Journal of Contemporary Educational Research, 2024, Volume 8, Issue 8
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Research on the Teaching Reform of "Big Data Analysis and Visualization" Course for College Students

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Abstract: Under the background of the big data era, the education of big data majors is undergoing a profound teaching reform and innovation. With the increasing role of big data technology in analysis and decision-making, updating and expanding the teaching content of big data majors has become particularly important. In the era of big data, modern enterprises have put forward new and higher demands for big data talents, which not only include traditional data analysis skills but also knowledge of data visualization and information technology. To address these challenges, big data education needs to reform and innovate in the development and utilization of teaching content, methods, and resources. This paper proposes teaching models and reform methods for big data majors and analyzes corresponding teaching reforms and innovations to meet the requirements of the new development of big data majors. The traditional classroom teaching method is no longer sufficient to meet the learning needs of students, and more dynamic and interactive teaching methods, such as case studies, flipped classrooms, and project-based learning, are becoming increasingly essential. These innovative teaching methods can more effectively cultivate students' practical operation skills and independent thinking while allowing them to better learn advanced knowledge in a real big-data environment. In addition, the paper also discusses the construction of big data processing and analysis platforms, as well as innovative teaching management and evaluation systems to improve teaching quality.

Keywords: Data science; Big data technology; Course; Teaching reform

Online publication: August 16, 2024

1. Introduction

The big data major mainly aims to cultivate high-quality talents with professional skills in data analysis. Through the study of this major, students will have solid basic theoretical knowledge of computer science and big data, master rich data analysis methods and tools, be familiar with the general big data analysis platform and environment, understand the domain knowledge of related cross disciplines, have a strong ability to develop big data software, analyze and apply big data to solve practical problems in related fields, and be able to engage in big data software development, big data analysis, and technical services in the Internet, information communication,

smart city applications, and other fields [1-3]. In the teaching of big data courses, how to carry out teaching reform and improve teaching quality, especially in the context of new engineering disciplines, how to reform teaching design, optimize teaching content, improve teaching methods, standardize teaching processes, improve teaching evaluation, and cultivate high-quality big data talents with engineering practical skills and technological innovation ability, has become an important issue that urgently needs to be solved in the research of undergraduate teaching reform of data science and big data technology in universities [4-7]. The course of big data analysis, as the main course of this major, has the characteristics of practicality, strong comprehensiveness, and fast knowledge updates [8]. At the same time, the big data major has a deep integration with other disciplines. During the rapid development of the big data industry, the Ministry of Education of China promptly proposed a new concept of vigorously cultivating new engineering majors. This places higher demands on the teaching of higher education institutions. How universities can enhance students' creativity and ability to solve complex engineering problems through curriculum construction, while strengthening their knowledge foundation and cultivating applied talents with industry knowledge, engineering practice, and innovation capabilities, has become a critical issue that urgently needs to be addressed in curriculum teaching. The demand for new majors and industries has also posed new challenges to the cultivation of applied talents. The teaching content, methods, evaluation mechanisms, and improvement measures of big data courses need to keep pace with the times and constantly innovate.

2. The significance of teaching reform

Nowadays, big data technology has been widely applied in fields such as smart cities, smart transportation, network security, and aerospace. According to research data, in recent years, companies have generally reported that college graduates have weak practical skills and insufficient theoretical knowledge of big data in the field of data analysis and visualization. How to ensure that students can proficiently master the skills of big data technology and effectively apply them when they enter the workforce after graduation is a problem that needs to be researched and explored. We aim to build a teaching achievement goal that closely integrates big data analysis and visualization courses with industry and market talent needs. This will enable students to truly learn big data analysis and visualization tools, apply big data thinking, and solve practical problems in their work. This is of great significance and value for teaching reform.

3. Content of teaching reform

3.1. Construction of engineering scenarios for course content

The "Big Data Analysis and Visualization" course includes 32 hours of theory and 16 hours of experiments. According to the chapter content, the basic theories and techniques are first explained and then the supporting experimental activities are performed. The experimental content is mostly confirmatory experiments. The teaching content lacks practical teaching content targeting industrial applications and job skills, resulting in students having a limited understanding of the course content and being unable to independently analyze and solve practical problems. These contents need to be reformed.

3.2. Classroom teaching

The project-based learning and challenging learning models have been less applied in practical teaching and have not fully mobilized students' initiative in learning. A small number of proactive students, through self-directed learning, can have a comprehensive understanding and comprehension of big data analysis and visualization technology; while the majority of students only aim to pass course exams and complete experimental content

based on experimental guides, they lack curiosity, do not actively explore and expand their knowledge, and do not actively relate to solving complex problems in actual data analysis and visualization. This requires the reform of classroom teaching methods.

3.3. Course assessment and evaluation

The current teaching assessment and evaluation mainly rely on traditional examination forms, but this assessment method has shortcomings. This approach mainly focuses on students' mastery and memory of knowledge, lacks comprehensive evaluation of other skill dimensions, and cannot achieve a comprehensive assessment of students. This situation limits the objectivity and accuracy of teaching evaluation, and cannot truly reflect students' performance and skills in practical applications and real-life situations. This requires further research on the methods of reform and assessment.

4. Teaching reform plans

4.1. Optimizing teaching content

It is necessary to pay attention to the development and changes in the global big data technology market, especially the changes in the domestic and international markets of analytics and business intelligence, which are closely related to big data analysis and visualization. Teaching content is adjusted in a timely manner and closely integrated with the development of new technologies. Based on industry demand and technological development, especially the knowledge and skill requirements for big data analysis and visualization courses in specific positions, we will replan and design course teaching content, introduce high-quality enterprise cases, design schemes, etc. into classroom teaching, integrate enterprise examples, and strengthen the effectiveness of teaching content. In the context of new engineering disciplines, the goal of talent cultivation is to cultivate individuals with moral character and academic excellence. We not only need to cultivate students' professional knowledge, but also their patriotism, sound personality, ecological awareness, professional norms, craftsmanship spirit, and so on. It is also important to sort out the content of each chapter, combine it with current scientific and technological events, and implement the entry points of course knowledge points, in order to cultivate students' correct logical thinking and value judgment skills through the process of course theory and experiment teaching and develop students' craftsman spirit of loving their job, striving for excellence, and focusing on innovation, striving to achieve the goal of strengthening students' ideals and beliefs and improving their professional ethics.

4.2. Innovating teaching methods

In the teaching process of big data major, attention should be paid to cultivating students' self-learning ability and continuous learning awareness, so that students can continuously update and expand their professional knowledge and skills. In the teaching process, it is necessary to explore the construction of practical engineering scenarios and correspond the stage goals of theoretical courses with different levels of project tasks. This can gradually cultivate students' ability to solve simple engineering problems, and then gradually deepen their ability to solve complex engineering problems, progressively empowering students and cultivating high-quality applied talents in the field of big data with solid basic knowledge, strong practical skills, and innovative style. With "Internet+," "Challenge Cup," and other national or provincial events as the carrier, the integration of big data professional curriculum teaching and innovation and entrepreneurship education is realized, further strengthening students' innovative thinking skills. Additionally, teaching resources, competitions, and projects provided by Yonghong BI and Huawei ICT College are utilized to achieve multidimensional teaching and improve teaching quality.

4.3. Collaboration between universities and enterprises

In order to improve the effectiveness of teaching big data majors, universities can collaborate with enterprises to develop real-life case study projects, allowing students to learn and apply big data analysis techniques in solving practical problems. Such practical activities not only deepen students' understanding of classroom knowledge but also help cultivate their ability to solve complex data problems. In terms of teaching resources, the latest big data analysis software and tools, such as cloud computing services and professional big data analysis software, can be utilized to provide students with more practical opportunities.

4.4. Strengthening case teaching

Case teaching is an important teaching method, in which analyzing a real big data scenario can help students understand the practical application of big data theory. Through case studies, students can see how data analysis can work in practical decision-making and learn how to use data analysis skills in complex big-data environments. The core of case teaching is to provide practical analysis examples of big data, through which students can further deepen their data analysis skills. In the case teaching mode, students need to discuss a specific example, usually solving a specific data problem. From the case design, execution process, to the result evaluation, students' active participation is required at each stage. Through case teaching, students' practical skills can be greatly improved, and their ability to extract information from data, analyze problems, and solve problems can be cultivated.

4.5. Strengthening the teaching of simulation training

There are many types of teaching methods, and simulation training is an efficient teaching method. Simulated training creates a big data environment that is close to reality, allowing students to apply theoretical knowledge and solve practical problems in simulated scenarios. This method usually utilizes advanced software and simulation platforms, such as virtual data laboratories, to provide practical training content such as big data decision-making and data analysis. In such an environment, students can engage in risk-free decision-making practices, thereby deepening their understanding of big data concepts and improving their problem-solving skills.

4.6. Introducing personalized education

Modern Internet technology is used to carry out personalized education. Through the incidental collection and analysis of students' online and offline learning data, we can comprehensively and accurately assess each student's mastery of knowledge points, build a personalized knowledge map for each student, and recommend learning resources with customized difficulty and personalized learning rhythm according to the knowledge map, so as to achieve "customized and individualized teaching" and improve the accuracy of identifying and addressing gaps in students' knowledge.

4.7. Building diversified assessment and evaluation methods

The course "Big Data Analysis and Visualization" is an essential core course. How to scientifically and reasonably assess this course is worth further in-depth research and exploration. The assessment plan designed for this course is as follows. The assessment methods are divided into process assessment and final assessment. Process assessment constitutes the regular score while final assessment constitutes the final score, each accounting for 50% of the total score. The process assessment includes attendance, homework and experiments, and in-class exercises, while the final assessment is a closed-book written test at the end of the semester. In order to more accurately evaluate the quality of students' learning, guided by their learning outcomes, a diversified assessment and evaluation method with comprehensive quality and skill evaluation as the core is constructed. Multiple dynamic

indicators such as student discussion, literature reading, and classroom questioning are added, and the evaluation indicators are refined. The experimental results are divided into attendance, practical operation, acceptance defense, report, etc., effectively evaluating students' ability to analyze and solve problems and collaborate with teams.

5. Conclusion

"Big Data Analysis and Visualization" is one of the important courses in the big data major, and the teaching effectiveness of the course is crucial for cultivating innovative, professional, and versatile talents in the context of new engineering disciplines. By carrying out teaching reforms and explorations in teaching content, teaching methods, and teaching assessments, we aim to contribute to the cultivation of engineering talents with noble moral qualities, innovative spirit, and practical skills in universities under the new engineering model.

Funding

Teaching Reform Project of Beijing Union University "Exploration of Teaching Reform of Big Data Analysis and Visualization Course under the Background of New Engineering" (JJ2024Y025)

Disclosure statement

The authors declare no conflict of interest.

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