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*Original Paper*

# Research and Practice on Integrating Ideological and Political Education into the Algorithm Design and Analysis Course

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***Abstract***

*To better fulfill the educational function of professional courses by integrating knowledge transmission with value orientation, this paper proposes the development of an ideological and political demonstration course based on the nature, characteristics, and content of the Algorithm Design and Analysis curriculum. The proposal emphasizes enhancing and innovating teaching objectives and evaluation methods, as well as optimizing teaching content and instructional approaches. The findings offer practical value and demonstrate strong potential for broader application and replication.*

***Keywords***

*Teaching research, Algorithm design, Algorithm analysis, Curriculum Ideology and Politics*

## 1. Introduction

Algorithm Design and Analysis is a key core course for computer-related majors. The content of this course plays a crucial role in both employment and qualification examinations for computer-related fields. While several outcomes have been achieved in reforming classroom and practical teaching for this course, few studies focus on integrating ideological and political education into it. This paper conducts an in-depth exploration of ideological and political teaching in the algorithm design and analysis course and proposes practical strategies to serve as a reference for educators and curriculum developers.

## 2. Construction of Ideological and Political Demonstration Courses of Algorithm Design and Analysis Course

### *2.1 Improve the Course Teaching Objectives and Teaching Evaluation*

To seamlessly integrate ideological and political education into traditional knowledge-based teaching and enrich the original course syllabus, we can begin with the following three approaches.

(1) By constructing ideological and political case studies and developing a correlation matrix based on the original course syllabus, a clear mapping between cases and ideological-political content is established. This enables the scientific and rational formulation of educational goals, particularly ideological and political objectives.

The course's ideological and political component emphasizes strengthening students' ideals and convictions, centering on love for the Communist Party of China, the country, socialism, the people, and the collective. The content is refined and optimized around key themes such as political identity, patriotism, cultural literacy, constitutional and legal awareness, and moral development. Systematic instruction is provided on socialism with Chinese characteristics and the Chinese Dream, core socialist values, the rule of law, labor, mental health, and traditional Chinese culture.

For example:

Goal 1: Cultivate and Practice Core Socialist Values.

Students are guided to align their personal values with the expectations of the country, society, and citizenship. The education process enhances individual qualities such as patriotism, dedication, integrity, and friendliness. It encourages students to integrate themselves into the collective, pursue national prosperity, democracy, civility, harmony, freedom, equality, justice, and the rule of law, and transform core socialist values into internal beliefs and conscious external actions.

Goal 2: Deepen Education in Professional Ideals and Ethics.

Students are guided to develop a deep understanding of, and consciously practice, the professional values and norms of their respective fields. The education process enhances their sense of professional responsibility and helps cultivate qualities such as rule compliance, dedication, integrity, fairness, and a spirit of innovation.

(2) Construct correlation matrices linking teaching content to ideological and political elements, and ideological and political cases to specific ideological and political points. These matrices help establish a clear mapping among "teaching content-ideological and political elements-ideological and political cases-ideological and political points". Table 1 illustrates an example of the correlation matrix between ideological and political cases and their corresponding ideological and political points. Ideological and political cases are selected based on the teaching content, and the corresponding ideological and political points are clearly identified. These relationships are presented in tabular form, making them clear, intuitive, and easy to understand at a glance.

**Table 1. Example of the Correlation Matrix Between Ideological and Political Cases and Ideological and Political Points**

| Teaching Content | Ideological and Political Cases (Presentation Format) | Scientific Spirit | Patriotic Sentiment | Moral Integrity | Ideals and Beliefs |
|---|---|---|---|---|---|
| Divide-and-Conquer Algorithm | Development of the "Two Bombs, One Satellite" Program(Video) | √ | √ | √ | √ |
| Dynamic Programming | Smart Transportation(Video) | √ | | √ | |
| Greedy Algorithm | Optimization of BeiDou Satellite Signal Coverage(Photo) | √ | √ | √ | √ |
| Backtracking Algorithm | Task Scheduling Conflict Detection in HarmonyOS(Video) | √ | √ | √ | √ |
| Approximation Algorithm | Chip Manufacturing(Photo) | √ | √ | √ | √ |

(3) Enhance the Evaluation of the Ideological and Political Teaching Effectiveness of the Course. Multiple evaluation methods-including student feedback and supervisor assessments-were employed to collect and analyze the effectiveness of ideological and political education in the course.

*2.2 Optimization and Enhancement of Course Content and Teaching Methods*

During the teaching process, the syllabus and course content are appropriately adjusted based on the ideological and political objectives, and relevant materials and examples are integrated into classroom instruction at suitable moments. For example, when teaching the backtracking method, HarmonyOS task scheduling conflict detection is introduced as a case study. The example highlights the outstanding contributions of Chinese scientists, conveying their dedication and passion for scientific research. This integrates national sentiment, ideals, and professional beliefs with the explanation of core technical concepts. When teaching the approximation algorithm, students are introduced to China's achievements in chip manufacturing. This cultivates students' awareness of scientific and technological self-reliance, and reinforces their sense of mission regarding independent innovation through real-world examples from domestic chip production. The instruction integrates professional knowledge with the scientific spirit, patriotism, ideals and beliefs, and moral education. Table 2 provides an example of how ideological and political elements are embedded in the optimized teaching content of the algorithm design and analysis course.

**Table 2. Examples of Optimized Course Content Integrating Ideological and Political Elements (Divide-and-Conquer Method)**

| Teaching Process | Teaching Content | Ideological and Political Materials | Ideological and Political Focus Points |
|---|---|---|---|
| Problem Introduction | The Process of "Task Decomposition-Step-by-Step Breakthrough-Overall Integration" in China's Nuclear Weapons Development | Video (Documentary: Military Industrial Memory) and Images (Successful Detonations of the Atomic and Hydrogen Bombs) | Scientific Spirit, Patriotism, Moral Integrity, Ideals and Beliefs |
| Problem Definition | Systems Engineering Methodology Proposed by Qian Xuesen | Photograph of Qian Xuesen | Scientific Spirit, Patriotism, Ideals and Beliefs |
| Algorithm Design | Three Steps of the Divide-and-Conquer Algorithm (Decompose-Solve-Combine) | Animation Demonstrating Algorithm Execution | Scientific Spirit |

Ideological and political elements are integrated into the instructional design, with the teaching plans for the algorithm design and analysis course continuously refined and expanded. Table 3 presents sample segments of lesson plans that incorporate ideological and political elements into the course.

**Table 3. Sample Section of the Algorithm Design and Analysis Teaching Plan Integrating Ideological and Political Elements (Greedy Method)**

| Teaching Requirements | Teaching Content | Teaching Form and Method | Time Allocation |
|---|---|---|---|
| Problem Introduction | Review: What is a Greedy Algorithm?<br>Discussion: Where Are Greedy Algorithms Applied in Real Life?<br>When teaching greedy algorithms, we present the "Signal Coverage Optimization of Satellite Navigation Systems" as a case study. Students compare the efficiency of the greedy strategy and the exact solution, analyzing the scientific rigor of | Heuristic Teaching<br>Pose questions to stimulate student thinking<br>Case Study<br>Introduce real-life examples to highlight the importance of algorithmic efficiency, thereby stimulating student interest and encouraging active thinking. | 5 minutes |

| | | | |
|---|---|---|---|
| Analysis of Greedy Algorithms | algorithm selection in the development of the BeiDou system.<br>★Ideological and Political Points:<br>The dialectical relationship between "local optimum" and "global optimum" in algorithm optimization is extended to the synergy between individual growth and national development, highlighting the spirit of craftsmanship and pursuit of excellence.<br>Greedy Strategy: Selects the satellite that covers the largest unserved area at each step. The time complexity is $O(n^2)$, making it suitable for real-time dynamic adjustments.<br>Exact Solution: Modeled as a Set Cover Problem, which is NP-hard and thus unsuitable for fast satellite response requirements.<br>★Ideological and Political Points：<br>By exploring the dialectical relationship between "local optimum" and "global optimum", students are guided to reflect on the connection between personal growth and national development. For example, in satellite coverage optimization, sacrificing local efficiency for global stability is used to analogize individual dedication to collective progress. | Write "Greedy Algorithm" and "Algorithm Analysis " on the blackboard<br>Guide students to review the implementation process of the greedy algorithm.<br>Present the case of satellite navigation signal coverage optimization to stimulate student enthusiasm, broaden knowledge horizons, and integrate ideological and political education at appropriate moments. | 10 minutes |

In addition, during the teaching of the Algorithm Design and Analysis course, various instructional methods—such as classroom discussions, flipped classrooms, and problem-driven teaching—are integrated with ideological and political education. By adopting diversified teaching formats, ideological and political education is embedded into the instruction of professional knowledge, achieving the integration of 'instruction' and 'value cultivation'.

## 3. Conclusion

As a key direction in higher education reform in the new era, curriculum-based ideological and political education is not only an innovative extension of traditional knowledge systems but also a crucial means of fulfilling the fundamental mission of moral education. In computer course instruction, it is essential to integrate ideological and political elements throughout the teaching process, leveraging the classroom as the primary platform to achieve a deep integration of knowledge transmission and value guidance, thereby establishing a scientific and standardized system of moral education practice. Taking the algorithm design and analysis course as an example, the development of an ideological and political teaching model rooted in disciplinary characteristics has not only significantly improved teaching effectiveness and educational quality, but also demonstrated strong transferability across disciplines, offering a replicable paradigm for ideological and political education in various professional fields.

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