



Practical Exploration of the “Trinity” Course of Material Mechanics in Civil Engineering Major

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Abstract. The mechanics of materials is one of the three major mechanics of civil engineering, which plays a supporting role in the cultivation of applied talents. This paper combined with the content of material mechanics, mining ideological elements, put forward the pursuit of science and patriotism, philosophy and craftsmen, dialectical and power innovation and team cooperation of the trinity of ideological path, and through the reform of teaching methods, evaluation and comprehensive second class comprehensive stereo practice, realize knowledge, value shaping, ability training, realize ideological courses and courses.

Keywords: civil engineering · mechanics of materials · curriculum thinking and politics · “trinity”

1 Introduction

Xi Jinping has pointed out that “the foundation of a university lies in cultivating people by virtue”. To comprehensively promote the ideological and political construction of the curriculum is a strategic measure to implement the fundamental task of moral education. For a long time, the traditional teaching of science and engineering pays attention to the teaching of knowledge, ignores the education of students' values, outlook on life, world outlook and scientific literacy, and believes that ideological and political education is the task of ideological and political courses. How to break the “island effect” of isolation between ideological and political education and professional education and implement the whole process, all-round and full staff of classroom teaching in colleges and universities is one of the important tasks facing Chinese colleges and universities in the new era. Material mechanics is a required course for engineering students such as civil engineering majors. With the dual attributes of basic and engineering science, it plays a supporting role in cultivating engineering talents. How to excavate the ideological and political elements in the course of mechanics of materials, and integrate ideological and political education into the course teaching, so as to realize the synchronization of knowledge, ability and accomplishment, is of great significance to the training of applied talents in civil engineering and other engineering majors.

2 Ideological and Political Elements in the Mechanics of Materials Course

The course of material mechanics mainly introduces the mechanical properties and component strength and stiffness stability analysis of materials under the basic deformation such as bending, shear and torsion. Its theory originates from the characteristics of practice and service practice, which determines the organic penetration of the multi-dimensional, multi-angle and multi-level ideological and political elements of this course. Combined with the specific content of the course, through the effective and effective penetration of ideological and political elements, the teaching of professional courses and ideological and theoretical courses are guaranteed in the same direction, so as to achieve the effect of subtle and silent moistening. From the introduction to the stability of the press, 15 ideological and political cases were excavated, summarizing ideological and political elements such as brave exploration, cultural confidence, critical thinking, serving the country through science and technology, innovative consciousness and team cooperation.

3 The “Trinity” Ideological and Political Education Path of Material Mechanics

Perfecting the comprehensive education path is the basis of the teaching practice of integrating ideological and political elements. To Xi Jinping secretary proposed “strengthen moral education and cultivate students” important measures to penetrate into all-round, form education pattern, in view of the material mechanical content and its ideological elements, mainly from the scientific exploration and the country feelings, philosophical dialectical and power craftsmen, practice and team innovation and so on three path to carry out the mutual penetration, mutual support of “trinity” course ideology.

3.1 Have the Courage to Explore, Establish the Pursuit of Scientific Consciousness, and Cultivate the Feelings of Family and Country

In the process of course teaching, the spiritual connotation of patriotism can better answer the fundamental question of “what to, how to and for whom to train students” in the fundamental task of cultivating people by virtue. The beginning of the mechanics of materials in the introduction chapter is marked by Galileo’s “On Two New Sciences” in 1638. Galileo first proposed the calculation of the mechanical properties and strength of materials, which is also the result of the continuous efforts and arduous exploration of many scientists. Through the explanation of the development history, students should have the courage to explore, deep thinking and innovative thinking consciousness. Through the stories of Qian Xuesen, Zhou Peiyuan, Guo Yonghuai and other great Chinese mechanical scientists, students are encouraged to have a firm faith, have the courage to explore the peak of science, and make contributions to scientific development and social progress.

3.2 Scientific Rigor, Understanding of Dialectical Philosophy, and Cultivating Craftsmen of Great Countries

For civil engineering students, the bending section is the key content. On the bending content of the beam, from the Galileo wood beam experiment, after Hook, Bernoulli, Navier scientists constantly practice and error correction, and after nearly 200 years, to determine the accurate position of the neutral axis, established the correct positive stress theory calculation formula. The process of solving this problem tells students that science is rigorous, to dare to question, have the courage to practice, philosophical dialectics, to eliminate the false and preserve the true, eliminate the rough and select the fine, and get the correct conclusion. Encourage students to be diligent in thinking in the learning process, scientific and rigorous, not afraid of difficulties, and experience the philosophical dialectical thought of practice-theory-practice.

When explaining the theory of stress state and strength, after the second strength theory was put forward, it was found that the internal pressure and axial tension pressure of the cast iron thin-wall circular pipe were not more in line with the experimental results than the first strength theory. This forces scientists and engineers to continue their experimental research and ultimately give a basis for the strength theory. The expansion of these contents enables students to have a deeper understanding of the content, and at the same time realize the limitations of theory, so as to learn to look at and solve problems more critically, and establish a correct view of the problem and deal with the problem. It also further improves the ideological level of students and guides contemporary college students to devote themselves to China’s modernization with the spirit of craftsman in a big country.

3.3 Hands-on Participation, Improve Teamwork Ability, and Practice Scientific Research and Innovation

The mechanics of materials in our school is 64 h, among which 8 h are in-class experiments, which are basic confirmatory experiments of bending and twisting. The course is through a group of 5 students. Students can preview in advance, design the experimental scheme within the group, operate independently, and finally process the data and submit the experimental report to complete the corresponding tasks. In the operation process, we mainly cultivate students’ team cooperation, innovation consciousness, communication ability and experimental spirit; through loading design and data processing, cultivate students’ comprehensive literacy of rigorous and realistic thinking, realistic science and dialectical thinking; through task driven, cultivate students’ ability to analyze and solve practical engineering problems, and enhance the sense of engineering responsibility and professional identity. On the other hand, through extracurricular practices such as making models, participating in structural design competitions and participating in big innovation projects, students’ spirit of collaborative innovation is further cultivated.

4 Three-Dimensional Teaching Practice of Ideological and Political Courses of Material Mechanics

Curriculum ideological and political education is not simply “curriculum + ideological and political education”. How to really implement the whole process of curriculum ideological and political education and realize the subtle effect, three-dimensional teaching practice is particularly important. The content of material mechanics and the ideological and political aspects of the courses cannot be separated, but flexible and decentralized methods must be adopted to put the ideological and political elements in the appropriate classroom content, links, natural penetration and seamless docking. Choose the most representative pictures or videos, carefully organize the text, combined with vivid, easy to understand the language, the knowledge points to speak clearly.

4.1 Online and Offline Integration, All-Round Knowledge and Solutions

Since the COVID-19 outbreak, we need to use good online and offline methods. Compared with the main knowledge of the course, the ideological and political content is more vivid and close to the engineering reality. Therefore, teachers can make the ideological and political content of each chapter into teaching micro videos and publish it to students for after-class or online learning with the help of resource platforms such as “Rain Classroom” and “School Cloud”. At the same time, the knowledge points related to ideological and political affairs of the course are assessed through online evaluation in the form of single selection, multiple selection, filling in the blanks and answering questions. The offline classroom focuses on key knowledge and highlights the cultivation of ability, thus forming an organic combination of online and offline teaching mode with different emphasis, so as to realize all-round teaching and solving doubts.

4.2 Various Ways and Methods to Enhance Students’ Sense of Participation

The mechanics of materials should make full use of the case method teaching, not only to solve the students’ “why to learn”, but also to guide the students to complete the “what to learn” and “how to learn”. We will strengthen students’ awareness of responsibility in engineering ethics, cultivate the spirit of striving for perfection in a big country, and stimulate students’ sense of family and mission to serving the country through science and technology. While mobilizing students’ learning enthusiasm and improving the quality of course teaching, the ideological and political goals of teaching and educating realized. The classroom is student-centered, and teachers guide students to think about the content through “questioning”, and cultivate reverse thinking ability. Through “speaking”, it can not only promote the learning of course content, but also increase the confidence and learning enthusiasm; through “speaking”, students can grasp the situation at any time, strengthen the calculation ability, and cultivate students’ lifelong learning ability of independent inquiry and independent thinking.

4.3 Practice Experiment Innovation and Make Good Use of the Second Classroom

In addition to the required experiments in class, the mechanics of materials should make full use of the second class to encourage students to study and innovate experiments through big innovation projects, mechanics competition, structural design competition, open experiments, scientific research papers, numerical simulation and other projects. According to the needs of the project, through the access to information, independently design the experimental program, complete the corresponding tasks, for the construction of science and technology power, the realization of the great rejuvenation of the glorious cause of the Chinese nation.

4.4 Diversified Assessment and Evaluation, and Equal Emphasis on Culture, Thinking and Politics

The comprehensive assessment of mechanics of materials should focus on process evaluation and adopt diversified assessment methods, that is, “10% of ideological and political scores + 20% of class scores + 50% of final score + 20% of experimental scores”. Among them, ideological and political scores are evaluated by the online content of students’ self-learning after class; classroom scores are composed of students’ in-class discussion, flipped classroom, homework, and open papers, etc.; the final scores, namely the closed-book examination at the end of the semester, are used to assess students’ mastery of the course content.

5 Conclusion

College classroom is the main position of the transmission of values. The ideological and political courses in the mechanics of materials should be developed from many aspects and gradually infiltrated to ensure the close combination of ideological and political teaching and course teaching. This paper to material mechanics course as the carrier, through the “trinity” course ideological education path and the three-dimensional teaching layout of the practice of exploration, the course education to all-round, the whole process, by updating the teaching idea and teaching methods, promote material mechanics teaching simplification, practical, improve students’ learning initiative, stimulate students’ interest in learning. In this way, the ideological and political courses should be put into practice, the fundamental policy and goal of “cultivating people by virtue” in college education should be practiced, and the value of ideological and political courses in teaching practice should be brought into play.

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References

1. Meng Qingyu, Yin Dongsheng. Comprehensively promote the ideological and political construction of the curriculum [N]. People's Daily, 2021–06–08 (13).
2. Zhou Ling. Exploration of ideological and political teaching of “mechanics of Materials” course [J]. Education and Teaching Forum, 2020–5, No.20 (110–111).
3. Sun Ruijing, Lu Wei, etc. Research on teaching reform and ideological and political construction of “mechanics of Materials” [J]. Science and Education Guide, 2021–32 (29–32).
4. Song Qihong, Yuan Junting, etc. Practical Exploration of ideological and political Construction in the course of Mechanics of Materials [J]. Curriculum Education Research, 2019–05 (85–87).
5. Yao Cun. Research on the Innovation of Professional Ethics Education for College Students in the New Era [D]. Chongqing: Chongqing University of Technology, 2019.
6. Chief Editor of Sun Xunfang. Mechanics of Materials (sixth edition), Higher Education Press.
7. Wang Anqiang, Zhao Bin, Chen Ruiqing. Course construction and application of Mechanics of Materials [J]. Education and Teaching Forum, 2020–6–17.

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