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The Ideological and Political Teaching Design and Practice of Structural Mechanics Course for Engineering Construction Majors: Taking the Teaching of Single Node Moment Distribution Method as an Example

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Abstract: Curriculum ideological and political education is the innovation and continuation of ideological and political courses, and is an important measure to implement the fundamental task of cultivating morality and educating people. This paper takes the teaching of the single node moment distribution method as an example to design the ideological and political education of structural mechanics course, realize the goal of collaborative education of ideological and political education of structural mechanics course, practice in the teaching process and put forward new thinking on the ideological and political education of the course.

Keywords: Ideological and political course; Structural mechanics; Course teaching

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1. Introduction

Thought is the soul of a country and a nation. As an innovative measure of ideological education, curriculum ideological and political education is a necessary element and requirement for teaching and educating people in the new era. It can not only promote the subjection of teachers' values and realm but also inspire and guide students' view towards the world, values and life [1]. The essence of curriculum ideological and political education is to teach and educate people, and its concept is to walk in the same direction with all kinds of courses and ideological and political courses. The purpose is to further implement the fundamental task of moral education and realize the collaborative education of disciplines and majors [2]. In 2004, while promoting the construction of ideological and political courses in colleges and universities, it also strengthened the ideological and political education of college students. After nearly ten years of development, it gradually changed from the construction of ideological and political courses to the construction of ideological and political courses, in order to build the pattern of "Three

comprehensive education" and stimulate the synergistic effect of various courses. In 2020, the "Guidelines for the Construction of Ideological and Political Courses in Colleges and Universities" (hereinafter referred to as the "Guidelines") issued by the Ministry of Education clarified the objectives and key contents of the ideological and political courses. It was also pointed out that the ideological and political courses of engineering majors should focus on strengthening engineering ethics, cultivating the spirit of craftsmen of a great country, and stimulating the sense of patriotism and mission, which pointed out the direction for the ideological and political courses of engineering majors. Under the guidance of the Higher Education Department of the Ministry of Education, the National Network Training Center for University Teachers hosted the ideological and political teaching ability training of university teachers in 2021. Not only was the director of the Higher Education Department Wu Yan's in-depth interpretation of the ideological and political construction policy of university courses, but also the actual case analysis of experts and scholars in colleges and universities. To a certain extent, it answers the question of how to think about ideological and political education in professional courses [3–5].

The course quality and ideological and political construction of basic mechanics have always been the challenges and difficulties in the course teaching of engineering majors. Many university teachers have explored the mining and integration methods of ideological and political elements of basic mechanics combined with the characteristics of majors and courses, guided and stimulated students' ideological and political potential in multiple dimensions to improve and enhance the collaborative education effect of basic mechanics [6–8]. As one of the three basic mechanics, structural mechanics is an "instrumental" course in engineering majors, which plays a bridge role in undertaking professional basic and professional core courses. Its analysis methods and ideas are the key to professional exploration, learning and research. The systematization of mechanics course content, the diversity of analysis methods and the complexity of research objects are the main reasons for the difficulty of learning, lack of interest and passive acceptance of most students. It has always been a challenge and difficulty in engineering-related professional teaching. Due to the lack of a systematic system and practical application, the contradiction between the importance of course content and students' attention has become increasingly prominent. Therefore, many teachers have carried out corresponding reforms and attempts to teach basic mechanics because of the differences in students' levels. Tang Keke et al. (2022) took the course education as the goal, took the development of classical mechanics as the vertical line, and integrated the elements of science supported by mechanics, engineering frontier research, and national major projects when teaching basic mechanics, and achieved good results [9]. Zhang Juan et al. (2019) explored the "Four-hall integration" hybrid teaching method under the emerging educational technology, reformed and practiced the teaching and assessment of basic mechanics, to finally improve the teaching effect of the course [10]. Yang Xiaofeng et al. (2018), guided by engineering problems, taught basic mechanics through case forms, which enhanced teachers' sense of participation and students' sense of achievement in solving practical problems [11]. Song Zheng (2021) took the structural design competition as the guide, through the three-stage teaching design of "leading-teaching-strengthening", the application content of mechanics in the competition corresponded to the course of basic mechanics, and achieved good results in stimulating students' interest and learning initiative [12]. The continuity and diversity of university teachers' exploration and reform in mechanics teaching have improved the quality of course teaching to a certain extent [13,14]. However, whether the adoption of new educational technology and teaching methods, or the integration of discipline competition and ideological and political content, all are based on the single aspects of interest stimulation, learning effect and practical application of basic mechanics course, which not only has certain application limitations. Moreover, it fails to solve the problem of systematic and integrated construction of basic mechanics courses. Therefore, this paper discusses the integration of structural mechanics course teaching and ideological and political education, takes the single node moment distribution method as an example to carry out teaching design, and stimulates new thinking on the ideological and political education of professional system courses through practice.

2. The ideological and political education goal of the course

The professional courses' ideological and political education is the continuation and expansion of ideological and political courses. It is also the practical path for college education and talent education to advance together [15]. The important tasks, core problems, content and objectives of ideological and political courses are clearly explained in the course outline. For the ideological and political courses, it is required to deeply excavate the ideological value and spiritual connotation contained in the professional knowledge system, pay attention to the combination of learning and thinking and the unity of knowledge and practice, to increase the knowledge and humanism of the course from multiple levels and dimensions. These mentioned protocols aim to enhance students' innovative spirit of courage to explore and practical ability to solve practical problems.

As a key course in the curriculum system of engineering and construction majors, the teaching of structural mechanics should not only pay attention to the theoretical teaching of course principles but also strengthen the practical application of analysis methods. Combined with the characteristics of the curriculum system, the ideological and political education objectives of the course of structural mechanics are set as four aspects:

(1) Cultivating engineering consciousness.

(2) Strengthening engineering responsibility.

(3) Inherits the great craftsman spirit of striving for excellence.

(4) Adhering to the combination of theory with practice.

3. Ideological and political teaching design of the course

3.1. The overall design of teaching

The moment distribution method is the beginning part of the teaching of the asymptotic method of structural mechanics. The analysis of the moment distribution method of the single node is the key to understand its principle. The overall teaching design of this part of the content is 2 periods per class, and the teaching design of each class is shown in **Table 1**.

Table 1. Lesson instructional design

Teaching process	Time allocation	Main content	Educational goals
Early lesson guidance	10 to 15 minutes	(1) Review the analysis steps and characteristics of the direct solution method (force method, displacement method), and summarize the problems existing in the direct solution method (2) To solve the existing problems in the direct solution method, the basic idea of the moment distribution method is derived	(1) Review the past experience to know the new knowledge and think innovatively (2) Strengthen the sense of engineering responsibility
Teaching in class	60 to 70 minutes	(1) Basic concept: rotational stiffness, distribution coefficient, transfer coefficient (2) Basic principle: two-span single junction example analysis (3) Practical application: abstract mechanical simplified model in practical case, analysis and expansion based on basic principles	(1) Establish a correct life values (2) Guide clear goals and cultivate reverse thinking (3) Focus on principle analysis and standardize the problem-solving process (4) Combine theory with practice and promote craftsman spirit of striving for excellence
Summary at the end of the class	10 to 15 minutes	(1) Summary of the characteristics, key points and difficulties of the direct solution method and moment distribution method (2) Put forward after-class thinking, leading to the content of the next course	(1) Cultivate the habit of summary thinking (2) Cultivate a spirit of inquiry and exploration

3.2. Teaching process design

The single node moment distribution method completes the whole teaching content and curriculum ideological and political design in three parts:

(1) The beginning of the class, summarizes the key content and analysis steps of the force method and displacement method, and achieving the education goal of "warming up." It takes the multi-span statically determined beam as an example to guide students to review, brings up the problems and difficulties existing in the analysis of the force method and displacement method, guides students to think about and solve problems, and achieves the education goal of "thinking new", introduces engineering accident cases and data while strengthening the sense of engineering responsibility.

(2) The teaching in class, which is designed to be carried out in three modules:

(a) The first module is the basic concept, which uses the analogy method to teach the concepts of rotation stiffness, transfer coefficient and distribution coefficient, to establish correct life values.

(b) The second module is the basic principle, taking a two-bridge single node statically determined beam as an example, the basic principle of the moment distribution method is deeply analyzed, and the advantages of the moment distribution method are compared with the displacement method, to achieve the education goal of clear guidance, cultivating reverse thinking and paying attention to principle analysis.

(c) The third module is practical application, explaining the subject competition project instead of textbook examples, guiding students to abstract mechanical models from project data, using the method of this section for analysis, realizing the standardized problem-solving process, adhering to the theory with practice, expanding professional knowledge points, cultivating professional thinking and exploration ability.

(3) Summary at the end of the class, which summarizes the key points and difficulties of the course, puts forward the application scope and limitations of the single node moment distribution method, reserves the same type of problems for consolidation, brings up new problems to promote students' thinking after class, and realizes the education goal of cultivating the habit of summary thinking and guiding the spirit of exploration and exploration.

The teaching team carried out pilot teaching of the above teaching design in some classes of civil engineering about water conservancy and hydropower engineering. By comparing the teaching feedback, the pilot class had a deeper understanding of the moment distribution method, and the average score on the examination questions was also improved. The students' questions and thoughts about the course content were significantly increased, and the learning purpose was changed from dealing with the examination to exploring the profession. The effect of the course is obvious and effective.

3.3. New thinking on ideological and political education of the course

Since the ideological and political course was proposed, a lot of exploration has been carried out in various disciplines, and a series of feasible ideological and political programs have been formed. The teaching team has accumulated corresponding experience in recent years and also summarizes the problems existing in the current curriculum of ideological and political education.

First, as for teachers, due to the ideological and political course being included in the teaching assessment, most teachers are in a passive state of acceptance. The ideological and political content of the course is only reflected in the teaching plan, and there is a lack of thinking about the ideological and political elements of the course content and the exploration of students' potential.

Second, in terms of students, in the rapid development of the Internet environment, external induction

has caused the deviation of students' thinking. Most students are not interested in learning and professional exploration, lack the ability to correctly utilize resources, and gradually lose their learning potential.

Thirdly, in terms of the system, some colleges and universities pay too much attention to the requirements of teacher assessment in the aspect of curriculum ideological and political education and weaken the construction of resource allocation, teacher strength and reward systems around curriculum ideological and political education. The phenomenon of clear assessment requirements, lack of corresponding incentive mechanism, clear content and objectives, and lack of corresponding security system often occurs. It has greatly affect the construction and development of curriculum ideological and political education.

Ideological and political education should not only be carried out in a full, all-round and comprehensive but also need to be brought into the course teaching naturally. In this system, the ideological and political education of professional courses is an important guide and teachers are the main body of the construction and students are the results of the construction. The teaching of professional knowledge is always the core of curriculum teaching. Ideological and political education is the continuation of curriculum teaching. It is necessary to ensure the core content and highlight the continuation of innovation, "teaching" and "educating" develop and work together. Secondly, teachers should have the correct ideological and political attitude, curriculum ideological and political education is not a task but a kind of responsibility, teachers cannot complete the assessment requirements for the purpose without any objectives. However, teachers cannot deliberately increase the ideological and political content, it has to be carried out silently in the course teaching process. Teachers teaching with their experience and practice are more appealing and will prompt more questions from students. In this case, an idea or a sentence expression can achieve the ideological and political goal. Finally, the construction of an ideological and political atmosphere, ideological and political education cannot be limited to the classroom and formality, it is necessary to create an ideological and political atmosphere in students' daily learning, their life and campus activities, so that students can improve their life and moral values.

4. Conclusion

Moral education is the fundamental task of college teachers. Ideological and political education is an innovative measure of professional education. Structural mechanics, as the core course of engineering construction, has the innate advantages of combining with practical engineering, and also has rich ideological and political elements. Clear teaching objectives, correct ideological and political attitudes and a good ideological and political atmosphere are important factors for the continuous development of ideological and political courses. College teachers should seize the development opportunity of ideological and political courses, while closely following the subject of education in the new era, adhere to the essential work of educating people and educating talents, and gradually enhance their value in the process of curriculum ideological and political education.

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References

[1] Yang Q, Ye H, Du J, et al., 2021, Collaborative Construction and Practice of Basic Mechanics Course Teaching and Curriculum Ideological and Political. Mechanics in Practice, 43(6): 955–958.

[2] Ye Z, Wang D, Zhao H, 2020, Curriculum, Teaching, Education: The Construction and Practice of Ideological and Political Education in Science and Engineering Disciplines and Professional Courses. Mechanics in Engineering, 42(2): 214–218.

[3] Li Z, 2018, Four Basic Problems in the Construction of "New Engineering" in Local Universities. Heilongjiang Higher Education Research, 36(12): 40–43.

[4] Li P, 2017, Why Engineering is New. Higher Engineering Education Research, 2017(4): 1–4.

[5] Zhong D, 2017, Connotation and Action of Emerging Engineering Construction. Higher Engineering Education Research, 2017(3): 1–6.

[6] Wang C, Jiang Z, 2012, Exploration and Thinking of Ideological and Political Teaching of "Mechanics" Course. Journal of University of Shanghai for Science and Technology (Social Sciences Edition), 44(1): 92–96.

[7] Qu S, Lu L, Song L, et al., 2021, Ideological and Political Teaching Practice of Material Mechanics Course: Taking the Stability of Pressure Bar as an Example. Mechanics in Practice, 43(6): 959–963.

[8] Wu C, Zhou Y, Wang Q, et al., 2012, Discussion on the Combination Model of Theoretical Mechanics Experimental Course and Ideological and Political Elements. Laboratory Science, 25(4): 209–211.

[9] Tang K, Wang H, Wen J, 2022, Construction of a Three-Dimensional Fusion Model for Educating Students in Engineering Characteristic Theoretical Mechanics Courses. Mechanics Quarterly, 43(1): 190–195.

[10] Zhang J, Wang Y, Yu L, 2019, Practice on the Reform of "Four Halls Integration" Blended Teaching and Assessment Mode of Theoretical Mechanics. Mechanics in Practice, 41(2): 210–215.

[11] Yang X, Liu Q, 2018, Reform and Practice of Engineering Problem-oriented Material Mechanics Teaching Method. Mechanics in Engineering, 40(4): 442–445.

[12] Song Z, 2021, Thinking on Engineering Mechanics Course Teaching Guided by Structural Design Competition for College Students. Mechanics in Engineering, 43(1): 144–149.

[13] Lu C, Lv H, Zhang Y, 2012, Construction Practice of Online and Offline Blended First-class Course of Structural Mechanics. Mechanics in Practice, 44(1): 203–211.

[14] Wang L, Lin X, Zhang W, et al., 2019, Application of Classroom Demonstration Experiment in Structural Mechanics Teaching. Mechanics in Practice, 41(6): 709–714.

[15] Wang F, Chai J, Wang Y, 2023, The Difficulties, Methods and Countermeasures of College Teachers' Curriculum Ideological and Political Education. Higher Engineering Education Research, 2023(1): 122–127.