Research on Integrating Ideological and Political Education into Professional Course Teaching Based on the Characteristics of Engineering Majors

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Abstract: Based on the characteristics of engineering sciences, this paper discusses the deep integration of ideological and political courses and professional courses from the perspectives of connotation and thought, teaching content, and engineering education of discipline professional courses. Taking the introduction to computer science and programming and the basic courses of program design as examples, the implementation path and results are introduced, and the organic unity of professional knowledge education and ideological and political education is realized.

Keywords: Ideological and political education, Engineering discipline, Engineering education

1. Introduction

Since the 18th National Congress of the Communist Party of China, ideological and political work in colleges and universities across the country has been continuously strengthened[1]. "Make good use of classroom teaching as the main channel, and all kinds of courses should be in the same direction as ideological and political theory courses to form a synergistic effect"[2], as an important strategy and concept to cultivate virtues and cultivate people in the new era, has been comprehensively deepened and implemented in all levels of colleges and universities.

Ideological and political education is a systematic project. Carrying out pilot teaching activities integrating ideological and political courses with professional courses is a bold attempt to explore the deep integration of ideological and political courses with professional courses. It not only changes the traditional teaching form of ideological and political courses, but also makes the ideological and political classes move from "plane" to "three-dimensional", making the teaching of ideological and political courses more friendly and targeted. It also strives to build a benign co-existence and resonance of "ideological and political" education community, so that professional teaching and ideological and political teaching work in the same direction, forming a synergistic effect, and implementing the fundamental task of moral education and cultivating people [3].

2. Methodology

2.1. Grasp the connotation of the discipline and find the point of ideological and political integration

2.1.1. Analyze the connotation of the discipline

The three major methods of scientific research are theory, experiment and calculation, and the corresponding three scientific thinking are theoretical thinking, experimental thinking and computational thinking.

- Theoretical thinking;

Theoretical thinking is reasoning thinking, characterized by reasoning and deduction, represented by mathematical disciplines.

- Experimental thinking;

Experimental thinking, also known as empirical thinking, is characterized by observing and summarizing the laws of nature, represented by physics[4].

▪ Computational thinking.

Computational thinking, also known as constructive thinking, is characterized by design and construction, represented by computational disciplines[5].

The three major thinking are all inherent parts of the human scientific way of thinking, theoretical thinking emphasizes reasoning, experimental thinking emphasizes induction, and computational thinking hopes to solve automatically.

2.1.2. Combined with computational thinking, explore the ideology and politics of computing disciplines

The Introduction to Computer Science and Programming course is a compulsory course offered by our school for new students majoring in computer science. This course aims to comprehensively introduce the fundamental knowledge and important concepts in the field of computer science, which plays an important role in deepening students' understanding of computer science, cultivating computational thinking, and stimulating their learning enthusiasm.

The ideological and political education of professional courses in the field of computing should establish a bridge between Marxist philosophy and specific professional courses in the field of computing, playing a connecting role. Under the guidance of Marxist worldview and methodology, the methodology of computing should be constructed, and then through the study of the methodology of computing, students' scientific thinking should be cultivated, and their professional competence and professional literacy should be improved[6].

Specifically, in the course "Introduction to Computer Science and Programming", examples should be used to apply Marxist worldview and methodology to recognize the essence of computational science, and to establish a correct understanding of the worldview and methodology of computational science. Based on the Marxist statement that "practice is the foundation of understanding", the overall design of the ideological and political structure framework for this course is carried out. At the level of disciplinary methodology, this structural framework is consistent with the knowledge structure framework of the course, as shown in Figure 1.
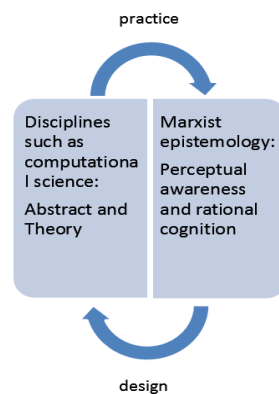
Figure 1: Marx's epistemological structure and the knowledge structure framework of curriculum ideology and politics.

Scientific abstraction refers to the cognitive process and thinking method of removing the phenomena and secondary aspects of similar things in thinking, extracting their common and main aspects[7], in order to grasp the general from the individual and the essence from the phenomena. Scientific abstraction is the decisive link in the leap of scientific knowledge from perceptual knowledge to rational knowledge.

Abstraction originates from the real world and experience, which is the idealization of the original form of reality and the conceptualization of real things. To achieve an understanding of the essence of things, it is necessary to combine experience and rationality to achieve the sublimation from abstraction to abstraction.

The abstract forms in a discipline contain concrete content, which are the scientific concepts, symbols, and thought models possessed by the discipline. Taking the course Introduction to Computer Science and Programming as an example, the core chapters of this course are constructed as Figure 2.
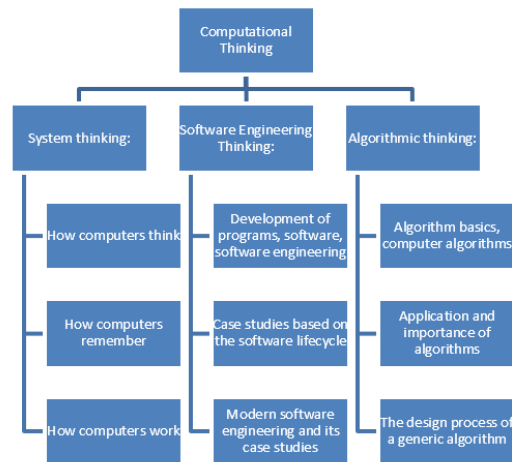
Figure 2: The core chapter of the Computational Mind Construction course in the discipline of computing.

In addition to the core chapters of the above courses, the course also features 11 experimental projects that combine the Marxist assertion that "practice is the foundation of cognition" with the computational thinking ideas embedded in the computational discipline. The Marxist worldview, as an ideological and political element, is naturally integrated into the professional course, establishing students' correct understanding of the worldview and methodology of the computer discipline.

2.2. Combine the humanistic factors in the discipline to explore ideological and political elements

In addition to the relevant elements of ideological and political courses in the teaching content, the disciplines and humanities in the field of engineering are also very excellent ideological and political resources for courses, and the life deeds and spiritual qualities of masters and experts can be used as an example to lead students to establish correct ethical values in engineering.

2.2.1. he humanistic and political elements contained in the teaching of software design patterns

Taking characters and deeds as examples, the following course ideological and political cases can be used in the teaching process of software design mode.

When explaining the Richter substitution principle in the object-oriented design principle, introduce to students the co proposer of the principle, the winner of the Turing Award in 2008, the winner of the John von Neumann Award in 2004, the academician of the American Academy of Engineering, the academician of the American Academy of Arts and Sciences, and Barbara Liskov, professor of the Department of Electronics, Gas and Computer Science of MIT, She devoted her whole life to the research of computer programming languages and the practice of system theory. Her research achievements have brought tremendous changes to the field of computer programming and greatly promoted the development of the computer industry. She is one of the greatest computer scientists in the world. In an interview, she mentioned that success cannot be achieved without a focused spirit, and creativity occasionally occurs, but this is not something that humans can plan for. Focusing on doing something may not necessarily lead to creative ideas, but it will always make you progress.

Taking the singleton pattern as an example, in the teaching process, the famous American anthropologist Margaret Mead's classic phrase "Always remember that you are absolutely unique, just like everyone else" (please always remember that you are unique, just like everyone else) leads to the uniqueness of the single case in the singleton pattern, and timely education on outlook on life and values is carried out; Then, taking the design of server load balancer software as an example, the structure and implementation of singleton pattern are introduced in detail. When explaining the specific implementation of the mode, compare and analyze the advantages and disadvantages of the two classic singleton pattern implementation methods, namely, lazy singleton mode and hungry singleton mode, and then lead to the question: Is there a better implementation method? Encourage students to think and discuss. Next, we will introduce other implementation methods of the singleton pattern. While explaining the implementation points of each method, we will analyze their advantages and disadvantages, improve students' learning interest, guide students to think deeply and summarize, and timely carry out dialectical materialism education and scientific exploration spirit education, integrating value shaping into

knowledge teaching.

By introducing the deeds of these well-known scientists and engineers, combined with their contributions, we convey to students the pursuit of dreams and the love of their profession by great scientists and engineers. By combining ideal and belief education with professional knowledge explanation, we have achieved good classroom teaching results.

2.2.2. The Ideological and Political Elements in Fundamentals of Program Design

Fundamentals of Programming is an important public basic course that involves a wide range of majors and a large number of students. The course uses C++ or Python language as a programming tool, with a focus on teaching the basic knowledge and methods of programming. While enabling students to master the basic process and thinking patterns of using computers to solve practical problems, the course team emphasizes the integration of UNESCO's education of "learn to do things, learn to be a person, learn to learn to learn, and learn to get along with others" throughout the course teaching process, taking on the responsibility of educating all students.

The basic course of program design, ideological and political education, should focus on integrating theory with practice, guiding knowledge with value, and integrating ideological and political education with engineering practice. It should be student-centered, combined with current events, and continuously explore ideological and political elements throughout the entire process of course teaching. For example, in 2020, the COVID-19 epidemic broke out, and China has achieved outstanding results in epidemic prevention and control, demonstrating the advantages of China's system. There is a large amount of news, epidemic situation statistics, and other data on the internet for statistical analysis, which should be timely integrated into curriculum teaching practice.

Emphasizing the integration of ideological and political elements with curriculum knowledge, we aim to cleanse students' minds in a silent and nourishing way, gain emotional resonance, and achieve a "taste and taste" in the classroom and an "endless aftertaste" in life, benefiting students for a lifetime.

2.3. The organic integration of ideological and political education and professional education under the engineering education model

2.3.1. The core concept of engineering education is in line with the essential concept of curriculum ideology and politics

In the classroom teaching of engineering courses, there is a widespread phenomenon of attaching importance to the practice of "hard teaching" and underestimating the "soft guidance" of humanistic spirit and moral quality.However, science and engineering should not only emphasize logical knowledge, but also humanistic thought, and there are also disciplines that can be excavated.The core concept of "student-centered", output-oriented and continuous improvement" advocated by the professional certification of engineering education is well in line with the essential concept of curriculum ideology and politics.

College education shoulders the mission of educating people, civilization and development, and the comprehensive realization of curriculum ideology and politics through multiple channels should be a topic that every engineering person strives to explore and practice.Teachers' teaching in the classroom is a process of "preaching and karmic dispelling."Science and engineering courses can not only talk about formulas and answers, but also include teachers' humanistic cognition and philosophical thinking on the subject, and also reflect the teachers' own world view and values.As a professional teacher, you should not treat your classroom as an "island of knowledge", but lead students to start from this world and look at the entire ocean of knowledge.

2.3.2. Correspondence between the ideological and political objectives of the course and the graduation requirements in the certification of engineering education major

The General Standards for Engineering Education Professional Certification require that majors must have clear, open, and measurable graduation requirements that can support the achievement of training objectives. The graduation requirements formulated by the major must fully cover 12 aspects such as engineering knowledge and problem analysis. The characteristics of ideological and political achievements reflected in graduation requirements are mainly reflected in three aspects:

▪ Responsibility and responsibility;

Cultivate students' sense of patriotism, including the awareness of the Party and the country, the core

socialist values, the national spirit, and the spirit of the times Personal character.

▪ Cultivate good moral character;

It including social morality, personal morality, professional ethics, and humanistic literacy; Having a sound personality and the ability to observe imagination, reason and judge, abstract thinking, and logical reasoning.

▪ A correct scientific perspective;

It has the good quality of being pragmatic, pioneering and diligent, as well as innovative awareness, critical thinking, and abides by academic integrity.

The corresponding relationship between them and the graduation requirement indicator point decomposition of the general certification standard for engineering education majors is shown in Table 1.

Table 1: Binding of Course Ideological and Political Objectives to Graduation Requirements Index Points in Engineering Education Professional Certification

Graduation requirements	Decomposed course ideological and political indicators	Curriculum ideological and political objectives
Engineering knowledge	Possess certain abstract thinking and logical reasoning abilities	Personal character and scientific outlook
problem analysis	Possess abstract model representation and perform reasoning, solving, and validation	Personal character and scientific outlook
Design/Develop Solutions	Correctly design, analyze, and evaluate algorithms	Personal character and scientific outlook
Research	Able to interpret and compare experimental data, and provide experimental conclusions	Personal character and scientific outlook
Using modern tools	Conduct data queries and literature searches, and master the basic methods of using modern information technology and tools to obtain relevant information; Analyze the advantages and disadvantages of the technologies, resources, and tools used, and understand their limitations	Personal character and scientific outlook
Engineering and Society	Basic knowledge and skills in social, physical, and mental health, safety, legal, and other aspects; Consider and evaluate the impact of engineering on society, health, safety, law, and culture; Social responsibilities to be undertaken in engineering practice in computer related fields	Responsibility and undertaking, personal character
Environment and Sustainable Development	Understand the connotation and significance of environment and sustainable development, as well as individual responsibilities; Able to understand and evaluate the impact of computer engineering practices on environmental and social sustainable development	Responsibility and undertaking, personal character
Professional norms	Broad knowledge of humanities and social sciences, with good humanities and social scientific literacy; Professional ethics related to the computer field, with a strong sense of social responsibility; Adhere to engineering professional ethics and norms in the field of computer engineering practice, and fulfill responsibilities	Responsibility and undertaking, personal character
Individuals and Teams	Understand oneself, understand the importance of personal qualities, and have a sense of teamwork; Communicate with team members in a multidisciplinary context, understand their ideas, and be able to coordinate and organize	Responsibility and undertaking, personal character
communicate	Cross cultural communication and communication skills; Effective communication and communication skills within the project team	Responsibility and undertaking, personal character
project management	Basic methods and techniques for managing various processes throughout the entire lifecycle of computer engineering projects	Personal character and scientific outlook
Lifelong learning	Adopting appropriate methods to develop oneself through learning, digestion, absorption, and improvement	Responsibility and undertaking, Scientific Outlook

2.3.3. Integrated Design Based on Conception, Design, Implementation, and Operation (CDIO) Concept

The integrated design based on the concept of conception, design, realization and operation (CDIO) includes comprehensive projects covering the whole process from data acquisition, data processing, data analysis to data visualization, organically combining practical projects with ideological and political elements, so as to achieve the integration and intercommunication of engineering education, ideological and political education and professional course education. Table 2 provides the teaching design ideas for

comprehensive projects under the CDIO concept.

Table 2: Teaching Design of Comprehensive Projects under the CDIO Concept

CDIO	Student activities (main body)	Teacher activities (led)
Conception	Analyze project requirements, select software design patterns, characteristics, and tools	Request
Design	Programming, drawing class diagrams, designing classes	guidance
Implementation	Write code, debug, and optimize graphical interface effects	Guidance and Q&A
Operations	Writing experimental reports, defense and acceptance	evaluate

3. Results

3.1 The effect of ideological and political education in computing disciplines

Table 3: Teaching points, integration points of ideological and political content, and effectiveness of computer introduction course

Teaching points	Integration points of ideological and political content	Teaching Forms and Methods	results
Introduce what a computer is, its components, the functions of each component, how it remembers, and how it thinks,	By introducing Tianhe supercomputers in China, guide students to understand the development process and achievements of supercomputers in China, and cultivate students' patriotism	Play Tianhe 2 supercomputer videos and pictures, and discuss with students about their understanding of it	1. Enable students to master computer composition, computer classification, and how computers store and work 2. Stimulate students' enthusiasm for learning and cultivate patriotism
Von Neumann computer architecture, how computers work in various situations	The core position of the central processing unit (CPU) in a computer is the foundation for the orderly execution of various instructions. Guide students to deepen their understanding of the importance of adhering to the core leadership position of the Party	Dynamic schematic diagram of system structure, understanding how the von Neumann computer system proceeds from input execution to output	1. Enable students to master the hardware structure and composition principles of computers 2. Students understand that China's development must have a strong core, which is the CPC chosen by history and the people
The development of computer application systems is a technical task that greatly affects the performance of the system and the efficiency of development work.	The achievements of any scientific research and technological application are the crystallization of collective wisdom, and teamwork is an important way to improve learning and work efficiency.	Explaining that the development of computer application systems is a work involving management science, which involves personnel organization, engineering, standardization, and other management tasks	1. Cultivate one's team awareness and cultivate students' initial ability to solve general problems 2. Guide students to cultivate the habit or awareness of comprehensively viewing and analyzing problems; Cultivate students' habit of complying with industry regulations
Algorithms and protocols in the field of computing	There are different algorithmic solutions to a problem, and optimizing the algorithm requires a lot of careful inspection and review, which requires the designer to calm down and complete it carefully	For the basic knowledge of algorithm design, it is important to compare it with the problems (especially mathematical problems) that classmates have encountered during the explanation, in order to enhance students' understanding.	1. Cultivate students' awareness of respecting others and being tolerant in handling affairs 2. From this, cultivate students' spirit of "craftsmanship" and improve their professional literacy

In the process of excavating the elements of ideological and political education, two core issues have been solved: where to dig and what to dig? In the specific implementation process of ideological and political education in the field of computing, combining the nature of the course and the characteristics of computational thinking contained in it, we mainly explore ideological and political materials such as text, images, and videos from the background, motivation and intention, structure and analysis, application and effects of the computational thinking mode, and integrate them into the ideological and political education curriculum of the subject.

According to the core chapters of the computational thinking construction course, identify the ideological and political integration points, and scientifically construct the ideological and political cases and incidence matrix of ideological and political points, as shown in the following table 3.

3.2 The Ideological and Political Effects of Disciplinary Humanities

By deeply exploring the humanistic and political education elements contained in the course "Introduction to Computer Science and Programming", and organically integrating ideological and political elements such as patriotism, rule of law awareness, social responsibility, humanistic spirit, and benevolence, the goal of ideological and political education is achieved through subject infiltration.

From the perspective of classroom teaching, students have high participation enthusiasm and enthusiastic response. Many students said that this teaching method not only deepened their understanding of professional knowledge, but also more deeply understood the importance and necessity of the "Internet plus" strategy and the "artificial intelligence" strategy pursued by the country. Through the construction of curriculum ideological and political education, we deeply realize that curriculum ideological and political education not only has a good effect on improving the effectiveness of curriculum teaching, but also greatly enhances students' professional identity.

In the teaching of program design, ideological and political education is carried out in a "guided by the situation and taking advantage of it" manner, with the teaching of "expression problem solving" knowledge points in program design being an example. We combine program examples to have students talk about "reflections", stimulate deep thinking and discussion, and help students understand the principles of life on their own.

The following are some students' comments in the programming class:

(1) Comparing 0.99365 and 1.01365, 'Make a little progress every day and be your best self; be lazy a little every day, it's a thousand miles away', 'The difference between working harder every day and being lazy a little every day over the course of a year is huge. By working harder every day, accumulating 365 days is a huge wealth'.

(2) By calculating 1.02365 and 1.01365, it can be concluded that "one percent more effort leads to a thousand percent harvest" and "every little makes a mickle, every drop wears away a stone, and every day one must make progress, even a little bit

(3) Calculate and determine if 1.013 * 0.992 is greater than 1.01. From the output results, it can be concluded that "after three days of fishing and two days of fishing, nothing will be gained".

3.3 The Effect of Ideological and Political Education under the Engineering Education Model

The computing discipline integrated into ideological and political education analyzes the development process of computer language from the aspects of natural language and formal language, Turing machine and von Neumann computers, machine instructions and assembly language, computer hierarchy, the meaning and role of virtual machines, high-level programming language, applied language and the formalization of natural language. After engineering practice, students have deepened the guiding ideology of Marxism and used the basic concepts of computer science to understand the understanding of practitioners and professional groups, cultivating students' sense of social responsibility and engineering ethics, as shown in Table 4.

Table 4: Four aspects of students' ideological and moral qualities and social responsibility

Understand the impact and role of computer technology on society	Guide students to establish a correct outlook on life, values, and social responsibility	Stimulating a sense of social responsibility
Cultivate students' innovative spirit and practical ability	Guide students to actively participate in technological innovation and practical activities	Innovation awareness and practical ability
Emphasize interdisciplinary and comprehensive practice	Guide students to learn multidisciplinary knowledge	Comprehensive quality and interdisciplinary thinking ability
Cultivate students' teamwork spirit and communication skills	Ability to collaborate with others to complete tasks	Improve organizational and coordination capabilities

4. Conclusion

The ideological and political education curriculum should neither be mechanically applied nor overly applied. The course of ideological and political education is not simply and directly incorporating some of the content of ideological and political education into professional courses, but rather naturally integrating it into the teaching of "adapting to the situation and following the trend". Curriculum and ideological and political education are not physical addition, but chemical reactions. There is "ideological and political content" in the course, and students do not feel abrupt; There is a "ideological and political flavor" in the curriculum, but students do not have a "preaching sense". Due to emotional resonance, students naturally accept it, which has a "moistening and silent" and subtle effect.

▪ Linking with reality and exploring humanistic connotations

In the teaching process, through specific knowledge and content, explore the ways of thinking, values, and cultural significance hidden behind the knowledge. Through the discussion on "Why AlphaGo Can Defeat Go Professional Masters", while understanding the crucial role played by deep learning algorithms, students are encouraged to think about the more crucial role of "people" behind them. This not only stimulates students' learning enthusiasm, but also cultivates an artificial intelligence awareness and thinking mode, encouraging them to explore the unknown, master excellent skills, and adapt to the needs of the new era of rapid development of new technology.

▪ By analogy, cultivate innovative spirit

In the teaching process, emphasis is placed on introducing programming methods, drawing inferences from one example, emphasizing knowledge transfer before and after, encouraging application innovation, and guiding students to master programming language knowledge in application practice. Classify different programming methods, summarize the programming ideas for each type of problem, guide students to integrate, and cultivate innovation and practical abilities.

▪ Selected examples to promote in-depth thinking

Through typical program examples, guide students to think and analyze their life insights, cultivate students' good qualities, and become a new generation with ideals, beliefs, and the courage to take responsibility. Circular structure is an important learning content that involves many programming methods. After describing program examples, four insights of programming are introduced: understanding the overall situation, adhering to small details, understanding rules, and having strong abilities. First, the basic literacy of programming is introduced, and then it is extended to being a person and doing things. It guides students to also understand the overall situation, pay attention to details, and cultivate good habits in practical life and work, and achieve understanding rules and discipline, Work hard to improve your abilities.

▪ Create an atmosphere and lead by example

In and out of class, online and offline, we truly care for students, help them solve various practical problems, create a harmonious learning atmosphere, reflect teachers' humanistic care for students, and provide warm teaching. Conduct a study situation survey before class, publish learning plans, computer software, and courseware, and post learning tips and live video playback after class. The MOOC discussion area and course group interact promptly, fully, and enthusiastically, ensuring that all questions are answered.

Curriculum ideology and politics should be intentional and silent, organic and traceless. We should recognize that ideological and political education in the curriculum is a fundamental requirement for moral education and an important responsibility of teachers. It requires the organic integration of ideological and political elements into the curriculum, natural integration into the classroom, and emphasizes the unconscious influence of students. It does not have quantitative indicators, but it can permeate every teaching process, and its content may not necessarily appear in the courseware, but it can be integrated into every lesson. Therefore, ideological and political education in the curriculum is an educational concept and a model of all staff education.

Acknowledgements

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