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Exploration and Practice on Teaching Reform of the Course "Data Collection and Web Crawlers" under the Background of Engineering Education Accreditation

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Abstract: Under the background of engineering education accreditation, the traditional course "Data Collection and Web Crawlers" suffers from issues such as a single knowledge system, inadequate integration of ideological and political elements with course objectives, and a singular assessment method. This paper proposes teaching reform measures in terms of optimizing the knowledge system, incorporating ideological and political elements, and reforming assessment methods, and verifies their effectiveness through practice. The aim is to enhance the teaching quality of the course and cultivate high-quality applied talents that meet the standards of engineering education accreditation.

Keywords: Engineering Education Accreditation; Data Collection and Web Crawlers; Teaching Reform.

1. Introduction

Engineering education accreditation, as an internationally recognized quality assurance system for engineering education [1], is centered on the principles of "student-centered, outcome-oriented, and continuous improvement." Since China joined the Washington Accord in 2016, engineering education accreditation has garnered widespread attention, imposing higher requirements on professional construction and teaching reform in universities [2], [3], [4], [5], [6]. "Data Collection and Web Crawlers" is a crucial course for computer-related majors, playing a vital role in cultivating students' abilities to acquire, process, and analyze data in the era of big data. However, traditional teaching models struggle to meet the requirements of engineering education accreditation and exhibit numerous shortcomings. Therefore, exploring teaching reforms for this course holds significant practical importance.

2. Current Teaching Situation of Traditional Data Collection and Web Crawlers Course

2.1. Single Knowledge System

The traditional knowledge system of the "Data Collection and Web Crawlers" course primarily revolves around basic concepts, principles, and simple techniques, with teaching content confined to textbooks and lacking the introduction of cutting-edge technologies and practical application cases. For instance, when discussing data collection, only common methods such as web scraping and API interface calls are introduced, while advanced techniques like distributed data collection and real-time data collection are scarcely covered. In terms of web crawlers, the focus is mostly on basic crawler programming, with insufficient in-depth explanations of complex crawler technologies such as focused crawlers and distributed crawlers. This singular knowledge system results in a disconnect between students' learned knowledge and actual demands, making it difficult for them to tackle complex and evolving engineering problems.

2.2. Inadequate Integration of Ideological and Political Elements with Course Objectives

Curriculum ideology and politics represent a crucial initiative for universities to fulfill their fundamental task of fostering virtue and nurturing talents. However, the traditional "Data Collection and Web Crawlers" course exhibits significant deficiencies in excavating ideological and political elements. Teachers often focus solely on imparting professional knowledge, neglecting the cultivation of students' values, professional ethics, and social responsibility. For example, when explaining web crawler technology, they fail to guide students to correctly understand the legality and ethical norms of web crawlers, potentially leading students to violate laws, regulations, and ethical standards in practical applications. Additionally, the alignment between ideological and political elements and course objectives is low, failing to organically integrate ideological education into professional teaching and making it difficult to achieve the organic unity of intellectual and moral education.

2.3. Singular Assessment Method

The traditional course assessment method primarily relies on final exams, emphasizing the evaluation of students' theoretical knowledge while neglecting the cultivation of their practical and innovative abilities. Final exam questions are mostly memory-based and comprehension-based, allowing students to achieve good grades through cramming before exams, which fails to truly reflect students' learning processes and actual abilities. Furthermore, experimental assessments also have issues, with some students exhibiting a lackadaisical attitude towards experiments and plagiarizing others' experimental reports, resulting in inaccurate evaluations of their practical operational skills. This singular assessment method is not conducive to stimulating students' learning enthusiasm and initiative and does not comply with the requirements of engineering education accreditation for student ability cultivation.

3. Teaching Reform and Practice of the Data Collection and Web Crawlers Course

3.1. Optimizing the Knowledge System and Enriching Teaching Content

3.1.1. Introducing Cutting-Edge Technologies

With the rapid development of information technology, new technologies and methods continuously emerge in the field of data collection and web crawlers. These cutting-edge technologies should be promptly introduced into course teaching to broaden students' knowledge horizons. For example, incorporating teaching content on distributed data collection frameworks (such as Scrapy-Redis) enables students to understand how to utilize distributed systems to enhance the efficiency and stability of data collection. Introducing real-time data collection technologies, such as data collection methods based on message queues (like Kafka), equips students with the ability to process real-time data.

3.1.2. Increasing Practical Application Cases

By introducing practical application cases, students can gain insights into the applications of data collection and web crawler technologies in various fields, enhancing their ability to solve practical problems. For instance, using the collection of commodity information from e-commerce websites as an example, students can learn how to use web crawlers to obtain information such as commodity prices, sales volumes, and evaluations, and then perform data analysis and mining to support decision-making for e-commerce enterprises. Taking social media data collection as another example, students can be introduced to methods for collecting user data on platforms like Weibo and WeChat, analyzing user behavior and emotional tendencies to provide references for corporate marketing and brand promotion.

3.1.3. Strengthening Interdisciplinary Knowledge Integration

Data collection and web crawler technologies involve multiple disciplines, including computer science, mathematics, and statistics. In course teaching, interdisciplinary knowledge integration should be strengthened to cultivate students' comprehensive qualities. For example, when explaining data cleaning and preprocessing during data collection, statistical knowledge can be introduced to enable students to understand how to use statistical methods for data screening, transformation, and normalization. When discussing algorithm design for web crawlers, mathematical modeling knowledge can be incorporated to teach students how to use mathematical models to describe and solve crawler problems.

3.2. Excavating Ideological and Political Elements to Achieve the Integration of Intellectual and Moral Education

3.2.1. Cultivating Legal Awareness and Professional Ethics

When explaining web crawler technology, students should be guided to correctly understand the legality and ethical norms of web crawlers. Through case analysis, students can learn about the legal issues that may arise from unauthorized data collection, such as infringement of privacy rights and intellectual property rights, cultivating their legal awareness and professional ethics. For example, introducing cases where individuals have been legally sanctioned for illegal data collection enables students to deeply recognize the importance of complying with laws and regulations.

3.2.2. Enhancing Social Responsibility and Sense of Mission

In conjunction with course content, students should be guided to pay attention to social hot issues and cultivate their social responsibility and sense of mission. For instance, when discussing data collection and analysis technologies, students can be encouraged to think about how to utilize these technologies to solve social problems, such as environmental pollution monitoring and public health event early warning. By organizing students to engage in related project practices, they can personally experience the application value of data collection and analysis technologies in society, enhancing their awareness and ability to serve society.

3.2.3. Incorporating Teamwork Spirit and Innovation Consciousness

In course experiments and project practices, emphasis should be placed on cultivating students' teamwork spirit and innovation consciousness. Through group experiments and project practices, students can collaborate, divide tasks, and jointly complete data collection and analysis tasks, cultivating their teamwork and communication abilities. Simultaneously, students should be encouraged to propose innovative solutions, and their innovative ideas should be acknowledged and supported to stimulate their innovation enthusiasm and creativity.

3.3. Reform Assessment Methods to Comprehensively Evaluate Student Abilities

3.3.1. Combining Process Assessment with Summative Assessment

Changing the traditional singular final exam assessment method, a combination of process assessment and summative assessment should be adopted to comprehensively evaluate students' learning processes and actual abilities. Process assessment includes classroom performance, assignment completion, experimental reports, and group projects, accounting for a certain proportion of the total grade (e.g., 40%). Summative assessment primarily adopts the form of final exams to evaluate students' mastery of core course knowledge, accounting for 60% of the total grade. Through process assessment, students' learning situations can be promptly understood, and problems can be identified and addressed in a timely manner to improve their learning effectiveness.

3.3.2. Diversifying Assessment Forms

In terms of assessment forms, a diversified approach should be adopted, including written exams, machine exams, and project presentations. Written exams primarily assess students' mastery of theoretical knowledge; machine exams focus on evaluating students' practical operational skills, such as writing web crawler programs and performing data collection and processing; project presentations mainly assess students' project practical abilities and comprehensive qualities, requiring students to present and defend their group projects, answering questions from teachers and classmates. Through diversified assessment forms, students' knowledge, abilities, and qualities can be comprehensively evaluated.

3.3.3. Establishing a Multidimensional Evaluation System

A multidimensional evaluation system should be established, incorporating not only teacher evaluations but also student self-evaluations and peer evaluations. Student self-evaluations enable students to reflect on and summarize their learning processes and outcomes, identifying their strengths and weaknesses and proposing improvement measures. Peer evaluations facilitate communication and learning among students, allowing them to understand their learning situations from different perspectives while cultivating their evaluation abilities and critical thinking. Teachers can then provide comprehensive evaluation opinions based on student self-evaluations and peer evaluations, making the evaluation results more objective, fair, and comprehensive.

4. Conclusion

Under the background of engineering education accreditation, teaching reforms for the "Data Collection and Web Crawlers" course are necessary and feasible. By optimizing the knowledge system, excavating ideological and political elements, and reforming assessment methods, issues such as a single knowledge system, inadequate integration of ideological and political elements with course objectives, and a singular assessment method in traditional course teaching can be effectively addressed. This enhances the teaching quality of the course, cultivates students' comprehensive qualities and innovative abilities, and enables them to meet the standards of engineering education accreditation, thereby cultivating more high-quality applied talents for society. In future teaching practices, experiences should be continuously summarized, and teaching methods and means should be continually improved to further refine the course teaching reform plan and adapt to the ever-changing social demands and technological developments.

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