

# ***Penetration and Integration of Ideological and Political Education in Teaching Design of Mechanical Measurement and Control***

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**Abstract:** Taking mechanical measurement and control as an example, we put forward a set of methods to identify the entry points of ideological and political education for courses of science and engineering. Then, our group point out the directions for collecting information of ideological and political education in courses of science and engineering, and formulate rules for selecting information of ideological and political education in the courses of science and engineering. Next, we conduct the teaching design of courses based on the above work, realize the integration of ideological-political education and professional knowledge, and cultivate new comprehensive engineering talents.

## **1. Introduction**

Undergraduate is a key period to establish students' correct outlook on life, so the ideological and political education of undergraduates is particularly important, and teachers in universities play a key role in the guidance <sup>[1,2]</sup>. In 2016, Chairman of China emphasized in the National Conference on Ideological and Political Work in Universities that we should combine the establishment of morality, education of human beings and the ideological work throughout the whole process of education and teaching, in order to realize the whole process of educating people and all-round education. Therefore, the integration of ideological and political information into professional courses is important for ideological and political education of universities, which can influence students' outlook on life and cultivate students' patriotism. Compared with the courses of humanities and social sciences which have an innate advantage, the courses of science and engineering often have the problem of “enough on profession, while not enough on red” <sup>[3]</sup>. However, to find out ideological and political information in majors of science and engineering, we need to find the entry point of ideological and political education and submerge the students in the ideological and

political courses. However, it is difficult to find the entry point of ideological and political education of science and engineering majors and to carry out ideological and political education via a subtle way. Therefore, this paper intends to take a typical course of science and engineering as an example (i.e., mechanical measurement and control), and to complete teaching design <sup>[4,5]</sup> as well as carry out moral education <sup>[6]</sup>.

## 2. Main contents

Fundamentals of Mechanical Testing and Control is a specialized basic course in the first-level discipline of mechanical engineering, including two parts of mechanical testing and control, which involves solving differential equations, Fourier transforms, Laplace transforms, etc. It requires students to have a solid foundation in mechanics and mathematics, and tests the students' ability of logic and discernment. Fundamentals of Mechanical Testing and Control” is characterized by large course volume and strong specialization, and teachers usually find it difficult to find the entry point of ‘course politics’ or carry out ideological and political education in a far-fetched way. Under the background of “Curriculum Civics and Politics”, how to realize the organic integration of the two has become a key issue that teachers of this specialized course need to solve. In order to address the above problems, the following research has been carried out:

(1) Discovering the entry points of “Mechanical Testing and Control Fundamentals”, exploring the commonalities of “Curriculum Civics” in mechanical courses, and proposing a method for identifying “Curriculum Civics” in engineering majors. We propose a method for identifying the entry point of “curriculum Civic and Political Studies” in engineering majors.

(2) Provide a method for collecting, screening and integrating ideological and political materials according to the entry point of “Curriculum Civics”.

(3) To propose effective teaching methods of “Curriculum Civics and Politics” to realize the organic integration of ideological and political education and professional knowledge.

## 3. Methods and implementation paths

### 3.1. Methods

Infiltrative teaching: The methods of infiltrative teaching and participatory teaching are adopted to realize the organic combination of ideological and political elements with the knowledge points of professional courses, to draw the distance between professional courses and Civic Politics, and to influence the life values of students in a subtle way.

Participatory teaching: “Classroom Civics” draws the distance between the professional courses and the students by focusing on the frontiers of science, telling the history of science, listing current affairs and politics, and practicing hands-on.

### 3.2. Implementation paths

Mechanical control is a fringe discipline across cybernetics and mechanical engineering disciplines, while testing technology is a synthesis of measurement and experiment. In view of the characteristics of Fundamentals of Mechanical Testing and Control, it is necessary to realize the organic integration of professional knowledge and “course politics” to form a systematic teaching system in order to cultivate more excellent talents for the society. The implementation path of mechanical testing and control teaching design is shown in Figure 1.

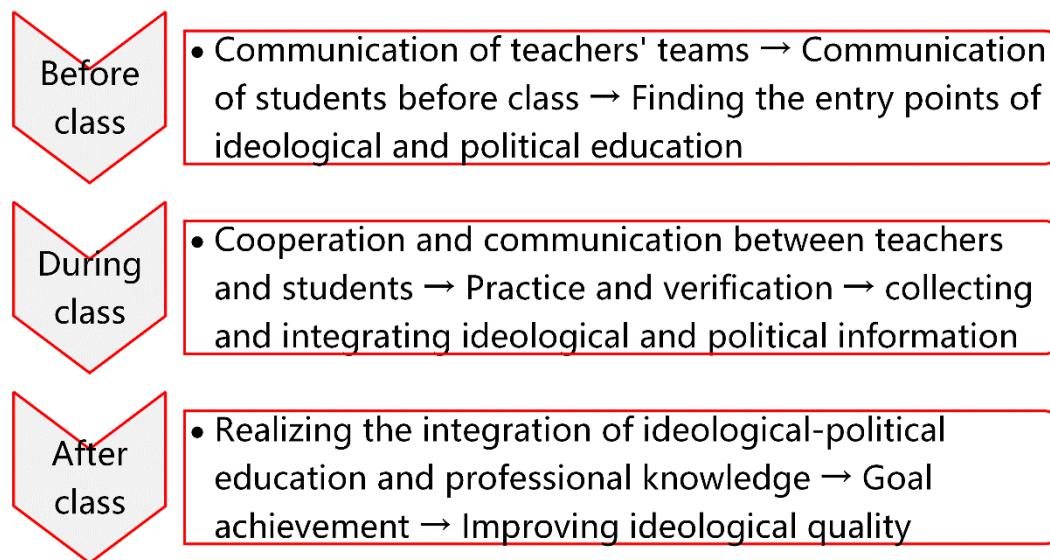


Figure 1 Implementation path for the teaching design of mechanical measurement and control

(1) Identifying the entry point of “course politics” in “Fundamentals of Mechanical Testing and Control”.

This paper combines the teaching objectives, in-class teaching content, extended application, personality training and other entry points to realize the organic integration of “course politics” and professional learning.

① Establish the entry point of teaching objectives.

Combined with the characteristics of the discipline, establish the goal of “curriculum politics” to cultivate professionals with both good character and good academic performance, as shown in Figure 2.

② Establish the entry point of teaching content.

Mastery of basic knowledge (enhancement of ability) → introduction to the history of the development of mechanical testing and control (enhancement of the sense of responsibility and sense of mission of the times) → focus on the frontiers of science and technology (enhancement of self-confidence and pride) → extracurricular practical content and students' personality development (cultivation of creativity and independent thinking ability)

(2) Collection and screening of relevant materials

For the entry point of “course ideology and politics” in Fundamentals of Mechanical Testing and Control, the ideological and political elements of Fundamentals of Mechanical Testing and Control are divided into 5 categories:

① Introduce the development history of Fundamentals of Mechanical Testing and Control and tell the stories of outstanding people in the field. For example, the story of Qian Xuesen, the founder of cybernetics, is introduced.

② Professional knowledge in science and engineering is often closely related to major national projects, which is a good material for “course politics”. For example, the application of cybernetics in Beidou system.

③ The combination of current affairs and politics with professional knowledge can also be the entry point of “course politics”, for example, the rapidity and stability of the world's scientific and

technological development.

④ Life cases can bring students closer. For example, the introduction of closed-loop system in rice cooker.

⑤ Focus on the frontiers of science and technology, such as artificial intelligence technology, and think about the future development prospects of the discipline.

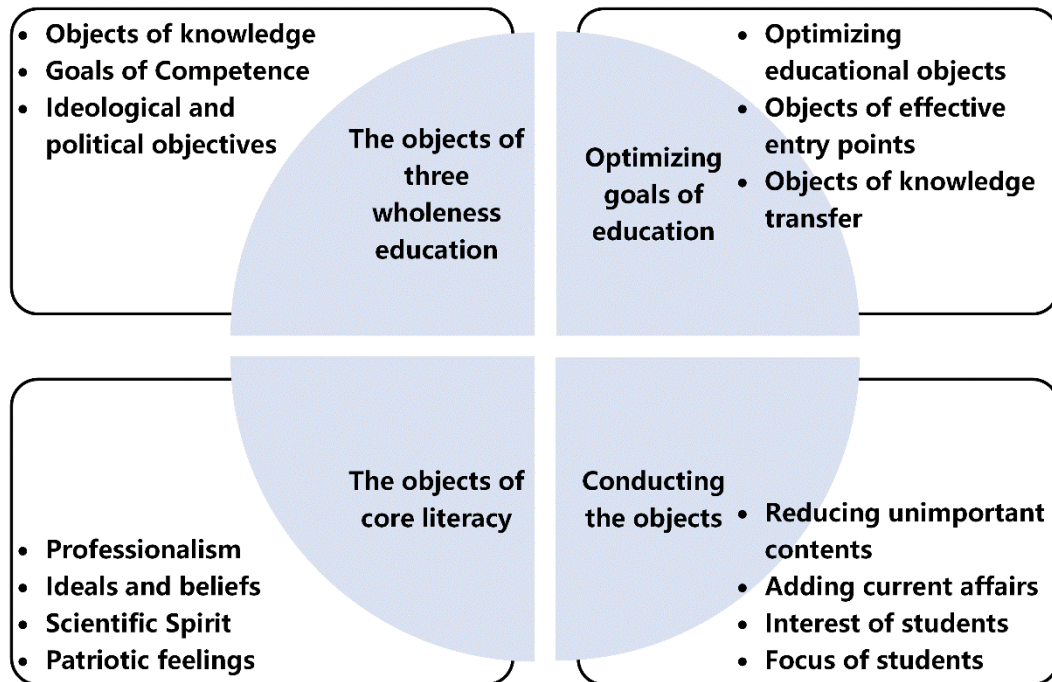


Figure 2 Teaching objects of teaching design of mechanical measurement and control

(3) Realizing the organic integration of ideological and political elements and knowledge of professional courses

Specific implementation methods include:

① Adopting the combination of storytelling and video playback to vividly teach students the knowledge points of specialized courses and the material of “curriculum ideology and politics”. For example, Zhang Heng's geodesic instrument of the Eastern Han Dynasty, Yan Su's compass car of the Song Dynasty, and the control systems of China's modern missiles, aviation and spaceflight.

② The combination of “assigning topics in advance + students' PPT presentations + teacher's comments” was used to increase students' participation.

③ Each class arranges experiments related to the knowledge points of specialized courses, and the experiments are related to real life as much as possible. For example, using the computer, MATLAB software and solid high level linear inverted pendulum, to master the solid high level linear inverted pendulum modeling method, using MATLAB and SIMULINK tools to analyze and design the characteristics of inverted pendulum.

④ Go into the factory and utilize the knowledge gained to link theory with practice.

#### 4. Achieved results

(1) We propose a method to identify the entry point of “Curriculum Civics and Politics” in science and engineering courses, and explore it from three levels, namely, teaching objectives,

teaching contents, and extracurricular expansion.

(2) We provide a method for collecting, screening and integrating materials, and identify materials for “curriculum politics” from various perspectives, such as the history of development of the discipline, outstanding scientists in the field, current affairs and politics, and life cases.

(3) Innovative teaching methods are designed for classroom teaching in the context of “Curriculum Civics and Politics” to realize the organic integration of ideological and political education and professional knowledge, and to improve students' ideological quality.

(4) At the same time, we have strengthened the construction of the “course ideology and politics” of “Mechanical Testing and Control Fundamentals”, published two papers on educational reform, and promoted the teaching reform experience in time, with good results.

## 5. Conclusions

(1) We clarify the learning objectives of “course civics and politics”, clarify the needs of the country and the times, and stimulate students' feelings of serving the country and taking up the responsibilities of the times.

(2) We integrate civics and politics into the classroom teaching design of fundamentals of mechanical testing and control, and realize the organic integration of knowledge points of professional courses and ideological and political elements.

(3) We provide effective teaching methods of “course ideology and politics”, increase students' participation, and improve students' ability of expression and hands-on ability with the help of DRVI rapid and reconfigurable virtual instrument platform and MATLAB software.

(4) Developing students' personality, guiding them according to their characteristics, encouraging them to explore their potential and give full play to their specialties, and letting them grow into engineers with independent and innovative spirit.

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