

Exploration of Online and Offline Mixed Teaching Model for Data Structure Courses Based on the Ideological and Political Education

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Abstract: The traditional offline teaching in the data structure courses had problems such as programming training, concept and application separation. The paper analyzed the current situation of mixed online and offline teaching research in the data structure courses, explored the implementation path of ideological and political education, used diversified teaching methods and multi-dimensional evaluation systems, and strengthened the organic combination of ideological and political education with course content. A online and offline mixed teaching model based on the ideological and political perspective of the curriculum has been proposed. This provided valuable reference for the ideological and political education courses.

Keywords: Data structure, Ideological and political education, Online and offline mixed teaching model.

1. Introduction

The integration of ideological and political education into professional courses is a new requirement. The Ministry of Education has proposed that ideological and political education in courses should be comprehensively promoted and implemented in all universities and disciplines[1]. However, traditional teaching mainly focuses on cramming, and the teaching effect is not ideal. How to combine professional teaching with ideological and political education to form a synergistic effect is still in the early stages of research. The rapid development of internet technology and intelligent terminals provides a good technical guarantee and carrier for the development of online teaching platforms. This has created a research hotspot in the teaching of ideological and political network courses. The online and offline mixed teaching mode has achieved good teaching results nationwide, and has changed the traditional teaching method[2-4]. This method can leave most of the classroom time to students, effectively stimulate their learning initiative, and provide a platform and soil for professional courses to carry out ideological and political education. It is worth conducting in-depth research.

2. Integration of Ideological and Political Elements in The Data Structure Course

2.1. The overall goal of ideological and political education

Data structure is a core course in the major of computer science, and integrates three courses: mathematics, computer hardware, and software. It is a professional course that combines theory and practice[5]. However, the complexity and abstraction of data structure courses make it difficult for students to understand, have poor practical skills, and have difficulty in assessing the practical part. This requires the use of computer technologies such as cloud computing and big data to enhance students' understanding of the course, unleash

their initiative, and strengthen teaching effectiveness. This article takes information technology as the starting point, adopts a online and offline mixed teaching mode, and integrates ideological and political elements into the teaching of data structure courses.

In the data structure experimental teaching plan, the experimental course had 16 class hours, divided into 8 experiments, each lasting 2 class hours. Before the experiment, the teacher needs to provide a 10 minute explanation of the key knowledge points and problem-solving ideas in the experiment. When explaining professional technical knowledge, teachers combine the characteristics of the course content to explore some philosophies and ideas contained in professional knowledge, and achieve resonance between knowledge education and value guidance. This method can enable students to understand the worldview in their professional knowledge, establish socialist core values, and cultivate the spirit of being a great country craftsman.

2.2. Design of ideological and political elements in the data structure curriculum

We should deeply explore the ideological and political elements contained in each chapter of the course and the educational functions it carries, select appropriate knowledge to integrate into the ideological and political elements, and complete the design of ideological and political education points through dynamic iterative optimization of "mining—integration—re-mining—re-integration". By this way, we could sort out the ideological and political education points and form six ideological and political education lines, including "ideological guidance", "emotional cultivation", "value shaping", "behavioral norms", "professional spirit", and "citizen personality". Then, we organize and aggregate ideological and political education lines to form four aspects of ideological and political education: "XIJINPING New Era New Thought", "Socialist Core Values", "Confident Development and Innovative Spirit", and "Moral Cultivation and Professional Spirit". Through the three-dimensional design of "points, lines, surfaces" in the system, the ideological and political elements of the curriculum are

formed, achieving the organic integration of professional knowledge points and ideological and political elements [6]. The three-dimensional case design of "points, lines, and surfaces" in the course is shown in Table 1.

When excavating ideological and political elements, three levels should be considered [7-9], including: 1. The guiding role of Marxist philosophical principles in professional learning and research, such as dialectics of nature, scientific

methodology. Those reflect in the scientific perspective. 2. The humanistic literacy reflected in the field of professional knowledge, namely the humanistic spirit of "people-oriented and people-centered", is reflected in the perspective of life. 3. The socialist core values contained in the professional field, such as the basic moral norms of citizens, professional qualities, and emotional attitudes. Those reflect in the level of values.

Table 1. The three-dimensional case design of "points, lines, and surfaces"

Teaching content	Ideological and political elements	Ideological and political education points	Ideological and political education lines	Ideological and political education surfaces
Chapter 3 Queue: 1.Queue characteristics 2.Queue operation	Queuing scenes that can be seen everywhere in life, such as bank queues, hospital queues, cafeteria queues, etc. Extending to society, with various rules and regulations, people's lives can proceed in a stable and orderly manner. The country has various laws and regulations, and people's lives can have safety guarantees. Educate students to understand rules and discipline.	1. Observe order; 2. Legal awareness; 3. Responsibility taking; 4. Labor education; 5. Moral cultivation	Ideological guidance	XIJINPING New Era and New Ideas
Chapter 4 String: 1.String Definition 2.String operation	Design a nucleic acid detection program that compares the presence of viral nucleic acid DNA in human DNA strings to determine whether the virus is infected. Motivate students to use professional knowledge to solve practical problems.	1. Technological innovation; 2. National sentiment; 3. Professional confidence; 4. Confident system	Emotional cultivation	
Chapter 6 Tree: 1. Definition of Trees 2. Storage structure of trees	Derive the concepts of family and genealogy based on the characteristics of tree structure, explain the development process of genealogy to students, encourage students to learn traditional culture, and inherit traditional culture.	1. Cultural confidence; 2. National pride; 3. Dialectical criticism; 4. National sentiment	Value shaping	The core values of Chinese socialism
Chapter 7 Figure: 1. Shortest path 2. Minimum Spanning Tree	Quoting the minimum cost problem of network connectivity in the engineering field, and the familiar express route selection problem for students. Stimulate students' interest in learning through problem creation and presentation effects.	1. Serving the country through science and technology; 2. Professional pride; 3. The spirit of craftsmanship; 4. Innovative spirit	Code of conduct	
Chapter 9. Find: 1. Hash function 2. Collision detection	Explain the classic MD5 algorithm fast collision method in hash algorithms, and stimulate students' scientific spirit of exploration.	1. International perspective; 2. Strive for excellence; 3. A technological powerhouse; 4. Technological innovation	Professionalism	Confident development and innovative spirit
Chapter 10. Sort: 1. Various sorting algorithms 2. Performance comparison of various sorting algorithms	Combining the sorting functions of common apps, this article introduces the widespread application of sorting algorithms and the importance of sorting efficiency. Efficient sorting algorithms can shorten sorting time and improve calculation speed.	1. Strive for excellence; 2. Professional confidence; 3. Professional pride; 4. Lifelong learning	Citizen personality	

3. Online and Offline Mixed Teaching Mode—Implementation of Ideological and Political Education in Data Structure Courses

3.1. Online and offline mixed teaching mode design

The ideological and political reform of data structure courses starts from the indicators that support graduation

requirements. It is necessary to focus on promoting the comprehensive development of students and be guided by talent cultivation goals. This can fully integrate multiple aspects of ideological and political elements such as knowledge transmission, ability training, moral cultivation, spiritual shaping, and habit cultivation, and carry out reform of ideological and political education in data structure courses.

The reform of ideological and political education in the curriculum is carried out in a online and offline mixed teaching mode. The course team members revised the teaching syllabus, improved assessment and evaluation

methods, strengthened before class preparation, deepened classroom teaching, expanded after class training, and strengthened course summary. In this process, the course team members optimized the courseware production and produced professional knowledge videos, ideological and political education videos, and programming practice videos. The teachers need to design case studies for ideological and political education in the curriculum and reconstruct the knowledge structure of the curriculum, deepen interactive

teaching in classroom teaching and introduce an intelligent practical teaching platform to achieve automatic homework management, organize course design in the form of competitions and actively guide students in subject competitions, strengthen information feedback between teachers and students, and mainly promote the improvement of course summary. Figure 1 is the implementation path of the online and offline mixed teaching for integrating ideological and political reform in the curriculum.

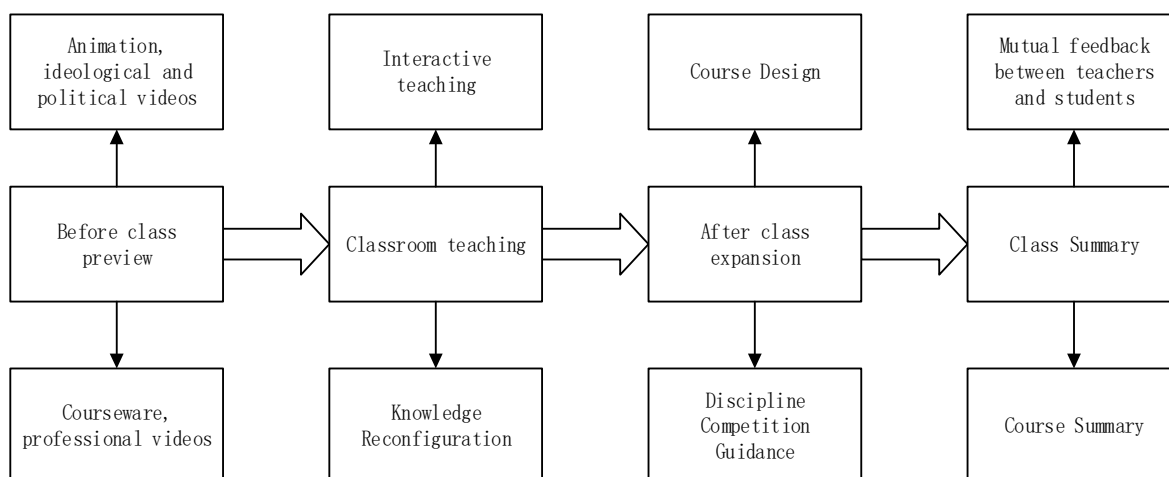


Figure 1. Implementation path of online and offline mixed teaching for integrating ideological and political reform

In the design process of ideological and political education, most of the ideological and political cases are pre-designed before class. Some ideological and political cases were implanted on-site during the teaching process, while others were temporarily arranged based on students' performance and teaching feedback during the teaching process. Table 1 lists some pre-designed ideological and political elements of courses that closely follow the knowledge points in the chapters.

3.2. Classification and organization of online resources

Learning resources are an important foundation for students to complete self-learning tasks, and can be distributed to students as before class previews, classroom exercises, and after class assignments. The quality of learning resources can affect students' self-learning effectiveness and also affect the implementation of classroom teaching. Online resources can be organized from the following five aspects:

(1) Based on the talent cultivation plan and teaching outline, combined with the learning data collected from previous students on online course platforms, this can help to reorganize the difficulties, doubts, and fallibility points.

(2) By combining past years' postgraduate entrance examination questions, a list of knowledge points can be compiled.

(3) Combining the knowledge points of subsequent professional courses, this can organize the precursor knowledge points of the course.

(4) Based on the fragmented nature of students' learning time, combined with the basic knowledge points and question banks, micro videos can be recorded to provide targeted explanations of key and difficult points, answer students' doubts, analyze existing error prone points, and answer common programming problems.

(5) Combining with enterprise applications, typical cases are compiled for students to further expand and practice in

class, which can help students more intuitively understand the specific application of knowledge in real scenarios.

3.3. Offline classroom design

In offline classrooms, various self-directed learning tasks are designed for students in the teaching objectives, before class test, participatory interactive teaching, after class test evaluation, and summary to enhance their self-directed learning abilities:

(1) Teaching objectives. The teacher can propose observable and measurable learning objectives based on the course content, such as "students being able to accurately describe the process of the reorder traversal, inorder traversal and postorder traversal of binary trees", "For the Joseph's ring problem, students can use knowledge of circular linked lists to design specific methods and correctly calculate the last surviving person based on the number of people present in the Joseph's ring and the password set".

(2) Before class test. It is necessary to understand the students' completion of the preview task and grasp their knowledge of the preparatory knowledge for this course. Through activities such as quizzes and questioning, teachers can conduct a thorough investigation. Based on the investigation results, teachers can design teaching and fine-tune activities to ensure that classroom teaching is more closely related to students' actual situations and needs. For example, "Given a set of decreasing and ordered data, let students choose one of the values." If students answer half the method to search and compare with the median each time, it indicates that they have a good grasp of the preliminary knowledge of "binary search" and can give full affirmation to the students.

(3) Participatory interactive teaching. The participatory learning process reflects that students are the core of the classroom, and it can mobilize as many students as possible to actively learn and participate in the classroom. Based on the content of comprehensive experimental design and

theoretical knowledge, specific problems and solutions are proposed, and thematic discussions are set up.

(4) After class test evaluation. According to the type and characteristics of classroom content, students' learning effectiveness in this course can be evaluated through objective questions, short answer questions, case studies, and result sharing. For example, there are several minimum spanning tree algorithms proposed, which scenarios are applicable to each algorithm. Through students' answers, we can understand whether they have achieved the predetermined goals after completing this lesson.

(5) Summary. This can be done through methods such as Q&A, discussion, and mind mapping. On the one hand, it can enable students to connect theory with life and apply what they have learned. On the other hand, it can also help students discover their knowledge deficiencies and make up for them in a timely manner.

4. Conclusion

The online and offline mixed teaching mode emphasizes student-centered approach, which can stimulate students' enthusiasm and initiative. And it is conducive to improving their practical abilities. In the context of educational informatization, teachers should actively implement the online and offline mixed teaching mode, improve the quality of education and teaching, and promote the teaching reform of data structure ideological and political courses.

5. Ethical Approval

This article does not contain any studies with animals performed by any of the authors.

6. Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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8. Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

9. Data Availability Statement

No data were used to support this study.

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