

Exploration and Practice of Curriculum Ideology on Theoretical Mechanics under the Background of First-class Curriculum Construction

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Abstract: In accordance with the educational goals of building a first-class course that meets the requirements of the new era and the characteristics of theoretical mechanics courses, combined with the core goal of ideological and political construction of the course "comprehensively improving talent training capabilities", the construction of first-class courses in theoretical mechanics is led with new ideas, from optimization Starting from three aspects: teaching content, reforming teaching mode and improving assessment mode, the specific implementation path of ideological and political courses in theoretical mechanics is explored and applied to teaching practice. The practical results show that the teaching model after the teaching reform can effectively mobilize and stimulate the students' learning initiative and enthusiasm, the students' satisfaction with the teaching is increased, and the theoretical mechanics course construction and teaching reform have significant effects.

Keywords: first-class curriculum; theoretical mechanics; curriculum ideology and politics; teaching reform

1. Introduction

Constructing a first-class undergraduate curriculum structure system with Chinese characteristics and world level is the key and core of talent training in the new era, and it also directly determines the quality of talent training. In the course of curriculum construction, it is necessary to deeply excavate the elements of ideological and political education contained in various courses and teaching methods, in order to truly implement the results of teaching reform into curriculum construction [1]. Theoretical mechanics is an important technical basic course for science and engineering majors, and it is the basis for other subsequent courses. This course has a rigorous logical and systematic knowledge system, and its theory and knowledge content are widely used in many fields and industries such as civil construction, material engineering, transportation machinery, and aerospace. In the process of building a first-class course in theoretical mechanics, the organic combination of ideological and political education and professional course teaching is of great significance for cultivating new-era scientific and technological talents with socialist core values and realizing the strategic goal of my country's scientific and technological power [2].

2. Current Situation and Problems of Theoretical Mechanics Course

Theoretical mechanics is classical mechanics, which is theoretical and logical. Since the establishment of the course, its theoretical system, structural framework and knowledge content have basically remained unchanged. However, with the development and deepening of education and teaching reform in my country's colleges and universities, the hours of theoretical mechanics courses have been continuously reduced, while the scope and content of teaching have not changed. Therefore, in the case of insufficient school hours, how to improve the teaching quality and teaching efficiency while carrying out the ideological and political construction of the course under the premise of ensuring the requirements of the teaching content, thereby improving the quality of personnel training, is a difficult problem that needs to be solved in the teaching reform of theoretical mechanics courses.

The theoretical mechanics course is highly theoretical and has a wide range of contents. "Teachers speak, students listen" is the most traditional teaching mode of theoretical mechanics, and students are in a passive acceptance state. In the learning process, students generally have the problem of "easy to

understand theories but difficult to apply". The assessment of traditional theoretical mechanics courses usually takes the form of a single final closed-book examination. The main disadvantage of this evaluation method is that some students do not pay attention to the usual course study and knowledge accumulation, but just review before the exam, and the learning effect is not ideal. It will obviously show that the basic knowledge is not grasped firmly, resulting in the difficulty of learning new knowledge, and the inability to achieve the teaching goal of the three comprehensive education of knowledge, emotion, intention, and behavior.

In view of the above problems and deficiencies highlighted in the theoretical mechanics course in the teaching process, combined with the first-class course teaching reform carried out by our school and the requirements of course ideological and political construction, the theoretical mechanics teaching team has carried out experiments from three aspects: teaching content, teaching mode and assessment mode. The teaching reform and practice have received satisfactory results.

3. First-class curriculum construction plan

In accordance with the requirements of building first-class undergraduate courses in the new era, in the process of curriculum reform and innovation, the fundamental goal of morality and talent cultivation will be realized. The ideological and political promotion process of theoretical mechanics course is to combine professional course teaching with general education, so that students can master professional knowledge and skills in the field of science, and grow into people with social responsibility and family and country feelings.

3.1. Optimize teaching content

In terms of teaching structure design, the whole course of theoretical mechanics is divided into three parts: statics, kinematics and dynamics [3]. There are 13 lectures and a total of 44 learning fragments. Content, PPT courseware, questions and reflections, exercises and assignments", and there is a "unit test" after each lecture. When formulating teaching goals, realize the effective integration of knowledge and skill goals and emotional goals, and fully reflect the laws and characteristics of emotion, attitude, and value training. In-depth exploration of the content of teaching materials, natural integration of emotional goals into the process of knowledge and skills imparting, close integration of the scientific nature of theoretical mechanics with the ideological nature of emotion, so that students can receive profound ideological education in the process of learning professional courses.

In terms of teaching content, the socialist core values are integrated into the whole process of theoretical mechanics teaching, educating and guiding students to establish a correct world outlook, outlook on life and values while studying the course. For example, when teaching the content of the chapter "Constraints and Binding Forces", the properties and definitions of free bodies and non-free bodies are given first, so as to guide students to understand and draw the conclusion that "only non-free bodies under certain constraints are the safest" in conclusion. Then it is concluded that the freedom of citizens only under certain legal constraints and social moral restrictions is true freedom. For architecture colleges, the connection between mechanics and architecture and the contribution of mechanics to architecture are indispensable contents in the teaching process. From ancient Chinese classic buildings such as the Great Wall and Dujiangyan, to the Bird's Nest and the Three Gorges Project, which marked the new height of my country's engineering construction, it is the embodiment of my country's superb mechanical level from ancient times to the present. The introduction of corresponding engineering cases in the teaching process is conducive to stimulating Students' sense of national pride and cultivate students' sense of home and country. At the same time, organically integrate the stories of scientists and the spirit of scientists in teaching, from Einstein's patriotism to the spirit of my country's manned spaceflight, educate and guide students to connect their personal growth with the destiny of the country and the nation, and train students to be scientists in the new era Spirit, to accumulate talents for the development of science and technology in the new era of our country.

3.2. Reform teaching mode

In the process of curriculum reform and ideological and political construction, Theoretical Mechanics adopts a mixed teaching mode. On the basis of traditional classroom teaching, the teaching team has opened synchronous online courses based on the school's comprehensive online education platform. According to the requirements of teaching objectives, make corresponding online teaching videos, and

provide corresponding chapter learning objectives, learning materials and related video materials. At the same time, the ideological and political elements that are in line with the content of this course are excavated and refined, including some classic engineering cases, or relevant video materials with strong timeliness. For example, the oldest existing Zhaozhou Bridge in the world in my country, its structural design is perfectly integrated with modern plastic mechanics and topology optimization methods, so that students can appreciate the wisdom and creativity of the ancient Chinese people, and stimulate their national pride. Modern super projects such as the Hong Kong-Zhuhai-Macao Bridge and the Shenzhou series of spaceships not only contain profound mechanical principles, but are also super-stages to demonstrate China's national strength and creativity. Through the explanation and analysis of examples, the "craftsman spirit" of excellence, dedication and pursuit of excellence will be cultivated in students, and at the same time, it will help to cultivate new era builders and successors with firm ideological and political stance, courage to struggle and dedication[5]. While providing rich teaching materials, it customizes the learning task list, and requires students to study the teaching videos before class and complete the learning tasks. As a guide for students' online self-learning before class, the learning task list also plays a role in supervising students' self-learning, and at the same time helps to cultivate students' independent learning ability.

After students complete the online pre-class study, they enter the offline classroom teaching link. According to the problems reflected in the students' pre-class task list, teachers will explain the key points and difficult points of knowledge in the classroom, and organize students to discuss and exchange related teaching content. The content of the discussion includes not only the exchange of learning experience, but also case analysis, etc. For example, what is the difference between the principle of aircraft take-off and the mechanical principle of rocket launch? In national sports, why does table tennis have straight and curved balls? Through discussion and communication, cultivate students' ability to correctly understand and analyze problems, as well as solve practical engineering problems. Through face-to-face discussions, students can exercise their language organization and expression skills, improve students' ability to think independently, and at the same time help to strengthen Emotional communication between teachers and students. Through the guidance and inspiration of teachers, students draw correct conclusions and realize the educational goals of curriculum ideology and politics.

At the end of the classroom teaching phase, students will test their mastery of the course through homework. At the same time, it makes full use of real-time communication platforms such as network resources WeChat group and QQ group to realize three-dimensional answering and answering questions across time and space anytime, anywhere. Students can also selectively conduct post-online learning of teaching videos according to the learning situation of online learning and classroom teaching, so as to deepen their understanding and mastery of the learning content, and ultimately achieve the internalization of knowledge into core literacy.

3.3. Improve the teaching evaluation mode

In order to test the students' learning and mastery of the teaching content, the normative and scientific nature of the course assessment must be improved in the process of first-class course construction. In the teaching process of theoretical mechanics, the "full-process-diversified" assessment and evaluation system is adopted. Through the whole-process, all-round, and multi-style assessment of students, a comprehensive assessment of students' knowledge, ability, and quality can be achieved. 4]. The usual online learning, online interaction, online testing and offline classroom learning are all included in the scope of assessment. The total score of the reformed course is divided into two parts: among them, the usual process assessment score accounts for 40% of the total score; the remaining 60% % is the final closed-book exam result. The usual process assessment scores are further refined into online course learning (10%), online tests and discussions (10%), online homework (10%) and offline classroom participation (10%). Paying attention to the overall evaluation of the learning process and closely combining quantitative and qualitative evaluation can fully reflect the multi-dimensional curriculum evaluation and promote the realization of the goal of first-class curriculum construction. Through the test of practical teaching, the "full-process-diversified" assessment and evaluation system can effectively enhance students' subject consciousness, and make students change from the passive nature of teaching objects to the initiative of learning subjects. This evaluation model is conducive to cultivating students' ability to understand knowledge, and at the same time helps to improve students' autonomous learning ability.

4. Teaching effect of curriculum construction

The teaching experiment was conducted through two different teaching classes of the same teacher, and the students in the two classes were used as the test group and the control group for comparative testing. The first group is the test group, which adopts a mixed mode of teaching, and the test subjects are 79 students majoring in mechanical engineering in 2019; the second group is the control group, which is 82 students majoring in underground space engineering in 2019, using the traditional mode of teaching. Students in the test group completed online and offline learning tasks as required. By testing the statistics of students accessing the learning platform during the semester, it can be seen that there are students logging in to the learning platform every day. Each student has different login times and login times. The maximum number of visits is 126 and the login time is 3620 minutes. It reflects the main body of students' learning, fully mobilizes students' enthusiasm for learning, and promotes students' personalized learning.

The teaching effect of theoretical mechanics course construction is verified by final exam and questionnaire. The two groups of students uniformly participated in the final closed-book examination organized by the school. The distribution of test scores and number of students is shown in Figure 1. It can be seen from the figure that the distribution of students' scores in the test group is relatively concentrated, with more students in the 60-70 score segment than the control group, and the average score is higher, indicating that the reformed teaching model can help improve the learning effect of students.

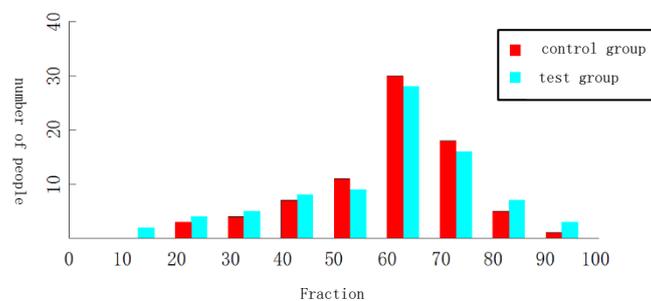


Figure 1 Comparison chart of final exam results

The questionnaire survey adopts the anonymous form of the network to organize two questionnaires at the mid-term and the end of the term to investigate the students' acceptance of the course, improvement of learning quality, satisfaction with the course design, and opinions and suggestions. 96.2% of the students in the test group participated in the questionnaire survey. All the students who participated in the questionnaire survey expressed their willingness to accept and agree with the reformed teaching mode. The rich online course resources and course links can meet the individual learning needs of the students, and the students are highly satisfied with this course.

5. Conclusion

Based on the blended teaching mode, the specific implementation paths of theoretical mechanics course ideology and politics in the process of first-class course construction were explored and applied to teaching practice from three aspects: optimizing teaching content, enriching teaching methods and improving teaching assessment mode. The results of teaching practice show that the reformed teaching mode is conducive to stimulating students' enthusiasm and initiative in learning, and the students' satisfaction with teaching is high. The curriculum construction has achieved initial results, but further rectification and improvement are still needed.

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References

- [1] *Implementation Opinions of the Ministry of Education on the Construction of First-Class Undergraduate Courses* [J]. *Bulletin of the State Council of the People's Republic of China*, 2020(05):57-62.
- [2] Pu Yuxue, Xu Haiyan, Hu Zongjun. *Ideological and Political Practice and Exploration of "Theoretical Mechanics" Course* [J]. *Education and Teaching Forum*, 2021(02):105-108.
- [3] He Yunxiang. *Discussion on improving the teaching quality of "Theoretical Mechanics"* [J]. *Three Gorges Higher Education Research*, 2012(2):43-45.
- [4] Zhao Xiaoli, Zhu Xiaoming, Xu Yan, et al. *Construction and Practice of "Whole-process-Diversified" Assessment Model* [J]. *Youth and Society, Chinese and Foreign Education Research*, 2009(12):15-16.
- [5] *Ministry of Education of the People's Republic of China. Notice of the Ministry of Education on Printing and Distributing the "Guidelines for Ideological and Political Construction of Colleges and Universities"* [Z], Jiao Gao [2020] No. 3.