



# Exploration and Practice of Ideological and Political Case Teaching of Fluid Mechanics Pump and Fan

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**Abstract.** Based on the school's educational orientation, educational philosophy, and talent training goals for building environment and energy application engineering majors, this paper proposes ideas for ideological and political construction of the course through the course introduction, course objectives and learning situation analysis of Fluid Mechanics • Pump and Fan, combined with the characteristics of the course, and provides examples of the implementation process and implementation methods of integrating ideological and political cases into the course based on relevant knowledge points. In order to realize the unity of classroom teaching content in knowledge imparts, ability cultivation and value shaping, it can provide reference for the ideological and political case teaching of this course in related majors.

**Keywords:** Fluid mechanics • Pumps and fans, Curriculum ideological and political, Case teaching.

## 1 Introduction

According to the Guiding Outline of Ideological and Political Construction of Curriculum in Colleges and Universities of the Ministry of Education, combined with the school-running orientation of "local, applied and open" of our school, we implement the educational concept aiming at cultivating high-quality applied talents, and constantly explore the ideological and political education cases contained in the curriculum. By integrating real cases such as socialist core values, rigorous scientific attitude, energy conservation and emission reduction development concept and great power craftsman spirit into the teaching of Fluid Mechanics • Pump and Fan, students will have good ideological and political consciousness, high sense of social responsibility, solid basic knowledge, strong practical ability and Innovation ability.

## **2 Basic Situation and Construction Ideas**

### **2.1 Course Introduction and Objective**

"Fluid Mechanics • Pumps and Fans" is a compulsory course for the major of building environment and Energy Application engineering in our school, with a total of 72 class hours (including 8 class hours of experiment). This course covers the main knowledge of fluid mechanics and fluid machinery (pumps and fans) in fluid transmission and distribution pipe networks. Through the study of this course, students will have certain basic knowledge of fluid mechanics, certain hands-on ability, and certain design ability and engineering practice ability.

1) Knowledge objectives: Improve students' cognition of the basic theories and professional knowledge of Fluid Mechanics • Pumps and Fans, so that students can master the basic concepts, basic principles and basic calculation methods of fluid motion, and lay a solid theoretical foundation for learning professional courses, engaging in engineering and technical work, and scientific research. Through the experiment in class, students have certain experimental skills.

2) Capability objectives: Cultivate students' basic ability to analyze and solve problems; To train students to correctly master the analysis and treatment methods of various fluid mechanics problems, and to solve some practical engineering problems; Cultivate students' careful, practical and logical thinking ability.

3) Quality objectives: Have the consciousness of engineering innovation, master the innovation method; Have a good sense of social responsibility, professional quality and other comprehensive quality; Establish the concept of energy conservation and emission reduction.

### **2.2 Necessity of Curriculum Ideology and Politics**

Following the traditional "infusing" ideological and political content teaching, the transition from professional knowledge to ideological and political content is not natural enough, ability cultivated and value guided by different frequencies, and lead to unsatisfactory effect. Although the textbook used is a planning for the major, its effect in integrating ideological and political elements and improving students' patriotism is not significant, and it cannot fully motivate students to study hard and take the initiative to learn. Therefore, it is very necessary to train students' case education of patriotic thought on the course, cultivate the basic knowledge of fluid mechanics, application technology, political confidence and firm patriotic political feelings that students must have to make Chinese manufacturing go to the world, and integrate the ideological and political thoughts into the course through case teaching.

### **2.3 Construction Ideas**

Make full use of modern intelligent teaching tools, increase the integration of ideological and political case content, and constantly improve students' learning initiative and consciousness; Take socialist core values as the core, establish curriculum ideological

and political case database, and refine and classify curriculum ideological and political teaching points to facilitate accurate teaching; Adopt timely and appropriate ways to introduce ideological and political elements, so that students can readily accept, and play a role in promoting for students' learning.

By means of flipped classroom, student grouping, class discussion and other forms, combined with typical cases, knowledge points and formulas learned are used to solve technical problems arising in the cases, increase students' enthusiasm for learning, consolidate the knowledge learned about fluid mechanics pumps and fans, and realize the organic combination of theoretical knowledge and practical application. Achieve the "Five transformations". That is, From "teaching as the center" to "learning as the center"; From infusion to heuristic, discussion-type teaching method; From "final examination to determine the grade" to the emphasis on process evaluation of academic evaluation; The role of teachers from "preaching, teaching and solving doubts" to the "guide" that stimulates students' innovation and creation; Students' behavioral shift from passive learning to active learning<sup>[1]</sup>.

### **3 Implementation Process of Teaching Cases**

#### **3.1 Course Introduction**

When teaching fluid pressure, introduce Dezhou "Yellow River story", Combined with the content of "Statics and dynamics" of fluid in the course, the dam force calculation is carried out. While teaching the professional knowledge of the course, it also cultivates the rigorous scientific spirit of students and improves their professional interest and learning motivation. Through historical stories, increase students' national pride and further stimulate students' patriotic feelings.

Introduce Dezhou current political news. On April 28, 2022, the Millennium Canal ushered in the revival of the century. Through the video, the students watched this exciting and important moment. Introduce this section of knowledge "Energy equation". By teaching the principle that the sum of pressure potential energy, kinetic and potential energy of any two points on the flow line remains unchanged in the flow of fluid ignoring viscous loss, students' understanding of this knowledge point is deepened and students' interest in pursuing science is stimulated.

#### **3.2 Take Major National Projects as an Example**

Based on hydrostatic equations, it leads to the development process of China's "Jiaolong" manned submersible. China is the fifth country in the world to master the technology of large depth manned deep diving. In 2002, the Ministry of Science and Technology of China listed the development of deep-sea manned submersible as a major project of the National High-tech Research and Development Program ("863" program), and started the self-design and independent integrated development of "Jiaolong" manned deep-sea submersible<sup>[2]</sup>. In June 2012, in the Mariana Trench to a depth of 7062 meters, 20 for the first time carrying female scientists to dive. Manned deep diving technology is crucial to China's development and utilization of seabed resources, and

its significance is comparable to Shenzhou flying. Introduce high-tech research work with independent intellectual property rights to students, and enhance students' national pride and self-confidence.

When teaching the calculation of pipeline flow, simplify the complexity, put forward the typical flow calculation diagram of water pipeline, and put forward the calculation of pipeline flow of water pipeline project of South-to-North water transfer project as a case. Adopting the form of series connection of pipe diameter thin at the front and thick at the back. It is conducive to the reduction of the entire project cost. Cultivate students' awareness of energy conservation and responsibility; At the same time, through the South-to-north water transfer project through the dam pipeline design scheme, combined with typical cases, using the knowledge and formula to solve the technical problems in the case, increase the enthusiasm of students.

### **3.3 Take Enterprise Real Project as an Example**

Through the self-made transformation test bench to check the flow coefficient of Venturi flowmeter. Through the combination of theoretical knowledge and real engineering cases, students can deepen their understanding of knowledge and make it clear that practice is the standard for testing truth.

### **3.4 Take the Scientist Story for Example**

When teaching the specific speed of pump and fan, the real story of scientist Qian Xuesen is introduced. When he deduced the formula of the ratio of revolutions at school, his teacher gave him 100 points, and Qian Xuesen thought that the variable  $N_s$  in the answer missed the bottom corner mark S (marked with red pen in the test paper), and asked the teacher to give him 96 points. Through this story, students are guided to learn Qian Xuesen's honest and rigorous learning attitude.

## **4 Implementation Method**

Excavate the ideological and political education resources of "Fluid Mechanics · Pump and Fan", establish the ideological and political case base, refine and classify the teaching points, and give precise teaching, so as to internalize the socialist core values into the spiritual pursuit of students. The combination of value orientation and ability imparting forms a new teaching model of "knowledge imparting, ability cultivation and value guidance".

Ideological and political content should correspond to knowledge points, optimize teaching links, adopt appropriate introduction methods, and integrate ideological and political elements such as socialist core values, feelings of family and country, innovation and craftsman spirit into teaching activities.

Innovate the classroom teaching mode, give full play to the role of information means in teaching, carry out online and offline mixed teaching, and implement the re-

sults-oriented curriculum reform, so that "ideological and political education" and "professional education" cleverly integrate and penetrate each other, and realize the education goal of moral cultivation and value shaping in a subtle and silent way.

Make full use of information technology and integrate it into the teaching process. The ideological and political elements of the course are infiltrated into multimedia courseware in the form of text, pictures, digital media videos. Enable students to gradually understand the complex and changeable fluid movement, realize the essential relationship of the objective existence of matter, cultivate students' scientific world view in the intangible, and realize the coordination of professional knowledge and curriculum ideology and politics.

## 5 Education Objectives and Results

### 5.1 Take Dezhou Water System Characteristics as an Example

After the course, a questionnaire survey was conducted for students aiming at the compatibility between ideological and political elements and teaching content in classroom teaching, and whether ideological and political content is helpful to the learning of course knowledge points<sup>[3]</sup>. The results showed that the introduction of ideological and political elements was recognized by most students.

1) The content of Fluid Mechanics · Pumps and Fans is 16 chapters, with a huge course system, numerous knowledge points and abstract concepts. The ideological and political content is interspersed in the form of cases in teaching, which greatly enhances the diversity, interest and attraction of the course<sup>[4]</sup>, and enhances students' learning interest. Truly realize the purpose of curriculum education, for the society to cultivate patriotic ideology, love the job and dedication of professionals.

2) To deeply explore the elements of ideological and political education to achieve "three full education". As for the content of the basis of fluid dynamics, combined with the principle of energy conversion, cultivate students' awareness of energy conservation and responsibility; For the derivation of the calculation formula of flow resistance and energy loss, we can combine the hundreds of experiments conducted by previous scientists to obtain reliable data, and promote the spirit of "great craftsman" to students. As for the design experiment in class, adhere to the principle of promoting learning by competition, encourage students to think boldly, and cultivate students' innovative consciousness.

3) The course takes the academic thought and historical development of scientists as an opportunity to introduce the contents of craftsman spirit, innovation consciousness into the course teaching, enhance students' cultural self-confidence and inspire students' patriotic feelings, and make the course not only have the ability to impart professional knowledge, but also have the function of value guidance<sup>[5]</sup>.

### 5.2 Effect

The teachers won the second prize of the first curriculum Ideological and political teaching competition of Shandong Huayu Institute of Technology; Won the most popular ideological and political teachers in Shandong Huayu Institute of Technology.

After adopting ideological and political case teaching, students' academic performance of this course has been significantly improved compared with the previous one; At the same time, students have a stronger intention to participate in various competitions at all levels, and won the third prize of the National College Students' Social Practice of Energy conservation and emission Reduction and science and Technology competition.

The distribution of grades 20 and 21 is shown in Fig. 1 and Fig. 2. According to the pie chart analysis, the excellent scores of grade 21 accounted for 2%, grade 20 accounted for 3%, and grade 21 was slightly less than grade 20. Level 21 good results accounted for 46%, level 20 accounted for 28%, and level 21 was 18 percentage points higher than level 20. The average score of grade 21 was 34%, that of grade 20 was 17%, and that of grade 21 was 7% higher than that of grade 20. Grade 21 students have consolidated the basic concepts of fluid mechanics and mastered the technical points of pumps and fans.

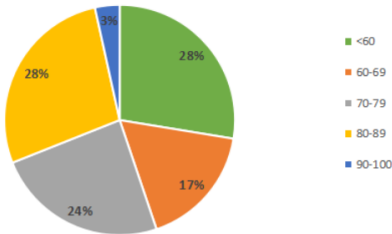


Fig. 1. Result distribution of Grade 20.

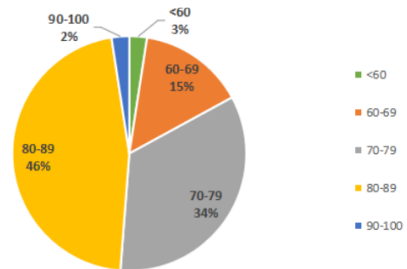


Fig. 2. Result distribution of Grade 21.

## 6 Conclusion

In combination with the course features of Fluid Mechanics · Pump and Fan, which is highly theoretical and has many formulas, and is easy to make students feel boring and boring, the ideological and political case teaching is introduced. Through teaching exploration and practice, elements such as socialist core values, excellent traditional culture and professional quality are integrated into the teaching, so as to achieve comprehensive, whole-process and all-round education goals. It provides reference for similar universities to train professional talents with all-round development of "morality, intelligence, physical fitness, beauty and labor".

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