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Mining of Ideological and Political Elements and Teaching Design in Computer Science and Technology Courses

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Abstract: Under the guidance of the "full-process, all-staff, and all-round education" philosophy, the integration of professional courses with ideological and political education has become one of the core tasks in higher education reform. As a key discipline driving the development of the digital economy, the Computer Science and Technology major contains abundant ideological and political resources in its curriculum system. This paper takes the courses of Computer Science and Technology as the research object. Firstly, it expounds on the era value and practical significance of ideological and political construction in courses. Secondly, it systematically mines the ideological and political elements in the core professional courses from four dimensions: family and country feelings, scientific spirit, professional ethics, and ethical norms. Finally, it proposes a four-in-one teaching design framework of "goal guidance - content integration - method innovation - evaluation guarantee", and provides practical cases combined with typical courses such as Data Structure and Numerical Analysis. The research aims to provide reference ideas and schemes for the implementation of ideological and political education in computer-related professional courses, and realize the organic unity of knowledge impartment and value guidance.

Keywords: Computer Science and Technology; Ideological and Political Education in Courses; Element Mining; Teaching Design; Value Guidance.

1. Introduction

The Guidelines for the Construction of Ideological and Political Education in Higher Education Courses [1] issued by the Ministry of Education in 2020 clearly states that "all colleges and universities, all disciplines and majors should comprehensively promote the construction of ideological and political education in courses", elevating ideological and political education in courses to the strategic height of talent cultivation in higher education. As the main position for cultivating core talents in the information technology field, the Computer Science and Technology major requires its graduates to not only possess solid professional skills, but also establish a correct political direction, firm ideals and beliefs, and noble professional ethics. Currently, China's digital economy is in a stage of rapid development. The wide application of technologies such as 5G, artificial intelligence, and big data has not only brought opportunities for industrial transformation, but also triggered many challenges such as data security, algorithm ethics, and network governance. This requires computer professional education to break through the traditional model of "emphasizing skills while neglecting values", and deeply integrate ideological and political education into the entire process of professional course teaching [2].

From the theoretical perspective, this paper addresses the integration difficulties between the technical attributes of computer professional courses and ideological and political elements, and constructs a systematic element mining system and teaching design framework, which enriches the theoretical research results of ideological and political education in the field of science and engineering. From the practical perspective, the research results can directly provide teaching references for computer professional teachers, helping them accurately mine ideological and political resources in courses and innovate teaching implementation paths, thereby cultivating high-quality computer talents who are both proficient in technology and responsible, and providing talent guarantees for the safe and healthy development of China's digital economy.

2. Core Dimensions of Mining Ideological and Political Elements in Computer Science and Technology Courses

Courses of the Computer Science and Technology major cover multiple fields such as algorithm design, program development, system construction, and data processing. Ideological and political elements are distributed in various aspects of the course, including the knowledge system, development history, and practical application. Combined with professional characteristics and talent cultivation goals, systematic mining can be carried out from the following four core dimensions [3].

2.1. Dimension of Family and Country Feelings: Cultivating the Ideal and Belief of Serving the Country through Science and Technology

Family and country feelings are one of the core contents of ideological and political education in courses. In computer professional courses, they are mainly reflected in China's development achievements in the information technology field, the striving spirit of scientific and technological workers, and the call of the times for national strategic needs. In the Computer Network course, China's development process of 5G technology from following to leading can be

introduced, and the contributions of enterprises such as Huawei and ZTE in the formulation of international communication standards can be presented, allowing students to feel China's breakthroughs in the information technology field. In the Operating System course, the arduous process of China's independent research and development of "Kylin Operating System" and "HarmonyOS" can be told, and the gap between China and foreign countries in the core technology field can be compared, inspiring students' sense of responsibility for tackling key "bottleneck" technologies. In Numerical Analysis, combined with China's development plan for the computational mathematics industry, application cases of numerical analysis technology in national strategies such as engineering simulation and scientific computing can be introduced, guiding students to closely integrate their personal career development with national needs.

2.2. Dimension of Scientific Spirit: Cultivating the Exploratory Character of Seeking Truth and Being Pragmatic

Computer science is a discipline based on practice. The scientific spirit of being rigorous and pragmatic, brave in innovation, and not afraid of failure runs through the entire development process of the discipline, and is an important carrier of ideological and political education in courses. In the Data Structure course [4], when explaining the process of algorithm optimization, the research and development processes of classic algorithms such as Dijkstra's algorithm and Huffman coding can be introduced, emphasizing the logical thinking and exploratory spirit of scientists when facing complex problems. In the Software Engineering course, combined with the concept of "iterative development" in the software development process, students can be guided to understand that "failure is the basis of iteration", cultivating their scientific attitude of being brave in trying and daring to correct mistakes. In the Database Principles course, through the explanation of core concepts such as data consistency and integrity, the rigorous spirit of "details determine success or failure" can be infiltrated, requiring students to eliminate omissions in database design and operation. In the course experiment link, for the program debugging errors encountered by students, they can be guided to solve problems through logical analysis and step-by-step troubleshooting, cultivating the practical character of seeking truth and being pragmatic.

2.3. Dimension of Professional Ethics: Shaping Industry Norms of Dedication and Integrity

The professional ethics of computer major graduates is directly related to the quality and safety of information technology products. The core connotations include dedication, teamwork, and integrity awareness [5]. In the Fundamentals of Programming course, students' rigorous programming habits can be cultivated by standardizing the format of code writing and requiring complete and clear comments. In the team project development link of Software Engineering, the real development scenario of enterprises is simulated, the division of labor and responsibilities of team members are clarified, guiding students to learn to communicate and cooperate, help each other, and realize the team spirit that "collective wisdom is greater than individual ability". In the Software Testing course, the core value of testing work, which is "discovering problems and solving problems", is emphasized, cultivating students' dedication to product quality. In course assignments and assessments, academic integrity requirements are clearly defined, and behaviors such as code plagiarism and falsification of experimental data are prohibited, shaping students' professional bottom line of standing by integrity.

2.4. Dimension of Ethical Norms: Establishing a Healthy and Positive Technical Values

With the popularization of information technology, ethical issues such as data privacy, algorithm fairness, and network security have become increasingly prominent. Guiding students to establish correct technical ethics has become an important task of ideological and political education in computer professional courses. In the Big Data Processing Technology course, combined with cases such as the "Cambridge Analytica data scandal" and the "Didi data security review", the privacy protection principles in data collection, storage, and use are explained, emphasizing the ethical bottom line that "technology serves people rather than infringing on people". In Numerical Analysis, regarding the correlation between numerical calculation accuracy and engineering safety, students can be organized to discuss the "ethical boundary of numerical methods", guiding them to recognize that technology application must conform to the requirements of social fairness, justice, and safe development [6]. In the Computer Security course, the difference between "network security protection" and "hacker attack behavior" is distinguished, the social responsibility of technical personnel is emphasized, and students are guided to establish the concept that "safeguarding network security is safeguarding national security".

3. Teaching Design Framework of Ideological and Political Education in Computer Science and Technology Courses

Based on the above-mentioned dimensions of ideological and political element mining, this paper constructs a four-in-one teaching design framework of "goal guidance - content integration - method innovation - evaluation guarantee", ensuring the organic integration of ideological and political elements and professional knowledge, and avoiding the problem of "two separate layers".

3.1. Goal Guidance: Constructing a Three-Dimensional Teaching Goal of "Knowledge + Ability + Value"

Teaching design first needs to clarify the three-dimensional teaching goals of the course, and set and implement the value goals, knowledge goals, and ability goals simultaneously. Knowledge goals focus on the mastery of core professional concepts, principles, and technologies; ability goals focus on the cultivation of problem-solving, practical innovation, and teamwork abilities; value goals revolve around family and country feelings, scientific spirit, professional ethics, and ethical norms. Taking the "Sorting Algorithm" chapter of the Data Structure course as an example [4], the knowledge goal is to master the principles and implementation of algorithms such as bubble sort and quick sort; the ability goal is to be able to select appropriate sorting algorithms and optimize

performance according to actual scenarios; the value goal is to cultivate the rigorous and pragmatic scientific spirit by analyzing the iterative optimization process of algorithms, and stimulate scientific and technological confidence by comparing the research achievements of Chinese scholars in the field of sorting algorithm optimization.

3.2. Content Integration: Realizing "Seamless Connection" between Ideological and Political Elements and Professional Knowledge

Content integration is the core link of ideological and political education in courses, which needs to follow the principle of "natural integration and silent influence" to avoid the rigid implantation of ideological and political content. Three integration paths can be adopted: "knowledge point connection method", "case embedding method", and "problem-oriented method". The knowledge point connection method refers to mining the ideological and political elements behind professional knowledge points. For example, when explaining "CPU" in Principles of Computer Composition, it can be connected with the development status of China's chip industry, integrating the feelings of serving the country through science and technology. The case embedding method is to integrate ideological and political elements into course cases. For example, in the Web Development course, the "Rural Revitalization Information Platform" is used as a development case to guide students to realize the social value of technology. The problem-oriented method triggers thinking by setting questions with ideological and political connotations. For example, in the Numerical Analysis course, the question "How to balance numerical accuracy and calculation cost in engineering calculations to ensure engineering safety" is put forward to guide students to discuss the responsibility boundary of technology application.

3.3. Method Innovation: Creating a Diverse Teaching Model of "Theory + Practice + Interaction"

Combined with the practical characteristics of computer professional courses, teaching methods should be innovated, and students' sense of participation should be stimulated through diverse teaching activities to improve the effect of ideological and political education. In theoretical teaching, the "lecture + case analysis" model is adopted to analyze the ideological and political connotations in cases while explaining professional knowledge. In practical teaching, the "project-driven" teaching method is implemented. For example, in the Software Engineering course, projects with social value such as "Smart Community Service System" and "Intangible Cultural Heritage Digital Protection Platform" are set up, allowing students to practice technical ethics and social responsibility in practice. In interactive teaching, activities such as "thematic debates" and "technology salons" are carried out. For example, debates on "Which is more important: algorithm efficiency or data privacy" are held to guide students to establish comprehensive technical values. Online teaching platforms are used to release extended resources such as China's information technology development achievements and scientists' deeds, realizing the collaborative education of online and offline.

3.4. Evaluation Guarantee: Establishing a Diverse Evaluation System of "Process + Result"

A sound evaluation system is the guarantee for the implementation of ideological and political education in courses [7]. It is necessary to break through the traditional evaluation model focusing on knowledge assessment, and establish a diverse evaluation system that takes into account knowledge mastery, ability improvement, and value shaping. The evaluation content includes three parts: professional knowledge assessment, practical ability evaluation, and ideological and political literacy evaluation. The evaluation method adopts the combination of "process evaluation and summative evaluation". Process evaluation records students' ideological and political literacy performance through classroom performance, experimental reports, project results, and group discussion speeches. For example, in project evaluation, "teamwork", "code standardization", and "ethical compliance" are taken as evaluation indicators. Summative evaluation sets questions with ideological and political connotations in the test paper, such as examining relevant professional knowledge combined with China's independent research and development technology cases, or requiring students to write short essays on "technology and social responsibility". At the same time, the combination of student self-evaluation, mutual evaluation, and teacher evaluation is introduced to ensure the comprehensiveness and objectivity of the evaluation.

4. Practical Case: Taking the Numerical Analysis Course as an Example

To verify the feasibility of the above teaching design framework, the chapter "Numerical Integration and Numerical Differentiation" in the Numerical Analysis course is taken as an example, and the ideological and political teaching design practice is carried out in combination with the core feature of this chapter, which is "theory supports engineering practice". Numerical integration and numerical differentiation are the key links connecting continuous mathematics and discrete computing, and are widely used in fields such as engineering simulation, scientific computing, and data processing. The algorithm evolution contains abundant materials of scientific spirit and family and country feelings.

4.1. Setting of Three-Dimensional Teaching Goals

Knowledge goals: Master the basic principles of Newton-Cotes formula, compound quadrature formulas (compound trapezoidal, compound Simpson) and numerical differentiation, and understand the core methods of convergence and error estimation. Ability goals: Be able to select appropriate numerical methods according to the accuracy requirements of engineering problems, and use Python to implement numerical integration and differentiation algorithms to solve practical problems. Value goals: Cultivate family and country feelings by sorting out the contributions of Chinese scholars in the field of numerical computing, cultivate a rigorous and pragmatic scientific spirit through the iterative optimization process of algorithms, and strengthen the professional cognition that technology serves

national needs through engineering case practice.

4.2. Integration Design of Ideological and Political Elements

In the explanation of "numerical integration algorithm evolution", the breakthrough contribution of the finite element method proposed by Chinese mathematician Feng Kang to numerical integration is introduced, and his experience of independently pioneering a new field of computational mathematics under the background of foreign technological blockade is told, integrating the family and country feelings of serving the country through science and technology. In the "error analysis" link, the case of "numerical accuracy problems in spacecraft orbit calculation" is used to emphasize the major engineering risks that may be caused by the accumulation of small errors, infiltrating the scientific spirit of "details determine success or failure". In the "algorithm application" part, the "successful application of numerical integration in the stress calculation of large dams in China" is compared with the "structural collapse of a foreign project caused by improper selection of numerical methods", guiding students to establish a sense of technical responsibility. In the practical project, the task of "developing a carbon emission accounting model based on numerical integration" is set up, combining the national "double carbon" strategy to let students realize the social value of numerical analysis technology.

4.3. Teaching Implementation Process

(1) Theoretical teaching: The integrated model of "principle derivation + character story" is adopted. When explaining the error characteristics of the compound Simpson formula, the research story of Academician Feng Kang in the field of computational mathematics is interspersed, and students' scientific and technological confidence and striving spirit are stimulated through the "struggle history behind the formula". (2) Practical operation: Students complete the project of "carbon emission accounting model development" in groups. From data collection (connecting with public energy statistics data), numerical method selection (comparing the accuracy and efficiency of different quadrature formulas) to result visualization, the authenticity of data and the reliability of algorithms are emphasized throughout the process. Teachers focus on guiding team division and cooperation and error troubleshooting. (3) Interactive discussion: Thematic debates on "the balance between numerical accuracy and engineering cost" are carried out, and combined with major engineering cases in China, students are guided to form the consensus that "technical rigor is the lifeline of engineering". (4) Extended learning: Extended materials such as the Report on the Development of China's Computational Mathematics Discipline and excerpts from Collected Works of Feng Kang are released online, and "scientific spirit sharing sessions" are organized, requiring students to write learning insights combined with course content.

4.4. Implementation of Diverse Evaluation

Process evaluation (60%): Including classroom speeches (10%, evaluating the understanding and expression of scientific spirit and family and country feelings), experimental reports (20%, evaluating the standardization of algorithm implementation and the rigor of error analysis), and project results (30%, evaluating the effect of teamwork, the rationality of technology application, and the depth of understanding of the "double carbon" strategy). Summative evaluation (40%): Essay questions such as "Combined with Academician Feng Kang's scientific research experience, discuss the significance of independent innovation of numerical analysis technology to the development of my country's engineering science and technology" are set in the test paper, and the practical application and calculation of compound quadrature formulas are also examined, realizing the organic unity of knowledge assessment and value evaluation.

5. Summary

This paper focuses on the core issues of the construction of ideological and political education in Computer Science and Technology courses, clarifies the four core dimensions of ideological and political element mining: family and country feelings, scientific spirit, professional ethics, and ethical norms, constructs a four-in-one teaching design framework of "goal guidance - content integration - method innovation - evaluation guarantee", and verifies the feasibility of the framework through practical cases of the Numerical Analysis course. The research shows that computer professional courses contain abundant ideological and political resources. Through systematic element mining and scientific teaching design, the organic unity of professional knowledge impartment and value guidance can be realized, and the comprehensive quality of students can be effectively improved.

Future research can be deepened from three directions: First, construct a resource library of ideological and political elements for computer professional courses, realizing the systematic sorting and sharing of ideological and political elements in different courses and different chapters. Second, combine technologies such as artificial intelligence and big data to develop an intelligent teaching platform for ideological and political education in courses, realizing personalized teaching and accurate evaluation. Third, strengthen interdisciplinary cooperation, and form a teaching team by combining ideological and political course teachers and computer professional teachers to improve the design and implementation level of ideological and political education in courses. At the same time, it is necessary to continuously track students' growth feedback, optimize teaching design, and promote the in-depth development of the construction of ideological and political education in computer professional courses.

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