Advances in Social Science, Education and Humanities Research, volume 516
Proceedings of the 2020 3rd International Seminar on Education Research and Social Science (ISERSS 2020)

Exploration and Practice of Theoretical Mechanics Course in the Process of Cooperative Education

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ABSTRACT
Theoretical mechanics is one of the compulsory courses for students of related mechanical majors, and the courses contain rich moral education resources. This work aims to study how to better exert the cooperative education function of the theoretical mechanics course in university education and improve the level of students' ideological and moral education. In this work, it dug deep into the ideological education cases in the course through the process of researching courses and teaching principles of mechanics, and adopted teaching seeding, cloud resources irrigation, and the teaching model where innovative experiments help a lot, to thereby realize that the content of the ideological education of the curriculum can be absorbed into the mind. On the other side, through the construction of this course, the synergy effect of knowledge transfer and value guidance is achieved, so that students' ideological and moral qualities will be comprehensively promoted while mastering the knowledge of theoretical mechanics, and the course's collaborative education function is able to be realized as well.
Keywords*: Theoretical mechanics, cooperative education, ideological and moral education, teaching exploration*

1. INTRODUCTION

Theoretical mechanics is the science of studying the general laws of mechanical motion of objects. Human production practice is the source and power to promote the development of mechanics, and advance the discovery, summary and application of complicated mechanics principles. Since the twentieth century, due to the needs of industrial construction, modern defense technology and other new technologies, theoretical mechanics has continuously developed in the direction of specialization. Theoretical mechanics education is an important course of mechanical engineering education in colleges and universities. It is generally regarded as the first mechanics course after college physics, laying the foundation for the learning of the subsequent mechanics and other professional courses.

The principles of mechanics run through all aspects of architecture, engineering, machinery and other fields. Many great and famous buildings and engineering embody human wisdom and the full application of mechanics principles. Mechanics principles and methods will inevitably be explained by analyzing these famous cases in mechanics courses. In the process of admiring the cases, students will also feel a sense of admiration for the designer, builder, or maker in the case, and will increase their love for the country. Therefore, in the education of mechanics, on the one hand, it is necessary to enhance the students' understanding of mechanics principles and methods, more importantly, it is to inspire the devotion to family and country and a sense of mission responsibility. Moreover, in the actual teaching process, the course not only teaches students the principles of mechanics, but also penetrates ideological education into the daily teaching process. It is of great significance to study how to better exert the cooperative education function of theoretical mechanics courses in university education and improve the plane of students' ideological and moral education.

1.1. Related Work

In the teaching study of raising students' ideological and moral level and values through curriculum education, scholars at home and abroad have carried out a lot of researches. For instance, Graham K. Brown [1] concluded the public education in Malaysia—particularly, but not exclusively. At the pre-university level, it is promoted as a nation-building tool, seeking to inculcate a sense of Malaysian-ness and patriotism. Jun Li [2] made further research and suggests that higher education institutions as civic actors to nurture active citizenship learning, to foster students as reflective and open-minded social agents, and to facilitate the growth of vibrant civil society. Cen Jing [3] believed that it was necessary to strengthen the education that was in the aspect of students' ideology and morality in experimental teaching. It can enhance students' awareness, consciousness, and organizational discipline of experimental classes with lessens the occurrence of equipment damage and loss. Chen Zheng-gui [4] let students participate in self-exercise, self-education, self-

motivation, and self-improvement in situational experience and activities. In addition, schools and teachers should create conditions to encourage students to actively join in various practical activities inside and outside the school as citizens to stimulate citizenship. Pan Yong [5] combed the deductive context of the value orientation of Chinese modern education thought under the influence of foreign educational thoughts, and believed that Chinese education has experienced a modern education concept with democratic characteristics and human-oriented development as its value orientation, to the instructional curriculum paradigm dominated by the will of national education and then to the multiple, individual and creative new curriculum. Gao Yong-sheng et al. [6] researched that the explicit curriculum and recessive curriculum of colleges and universities contain rich moral education resources. The rational development and effective use of these moral education resources will give full play to their ideological education functions, which is of great significance for the smooth development of ideological education and improving the effectiveness of ideological education in colleges and universities. Frank Reichert et al. [7] considered that teachers' beliefs have previously been found to influence decisions about teaching contents and classroom practices and how teaching contributes to students' civic development. Zhang Bin et al. [8] believed that ideological education elements should be incorporated into the curriculum teaching content and various personnel training links to strengthen the ideological education concept of students. Lu Shanshan [9] believed that what students learn in class ought to be employed in practice. When conducting civic education, students' principal role need to be fully motivated, combining theoretical indoctrination with social practice, and allowing students to think independently. After research, Yang Lan et al. [10] concluded that British scholars' research on national identity education is generally based on national policy documents, and the UK's national identity education research also reflects the characteristics of close connection with practice. The school curriculum is the basic way to carry out national identity education in the UK. In the aspect of theoretical mechanics teaching, this work carried out related studies about how to excavate the ideological education cases in the course, strengthen the ideological and moral education of students, and develop the cooperative education function of professional basic courses.

1.2. The Overall Research Goals

In the process of research, the curriculum insists on the combination of knowledge transfer and value guidance, grasps the main position of the classroom, and makes full use of the main channel of teaching. The content of the course closely follows the development of the times and responds to the concerns of students. It not only has a deep academic accumulation, but also effectively stimulates students' demand for knowledge. Besides, it is necessary to enable students to master the basic concepts, basic theories and basic methods of theoretical mechanics, and be able to initially solve practical engineering problems. Combining the characteristics of this course, it is essential for the teachers to explore and design the content and theme of theoretical mechanics courses that can cultivate the ideals and beliefs, value orientation, social responsibility and national pride of students, to thereby foster students to become applied talents with both ability and integrity and comprehensive development.

2. THE RESEARCH ON THE STRUCTURE OF COURSE CONTENT SYSTEM

The theoretical mechanics course mainly focuses on the study of mechanics phenomena and principles in many engineering technical fields such as modern machinery, civil engineering and aerospace, and continuously cultivates university ideals, beliefs, value orientations, and ideological and moral level in the process of collaborative education with the help of engineering cases. The design idea of the ideological and moral education of courses is to adopt the trinity teaching mode, which is fostered by classroom teaching seeding, cloud resource irrigation, and innovative experiments

2.1. The Analysis of the Subject of Collaborative Education that Contained in the Course

The theoretical mechanics course is a professional basic course with strong theoretical nature, and it is the foundation of many subsequent professional courses. The course content involves a lot of content about architecture, structure, mechanical structure of machinery, nature of motion, etc. Every detail of professional courses can be integrated into the value guidance for students, and according to the characteristics of students' age and their cognition rules and psychological characteristics, in the existing educational requirements of emotions, attitudes and values of theoretical mechanics courses, the ideological and moral education is implemented to the foothold of this ideological education through some specific cases. Combined with the analysis of the characteristics of mechanics, students have not only learned the knowledge and skills related to theoretical mechanics, but also can understand the great achievements of modernization construction from it, which increases the national pride greatly. In addition, it is important to organically integrate the principles, requirements and content of ideological education with curriculum implementation and curriculum evaluation to realize the integration of ideological and moral education and knowledge education. Here are two examples for illustration. The first example is in the process of teaching the plane force system, the problem of force balance while the torch was lighting by Li Ning in the 2008 Beijing Olympic Games. In the process of running on the dome of

the Bird's Nest Gymnasium, Li Ning realized three approximate parallel force system balancing methods based on three different suspension methods of wire ropes. On the one hand, it explains to students the knowledge points of the equilibrium equation of the plane parallel force system. On the other hand, it allows students to understand that the 2008 Beijing Olympic Games was held in China and attracted the attention of the world, making students unconsciously cultivate the spirit of patriotism and national pride in the process of learning. Moreover, students can deeply understand that the slogan of "higher, faster, stronger", which is able to steadily inspire the Chinese nation to persevere in improving and making progress. The second example is based on the momentum theorem telling the process of high-speed rail movement. The faster the speed is, the greater the impact force at the joint between the wheels and the rail happens. Consequently, China's high-speed rail trains apply a seamless rail design. In the course, in addition to explaining the principles of mechanics through the momentum theorem, and interpreting to students the design concept and realization process of seamless rails, more vitally, students can also understand that China has mastered the core technology of high-speed rail, and high-speed rail has gone abroad to become a "China's calling card" and connect the Belt and Road countries to serve the formation of a global community with a shared future.

2.2. The Guiding Ideology for Implementation of Curriculum Collaborative Education

Starting from consolidating the basic knowledge of theoretical mechanics and cultivating engineering problem-solving skills, the ideological and educational elements contained in the course require to be deeply explored. Meanwhile, ideological and moral education ought to be integrated into the whole teaching process through specific examples of mechanics. In addition, it is necessary to pay attention to cultural influence, thus to make students continuously receive ideological and moral education in the silent moist.

2.3. Teaching Links and Related Resources for the Implementation of Collaborative Education

The specific implementation of the collaborative education of this course adopts the model of teaching seeding + cloud resource irrigation + facilitating innovative experiment, and the corresponding auxiliary resources mainly include student books, multimedia courseware, network cloud resource library, WeChat public account, and open laboratory. Teachers teach the key points of mechanics knowledge and introduce relevant ideological and moral education materials in the classroom. Students obtain and interact with extracurricular learning resources through the network cloud resource library and WeChat public account, and complete the practice of mechanics models and innovative designs in the laboratory.

2.4. The Implementation Methods and Cooperation Relations of Each Link

Teaching seeding integrates the key points of mechanics knowledge and important cases of engineering construction, implements professional knowledge and ideological and moral education in daily classroom teaching, focusing on the learning of basic knowledge points of theoretical mechanics and the training of theoretical calculation ability to solve engineering problems while quietly sowing ideological and moral education into students' thoughts.

Cloud resource irrigation encourages students to access the theoretical mechanics network cloud resource library with the help of media such as computers and mobile phones that students often use after class. At the same time, the valuable resources obtained by oneself are also allowed to be uploaded to the resource library for sharing, enabling students to complete the transition from passive viewing to active learning and sharing.

Facilitating innovative experiments complements the lack of experimental shortcomings in the original syllabus of theoretical mechanics through the design of innovative experiments, assuring students to conduct innovative experiments through modern technologies including 3D design and analysis, 3D printing, which can further deepen their understanding of course knowledge.

3. TEACHING METHODS AND TEACHING MEASURES

The current stage of this course is mainly for students born after 2000. Most students have received comprehensive family education and school education. They think highly of social values and collective interests. On the other hand, there are many channels for receiving information and a large amount of information. Accordingly, students' psychological and study habits are also diverse. This kind of group characteristics of students must be considered in the design of the teaching research and teaching mode of collaborative education. The following teaching methods and measures will be applied to carry out teaching activities.

3.1. A Combination of Regular In-Class Teaching and Extra-Curricular Network Resources

With the help of multimedia and other teaching media, through regular classroom theoretical content teaching, teachers impart the key points of knowledge and problem-solving methods for students in class, deal with students' confusions, and supplement them with a series of network

resources such as network cloud resources and WeChat public accounts. In this respect, cases, videos, text materials and other content that cannot be fully played in the classroom are pushed through the network platform to suit the different learning needs and learning habits of various students, and encourage students to develop the habit of independent learning. Through classifying and sorting out the learning interests of students, the following targeted teaching and cultivation are promoted: For students with strong learning ability and interested in the content of theoretical mechanics, the difficulty of the exercises ought be increased in a targeted manner to thereby further improve their research ability and level. Besides, it is also necessary to push some engineering cases that require certain thinking and a good mechanics foundation for this kind of students outside the class, experiencing and understanding the spirit of modern craftsmen and the importance of technological innovation during the learning process. For students with poor learning ability and lack of interest in the content of theoretical mechanics, teachers should focus on improving students' attention in class, and increasing their confidence in the content of the course through relatively simple exercises, then push some popular science engineering cases outside of class to strengthen their national pride and have confidence in the future of the country and the individual.

Through the combination of regular in-class teaching and extra-curricular network resources, synergy effects are formed in and out of class, so that students can better understand the theoretical knowledge of the course, flexibly control their learning time outside of class, and repeatedly check the content of their interest, thus to continuously improve their learning effects, and integrate ideological and moral education throughout the whole process of in- and extra-curricular education and teaching.

3.2. A Combination of Classroom Theoretical Teaching and Innovative Experimental Training

The basic theory and concepts are taught through classroom theoretical teaching, and the fundamental mechanics thinking mode and accomplishment are formed. On the other hand, with the practical projects which can strengthen the understanding of basic knowledge and cultivate the basic practical ability, the purpose is to further enhance students' interest in learning, increase students' learning time in this course. Lastly, from the perspective of time accumulation, the effectiveness of the ideological and moral education content in the curriculum to students is truly improved.

At this stage, the curriculum syllabus of theoretical mechanics in many colleges and universities does not arrange experiments and other practical links. In order to enhance students' understanding of the course knowledge points and apply mechanics principles to the actual mechanics structure, the course will set up a second class of innovative experiments for the design and production of some mechanics models, and simplify the mechanics characteristics of the model through discussion of actual engineering cases in the course, encourage students to design and implement mechanics models, and organically link theoretical learning and practical teaching. In the process of designing and realizing the model, students are able to experience the technical difficulties and complexity in modern engineering construction, thereby forming a consensus on the basic connotation of the "craftsman spirit" in the new era.

3.3. A Combination of Students' Passive Learning and Active Sharing

The Internet makes the interaction and collaboration between teachers and students more convenient, and it is more conducive for teachers to grasp the learning effects of students at each stage, and to understand students' opinions on the ideological and moral issues reflected in the course content through the network platform. From the in-class learning process to the extra-curricular knowledge supplement process, teachers turn into the instructors of learning, and students have changed from passively receiving education to consciously understanding the key points of curriculum collaborative education. In this respect, teachers need to inspire students to take the initiative to share learning results, and test the effectiveness of the teaching content of this course to students through questionnaires and voting and a series of links which are initiated by the network platform.

4. CONCLUSION

The teaching exploration of the integration of ideological and moral education into the theoretical mechanics course has important practical significance. In the implementation of this course, teachers need to strengthen their own ideological and theoretical level and dig deeper into the ideological and moral education elements contained in the course. Combining the characteristics of the teaching of this course, while teaching the principles of mechanics, it realizes the synergistic effect of knowledge transfer and value guidance, so that students' ideological and moral qualities can be comprehensively improved while mastering the knowledge of theoretical mechanics, and the collaborative education function of the course is also achieved.

ACKNOWLEDGMENT

This work was supported by Industry-University Cooperation Collaborative Education Project of the Ministry of Education(201902152004, 201902303041), First-class undergraduate construction course project of Tianjin University of Technology and Education(Cloud Programming Technology).

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