in the cultivation of talents from professional basic courses to professional courses throughout the key training of talent innovation and engineering ability [4]. Structural mechanics, as the most important professional basic course in civil engineering, has an undoubtedly important position in the entire civil

engineering curriculum system [5]. The teaching goal of structural mechanics course should be changed from the traditional "knowledge solving" to the "problem solving", from the grasp of traditional mechanics knowledge to the cultivation of innovation ability and engineering ability [6]. Therefore, it is necessary to study and reform the structural mechanics course of civil engineering specialty from the aspects of teaching content, teaching methods, and setting of practical links, so as to really improve students' mechanical literacy and innovation ability [7].

With the rise and deepening of education informatization, the online learning of the Internet is used to give learning autonomy to students, which is convenient for students to personalize the study time and learning progress, highlighting the student's dominant position, but pure online Learning has the disadvantage that students cannot control the key points and key knowledge points, and mixed teaching arises at the historic moment. Mixed teaching integrates online self-directed learning with traditional classroom teaching. It can combine the two teaching methods to complement each other and combine them in a targeted manner. Based on the above considerations, this research will actively explore the construction of online and offline mixed courses for the teaching team of structural mechanics in universities, and have achieved some construction results and practical experience.

2. Method

2.1 Application of Informatization in the Field of Education

The application of informatization in the field of macro-education is mainly reflected in teaching evaluation, individual analysis of students, and public opinion prediction in the process of education.

(1) Teaching evaluation

Under the background of big data and informatization, the teaching evaluation of Chinese, mathematics, politics, music, sports and other courses in the field of macro-education becomes more accurate. Big data is very different from the traditional data. In the traditional data, people are still in the stage of covering up the data collection. But in many cases, one can not do anti-three, in this way, there is uncertainty or instability in the collected data, which brings a series of potential contradictions to the teaching. Big data is the integration, adjustment, and regulation of all the data that can be collected. These data may be in the thousands. In high school teaching evaluation, the use of big data is the most direct, accurate and effective way to collect teaching data.

(2) Individual analysis

Individual analysis, like teaching evaluation, often appears in the school's teaching model, and individual analysis is more widely used. The main body of the individual analysis is the student. Through a comprehensive understanding of the student's various information, including the student's learning style, academic performance, learning age, learning habits, etc., then according to these specific circumstances, a teaching plan adapted to the student's own development is developed. And use the corresponding books and materials to provide reference for students, so as to "be student-oriented". While individual analysis is being carried out, it usually borrows data from teaching evaluation, which also means that under big data, all information can be recycled, and it will only be used as much as possible, and the more valuable the more.

(3) Public opinion prediction

The prediction of some situations is a "semi-monitoring" method of macro-education under big data, which targets students. High school students are in a critical period of their lives, and they are still at a loss as to how to choose their next steps. While using the online platform for learning, students will also browse some other webpages. There may be some unfavorable factors in these webpages that affect the future development of the students, making the students sink deeper and deeper. Predict the occurrence of these situations, and "monitor" these situations in time to ensure the safety of students in the future, so that they can learn with peace of mind. This is a problem that needs attention in the teaching field under big data.

2.2 Research on the Reform of the Teaching Content and Teaching Methods of Structural Mechanics

(1) The teaching content and teaching examples are completely consistent with the engineering practice. Traditional structural engineering teaching achieves knowledge control by studying mechanics theory and explaining problem examples. Examples of selection problems are not closely related to engineering practice. Students learn to understand problems, but it is difficult to improve their ability to solve engineering problems [8]. Therefore, it is necessary to combine various forms of political engineering to reasonably select capital examples, and try to be close to the application of mechanical reality, taking actual mechanical problems as an example for teaching analysis, explanation and discussion, such as the use of mechanical principles for accident analysis and mechanical structure optimization. Design and so on. The shift from focusing on cultivating unique problem-solving abilities to improving mechanical education, combined with engineering practice, will also greatly increase students' interest in learning and provide a more favorable basis for future vocational learning [9].

(2) Research on the transformation of classroom teaching to differentiated teaching mode. In the past, structural engineering courses were mainly taught in classrooms. All the students in the class are singing the songs of the professors. The students accept passively and the learning effect is not good. But to really improve students' ability to solve problems, not only do teachers need to sing "one-man play", but also students "sing a song". Knowledge is understandable, but it cannot be transformed into ability. Only by thinking, summarizing and improving on this basis can it be gradually transformed into ability [10]. This not only stimulates students' interest in learning engineering, but also improves students' ability to use knowledge to solve problems. In addition, it can also take the form of student lectures and analysis reports.

3. Experiment

3.1 "Flip Class" Teaching

"Flip classroom" teaching, first of all, through the integration of teaching resources, extract the teaching content that helps to increase students' interest in learning and upload to the learning system. Secondly, the dynamic process of student learning is generated to help teachers understand the student's learning progress and the questions generated during the learning process in real time. Finally, teachers can answer the questions of students one by one online or offline. At the same time, "flip classroom" can also achieve teacher-student interaction on the Internet, make full use of network resources, expand students' horizons, improve the depth of student learning, and promote the development of student personality.

3.2 Inquiry Teaching

The most basic of inquiry teaching is to require students to have a sense of problem throughout. Students' interest in problems can make them active participants in teaching activities and active practitioners in teaching practice. In classroom teaching, students reflect on their understanding of the problem through communication and dialogue with teachers and classmates, and re-recognize and analyze the problem from various angles. On the basis of fully understanding the learner's ideological reality and existing knowledge structure, the teacher creates a teaching situation of structural mechanics theory course, and gives the learner appropriate feedback and guidance throughout the teaching process. "The display and exchange of inquiry learning should not only be the display of results, the key is to communicate the process of exploring knowledge; not only the display of inquiry methods, but also the exchange of emotional experience; the communication of results should not be seen, the learners should also I got an exercise in it-learners express their views and opinions, enhance self-confidence, broaden their horizons by listening to others' opinions, learn to analyze problems from multiple angles, recognize their own deficiencies through discussion and exchange, and understand their own Opinions are enriched and sublimated ". Inquiry teaching is an important channel for cultivating students' innovative ability. Through inquiry teaching,

students' awareness of problems can be cultivated, their awareness of problems can be improved, and innovative talents can be fostered.

3.3 Practical Teaching

To reform the teaching orientation, urge students to increase their consciousness of closely integrating with reality and paying attention to social life, enhance the awareness and explanatory power of "teaching content for reality, enhance the credibility and feasibility of course theory, and reverse the classroom The state of dissociation from social reality. " Finally, it is necessary to proceed from the students' ideological reality, "There is no investigation, no research, no analysis of the propaganda object, and it is impossible to talk indiscriminately." Practical teaching must focus on the students' ideological reality and understand the students' Basic information, knowing the actual needs of students, grasping students 'acceptance interests, mastering students' knowledge reserves, evaluating students 'acceptance ability, and starting teaching activities from students' actual conditions. Human consciousness will change with changes in the surrounding environment, and students' mental state will also change with the development of society. Therefore, the practice teaching should always focus on the students 'ideological status, and adjust the practice teaching method in time according to the changes of the students' ideological status.

4. Discuss

4.1 Analysis of Structural Mechanics Results

Both teachers and students expect to change the original assessment method, and use multiple assessment methods to test the effect of students studying structural mechanics. To construct a reasonable and perfect assessment method, we must first clarify the guiding function of students' structural mechanics theory teaching is to guide students to combine the learned theory with their own reality, and improve the theoretical knowledge level, ideological and moral level and social practice level. The assessment of structural mechanics theory courses can not only be written scores of students' academic achievements, but more importantly, guide students to think about how to combine the knowledge they have learned with their own value orientation, and whether they can become a comprehensive development talent useful for social development Combined. Therefore, the assessment of structural mechanics theory courses for college students should pay more attention to human culture, detail and process, so that students can truly master the theory "keep in mind and externalize in line". The situation of students taught over the years is shown in Table 1.

Table 1. The situation of students taught in previous years

School year	Total number of students / person	Number of participants in traditional teaching mode	Number of participants in mixed teaching pilots / person		
			Fresh student	Retake students	Subtotal
2017-2018	291	193	57	41	98
2018-2019	267	227	43	32	75
2019-2020	298	225	44	29	73

The statistics of the assessment methods of the students' structural mechanics theory courses are shown in Figure 1.

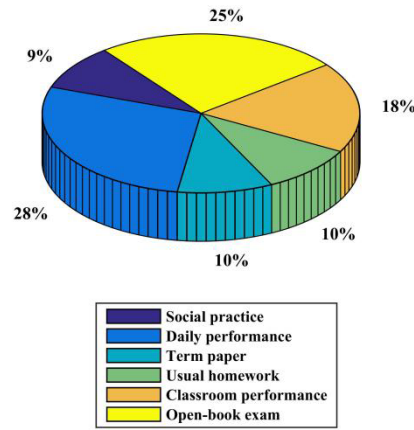


Figure 1. Assessment methods for students' structural mechanics theory courses

Material mechanics scores intuitively reflect the students' knowledge of the structural mechanics prerequisite courses and indirectly reflect the students' basic level of mechanics. By comparing the results of structural mechanics and material mechanics, the analysis of students' performance progress or regression is analyzed. The comparison between structural mechanics and material mechanics is shown in Figure 2.

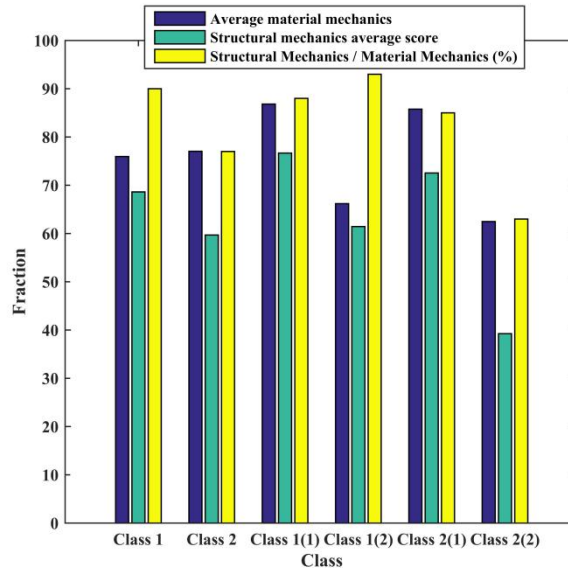


Figure 2. Comparison of structural mechanics and material mechanics

The average score of the second class of structural mechanics and material mechanics is lower than that of the first class, indicating that overall, the mixed teaching of structural mechanics courses is not as effective as traditional teaching. In order to facilitate the comparison between the mixed teaching pilot class and the traditional teaching students of the same level, the structural mechanics of students with a material mechanics score of 75 or more (second class (1)) and below 75 points (second class (2)) Statistical analysis with the results of material mechanics and comparison with a class of students of the same level. From the analysis results, we can see that for the first time students participating in learning, mixed teaching has disadvantages compared with traditional classroom teaching, especially for students with relatively poor foundation The disadvantage is more obvious.

4.2 Analysis of the New Teaching Model of Structural Mechanics

The classroom explanation highly restores the atmosphere of classroom teaching, with pictures and texts, and rich cases. It adopts heuristic teaching methods and focuses on improving students' qualitative analysis ability. The experimental expression combines traditional teaching methods of

structural mechanics with important engineering research methods. In the process of studying structural mechanics, students tend to focus on theory rather than practice, and currently there are few universities in China that offer experimental courses for structural mechanics. This course integrates experimental structural mechanics into teaching activities, which makes up for this deficiency. The experimental expression uses a combination of explaining the experimental principles, shooting specific experimental operation procedures and data processing. Students can intuitively observe experimental phenomena, deepen their understanding of the corresponding structural concepts, and solve the limited resources of experimental sites and experimental devices. The problem.

The structure mechanics online course exercise discussion class is mainly aimed at students who usually feedback more knowledge points that are easy to mix and mistake, and enters the actual classroom shooting. Based on the actual learning status of students, the interaction between teachers and students is realized. Aiming at typical exercises, the problem-prone form is explained through questions and discussions, and the wrong answers given by the students are all typical errors that are easy to occur in actual teaching. During the course, students can put their analysis results on the main screen in real time, which is convenient for comparative analysis, and make full use of information technology resources to support teaching.

Conclusion

Compared with the traditional teaching model, students who are beginning to learn structural mechanics participate in mixed teaching. Students arrange study time more reasonably, and students with poor self-learning ability should choose the mixed teaching mode carefully. The mixed teaching model is more suitable for re-students who have learned the course once and can not guarantee the normal learning time, but can insist on participating in learning. The factors that affect students' achievements mainly include face-to-face teaching, online learning and classroom tests. Face-to-face teaching plays a key role in mixed teaching. Especially for beginners, face-to-face teaching cannot be replaced. This time, the effect of the mixed teaching model was discussed based on the final examination results. For the evaluation of students' comprehensive abilities, more appropriate assessment and evaluation mechanisms are yet to be studied.

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