



Research on integrating ideological and political education into the teaching of fluid mechanics

Shengchuan Cai*, Min Dong^a

Shandong Huayu University of Technology, Dezhou 253000, Shandong, China

*shengchuancai@163.com, ^a531797208@qq.com

Abstract. Cultivating morality and talents is the fundamental task of higher education and the foundation of contemporary universities. Curriculum ideological and political education is an important way to implement the fundamental task of cultivating virtue and nurturing talents. Based on the direction and focus of ideological and political construction in fluid mechanics, and combined with its characteristics, this article studies a new model of integrating ideological and political education into the teaching of fluid mechanics from the aspects of teaching objectives, contents, methods, and evaluation. The purpose is to achieve value guidance for students in the process of imparting knowledge of fluid mechanics, and effectively playing the role of the main channel of classroom education. Research has shown that integrating ideological and political education into the teaching of fluid mechanics enhances students' enthusiasm for learning, stimulates their patriotism and sense of responsibility, cultivates their rigorous scientific thinking, persistent research spirit, and craftsmanship spirit of striving for excellence, and achieves the goal of cultivating virtue and nurturing talents.

Keywords: Curriculum ideological and political education; Fluid mechanics; Teaching reform; Teaching method.

1 Introduction

Curriculum ideological and political education is an important strategic measure to implement the fundamental task of cultivating morality and talents. It is a new issue that universities face in the new era, which is the fundamental question of what kind of people to cultivate, how to cultivate them, and for whom to cultivate them^[1]. Comprehensively promoting the construction of curriculum ideological and political education, fully exploring and utilizing the ideological and political education resources contained in various disciplines, and adhering to the all-round education of all staff, processes, and aspects^[2] are important ways for universities to implement fundamental tasks and solve fundamental problems. Each course should combine its different characteristics, thinking methods, and value concepts, deeply explore the ideological and political elements, organically integrate them into the course teaching, and achieve a silent and nurturing effect^[3]. Comprehensively improving the level of curriculum ideological and

political has become a very important and urgent task for universities to promote and deepen education and teaching reform.

In the process of promoting curriculum ideological and political education construction, the attention and related research results of the academic community have gradually increased. The understanding of the value, practical exploration and theoretical summary of curriculum ideological and political are constantly deepening and comprehensive. which provides many useful content and model references for promoting the construction of ideological and political education^[4-7]. Although there is no concept of ideological and political education in foreign countries, there are ideological and practical activities similar to curriculum ideological and political education^[8-10]. However, the practical path and educational function of curriculum ideological and political education need to be further optimized.

This study aims to break through the traditional teaching mode and explore the key and difficult problems that urgently need to be solved in ideological and political education by implementing ideological and political education in the fluid mechanics. It focuses on achieving value guidance for students in the process of fluid mechanics knowledge transmission. This will help promote innovation in the mode, concept, content, method, evaluation, and system of ideological and political education teaching, further enrich and improve the theoretical system of ideological and political education teaching, and provide valuable references for promoting curriculum education.

2 Ideological and Political Education Construction Ideas for Fluid Mechanics

The fluid mechanics is an important foundational course for the energy and power engineering major at our school, focusing on the basic concepts, principles, methods, and experimental skills. The fluid mechanics is rich in content, with strong theoretical and logical characteristics, involving the application of knowledge in courses such as advanced mathematics and university physics. Classroom teaching mainly focuses on teaching principles and methods, and students lack interest and initiative. How to reasonably integrate ideological and political elements into the course within limited class hours is a challenge for teachers. The research group combines the teaching content and characteristics of the fluid mechanics, based on the training objectives of the energy and power engineering major and the social demand for talent quality cultivation, guided by socialist core values, clarifies the course's value objectives, then determines its ability and knowledge objectives, and systematically completes the teaching tasks. The construction ideas for this course are as follows:

2.1 Improve the Teaching Syllabus and Prepare a Teaching Calendar

Based on the main job requirements and professional talent training programs of the energy and power engineering major, and according to the needs, development levels, and personalized differences of students, three-dimensional and hierarchical teaching

objectives of the fluid mechanics are set, to improve the course teaching outline. Develop a teaching calendar based on the teaching outline and schedule of fluid mechanics, refine teaching content, methods, and progress, and arrange teaching content reasonably.

2.2 Integrate Teaching Resources and Write Teaching Designs

Focusing on the teaching objectives of the fluid mechanics, and closely combining with the application achievements of the fluid mechanics, deeply exploring the necessary ideological and political education elements in the professional teaching process, forming a professional ideological and political education case library, and enriching the teaching content system. The teaching design is aimed at improving teaching effectiveness, strengthening the pertinence of teaching content, increasing research-oriented, innovation, and comprehensive content, and implementing the principle of combining theory with practice.

2.3 Practical Classroom Teaching

Highlighting the student-centered teaching philosophy, guided by value orientation, and using problem driven teaching methods as the main thread, classroom teaching is carried out according to the process of introducing cases, new teaching explanations, returning to cases, and problem-solving, so that students can understand why to learn, what to learn, how to learn, and how to use them. At the same time, flexibly utilizing various teaching methods, guiding students to actively participate in teaching, actively explore knowledge, and be diligent in analyzing and thinking, enhancing their ability to innovate and solve practical problems.

2.4 Conduct Teaching Evaluation

Add ideological and political education evaluation index to the existing teaching evaluation indicators, reconstruct a new teaching evaluation system suitable for the fluid mechanics with “professional knowledge+ideological and political elements”, integrate ideological and political education into the entire process of course assessment, and reflect on the evaluation results to further improve teaching, enhance students' ability to solve practical engineering problems, and implement the curriculum education goals.

2.5 Teacher Led Demonstration

The self-cultivation and quality of teachers are crucial in ideological and political education teaching, directly affecting the growth and development of students. The teachers of the research group have strengthened their ideological and political awareness, strengthened their moral education awareness and ability construction, formed correct ideological and political values, possessed noble moral and cultural qualities, solid sci-

entific knowledge foundation, and a spirit of benevolence and dedication. In the teaching process, team teachers lead by example, emphasizing the unity of teaching and education, the unity of words and examples, and playing the guiding and exemplary role of role models.

3 Ideological and Political Education Construction Content of Fluid Mechanics

3.1 Deeply Digging into Ideological and Political Elements and Constructing a Pattern of Education

The teaching principles of student-centered, demand-oriented, knowledge imparting as the foundation, and ideological and political education as the guide, comprehensively sort out the course content. On the basis of ensuring the scientific and logical nature of the course knowledge system, fully explore the ideological and political education elements contained in the course, form a case library of ideological and political education, and enrich the resources of course ideological and political education. The corresponding framework between teaching content and course ideological and political education elements is shown in Table 1. Ideological and political education elements are integrated into the classroom teaching, experimental teaching, and innovative practical teaching of fluid mechanics through teaching design, integrating value orientation with ability transmission, forming a new teaching model that integrates knowledge transmission, ability cultivation, and value guidance. Taking the achievements of fluid mechanics in various fields as a case study, students will master the knowledge of fluid mechanics in case applications, achieve a close combination of theory and practice, improve their ability to correctly analyze and solve practical engineering problems, cultivate their innovative and creative abilities, unity and cooperation spirit, and social responsibility consciousness, enable them to have a spirit of exploration of unknown, pursuit of truth, and courage to challenge. Stimulate their patriotism and mission to serve the country through science and technology, and achieve the goal of cultivating morality and talents.

Table 1. Integration of teaching content and ideological and political education elements in fluid mechanics

Teaching unit	Knowledge points	Ideological and political materials	Ideological and political elements
Introduction	①Summary ②Continuous medium assumption ③The main physical properties of fluids	①Dujiangyan irrigation project, Liaoning aircraft carrier, Jiaolong deep-sea submarine. ②The story of scientists such as Qian Xuesen, Euler, Newton and Bernoulli.	①Patriotism. ②Cultural confidence. ③National pride, sense of mission and responsibility. ④The spirit of dedication and collectivism, Scientific methods.

	④The viscosity of fluids		
Hydrostatics	①Differential equations for fluid equilibrium ②Basic equation of hydrostatics ③Balancing fluid forces on walls	①The three gorges dam project, Jiaolong deep-sea submarine. ②The story of scientist Euler. ③Application of Pascal's principle in engineering.	①Rigorous scientific attitude. ②The spirit of dedication and innovation. ③National pride, patriotism. ④The spirit of great country craftsmanship. ⑤Dialectical materialism.
Basic concepts and equations of fluid motion	①Two methods for describing fluid motion ②Continuity equation ③Bernoulli equation ④Momentum equation	①The story of scientists Euler, Lagrange, and Bernoulli. ②C919 Domestic Large Aircraft. ③Yellow safety line on high-speed railway (subway) platforms. ④Bundling water and attacking sand, widening the river and blocking sand.	①The spirit of rigorous scientific and engineering. ②Safety, conservation and rule awareness. ③Energy conservation and emission reduction concept. ④Green and sustainable development concept.
Similarity theory and dimensional analysis	①Similarity theory ②Dimensional analysis	①Hong Kong-Zhuhai-Macao Bridge. ②Beijing Olympic Stadium Bird's Nest.	①Engineering ethics. ②Scientific methodology. ③The spirit of innovation. ④Patriotic sentiment and mission responsibility.
Internal flow of viscous incompressible fluids in pipes	①Two flow states of viscous fluids ②Flow resistance and energy loss ③Hydraulic computations of pipes	①The story of scientists Zhou Peiyuan, Reynolds, and Nicholas. ②The south-to-north water diversion projec. ③Natural gas transportation engineering from west to east.	①The spirit of hard work and perseverance in research. ②National pride. ③The sense of responsibility. ④The rigorous scientific attitude.

3.2 Innovative Teaching Models to Stimulate Teaching Vitality

In the design of course teaching, research and selection of appropriate teaching methods and carriers are carried out, fully relying on technologies such as the Chaoxing Learning Platform and virtual simulation experimental teaching system. Modern information technology is deeply integrated with theoretical knowledge and ideological and political education elements. Through diversified teaching methods such as inquiry

based, discussion based, project based, case based, and blended teaching, ideological and political education is carried out while teaching professional knowledge, achieving a virtuous cycle of simultaneous progress and mutual promotion between professional knowledge teaching and ideological and political education. This cultivates students' independent learning thinking, scientific thinking, and innovative thinking, enhances their interest in learning, stimulates classroom teaching vitality, and fully mobilizes their enthusiasm and initiative in learning. achieves the organic unity of knowledge transmission, ability cultivation, and value guidance.

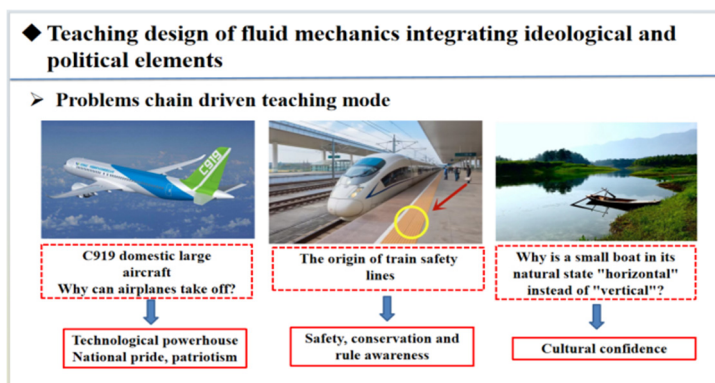


Fig. 1. Course ideological and political education elements

For example, when teaching the Bernoulli equation, a problem chain driven introduction model is adopted, interesting and engineering examples are selected, and closely related to real-life situations as shown in figure 1. Knowledge points are introduced in the form of problems to stimulate students' interest in learning. Enable students to gradually understand the complex fluid movements, recognize the objective laws hidden in physical phenomena, cultivate their scientific worldview and methodology invisibly, and achieve the synergy between professional knowledge and ideological and political education in course.

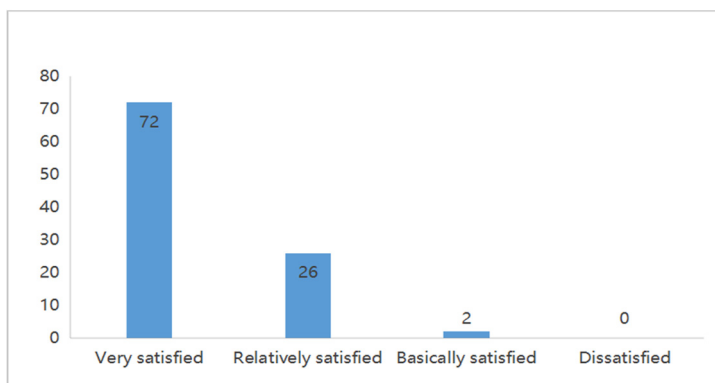


Fig. 2. Questionnaire on satisfaction with course ideological and political reform

3.3 Optimize Teaching Evaluation and Implement Educational Goals

Adding ideological and political evaluation indicators to the existing teaching evaluation index system, reconstruct a new teaching evaluation system with “professional knowledge+ ideological and political elements”, adopting a process evaluation method that combines teaching processes and evaluation methods, focus on application and practical ability assessment, and evaluate students' course learning in a diversified and all-round manner. Integrating ideological and political education into the entire process of course assessment, highlighting students' practical abilities, value cognition, and emotional attitude assessment, enhancing their interest and motivation in active learning and exploration. The results of a questionnaire survey conducted on 36 students in one teaching class of our school in 2021 are shown in figure 2. The survey results indicate that students have a high level of recognition for this course and have affirmed the implementation effect of teaching reform.

4 Conclusion

Cultivating morality and talents is the foundation of education. Deeply explore the ideological and political elements contained in fluid mechanics, and establish a course ideological and political case library from various aspects such as scientist stories, typical hydraulic engineering, and engineering ethics education. Adopting various teaching methods, effectively integrating ideological and political education into course teaching, and achieving an organic unity between ideological and political and knowledge education. Adopting a teaching evaluation system of "professional knowledge+ideological and political elements", closely combining knowledge imparting, ability cultivation, and value shaping, it cultivates students' scientific thinking habits, unity and cooperation spirit, innovation and creativity consciousness, and social responsibility consciousness, achieves the goal of cultivating morality and talents.

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