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Research on the Teaching Reform of Data Mining and Data Analysis Based on the Concept of "Outcomes-based Education"

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Abstract: In the development process of higher education in China in the new era, the construction of new liberal arts has become an important milestone. The idea encourages the integration and development of interdisciplinary disciplines and advocates a shift from a traditional discipline-centered model to an oriented model sensitive to social and market needs. In the face of this change, the course "Data Mining and Data Analysis" has introduced the concept of "OBE" (Outcome-Based Education), which is combined with project-based teaching methods to promote educational reform. This article deeply integrates the teaching reform of information technology tools, fully considering the professional characteristics and market demand, and integrates real project cases into the classroom in a task driven manner. Through the four links of demand acquisition, content integration, teaching module reconstruction, and evaluation mechanism optimization, it breaks the traditional talent training framework. This reform practice promotes the cultivation of students' multi-dimensional ability, enhances their employment competitiveness, improves the teaching quality of teachers, enriches educational resources, and provides impetus for the transformation and promotion of business and other related majors in the new liberal arts environment.

Keywords: OBE; Teaching Reform; New Liberal Arts; Project-based Teaching

1. Introduction

With the rapid development of information technology and the increasingly obvious trend of global education, higher education is facing unprecedented challenges and opportunities. In this context, teaching reform has become a hot topic in the field of education. The new liberal arts requires integrating modern information technology into the humanities and social sciences, providing students with comprehensive interdisciplinary learning, expanding knowledge and cultivating innovative thinking. The construction of new liberal arts has become an important milestone in promoting the reform of higher education. It encourages the integration and development of interdisciplinary subjects and advocates the transformation from the traditional center model to a guiding model that is more sensitive to social and market needs. Under the background of "new liberal arts", it is urgent to cultivate innovative courses of data thinking based on subject integrations [1].

To this end, more and more liberal arts colleges have opened the course of "Data Mining and Data Analysis" and continuously carried out teaching reform. At present, the teaching reform of Data Mining and Data Analysis adopts a variety of methods, including case teaching and group cooperative learning. By introducing the cases and allowing the students to analyze and solve the problems, the students' problem-solving and teamwork ability are cultivated. However, there are still problems, such as a lack of docking with actual scenarios, lack of sufficient practical links, incomplete evaluation methods, and insufficient systematic cultivation. Song Zhenyu et al. emphasized that the problem-based teaching methods and teaching modes lag [2]. Wei Dongmei et al. analyzed the characteristics and deficiencies of Python language teaching and pointed out that the existing curriculum system and training mode need to keep pace with The Times to adapt to the needs of market development and the development trend of big data [3]. In their paper, Liu Manlan and others pointed out that the teaching content is out of line with the learning situation, and some students of liberal arts and science students have a weak ability to think independently, making it difficult to understand complex and abstract knowledge points [4].

The OBE education model focuses on the analysis of students' learning results. It is oriented by the learning results, and clearly pays attention to and organizes every link in the education process, to ensure that students achieve the expected results in the learning process [5]. Therefore, the introduction of OBE education concept into the curriculum teaching design has a very important practical significance to improve the teaching effect and talent training [6].

Many scholars have also studied this, Wang Jiping and Wang Yuyang focused on the "rain classroom" platform, analyzed the current situation of course teaching, and explored the aspects of course group construction, online and offline mixed teaching, case teaching, and process assessment [7]. Based on the grammar characteristics of Python language, they proposed a mixed teaching reform plan, stimulated students 'interest in learning through project teaching, and optimized the teaching content and evaluation system to cultivate students' practical ability and self-study ability [8]. Liu Yifeng et al. proposed to adopt diversified assessment methods, mainly composed of data analysis reports, group cooperation reports, and process practice assessments [9]. Pang Ting et al. emphasized that the application of the OBE education concept in business professional courses can effectively enhance and improve the effect and quality of business teaching [10]. Li Mei et al., based on OBE theory, based on course preparation, design, practice, and evaluation, to improve the teaching quality and cultivate students' independent innovation ability [11].

This teaching reform introduces the concept of "OBE", and on this basis reforms the teaching objectives, teaching contents, teaching structure and evaluation methods of Data Mining and Data Analysis, which promotes the improvement of students' application ability and comprehensive quality, and provides relevant reference and practical experience for teaching reform.

2. New liberal arts "Data Mining and Data Analysis" Course Has Problems

2.1 Weak Foundation and Lack of Initiative

Under the influence of traditional education concepts, students of liberal arts departments lack due attention to the course of Data Mining and Data Analysis. Most students feel unfamiliar with the basic principles of data mining and programming knowledge, and rarely engage in the practice of data analysis by programming means, so the foundation is relatively weak. Many students believe that this course is more based on interest rather than compulsory vocational skills, and some even question their suitability in the business education system, and believe that the practical application value of the course content in the future workplace is limited. Such a cognitive attitude undoubtedly weakens their learning enthusiasm and the motivation to explore independently. With the deepening of the course process, the difficulty of learning gradually increases. Students who fail to grasp the initial knowledge feel frustrated in the face of challenges, and their enthusiasm and participation decrease, which further affects their active learning attitude. In the middle and late stages of the course, the differentiation of ability began to show sharply, and the students without a solid foundation have difficulties keeping up with the teaching progress. This phenomenon constitutes a significant obstacle to the course teaching.

2.2 The Cases Are Old and Deviate from Reality

Data Mining and Data Analysis is dedicated to teaching students how to apply theoretical knowledge and skills to solve practical problems. At present, simulation cases in teaching materials are widely used to guide teaching. The structure of these cases is refined and easy to understand, which is conducive to helping students solidify and deepen theoretical concepts. However, this traditional teaching approach lacks the interactivity that stimulates student participation and learning enthusiasm because the case content is not derived from the research area that the students themselves are interested in. In addition, with the rapid development of data mining technology and the improvement of enterprises' requirements for the precision and scientificity of technology application, traditional case teaching has gradually no longer met the actual needs of the current industry, and has a deviation from the real and complex business environment. The obsolescence of the case content may lead to difficulties in applying theoretical knowledge to practical problems, which will indirectly weaken students' learning enthusiasm and participation.

2.3 The Low Fit of Online Resources and Insufficient Interaction

The existing data mining and data analysis courses mainly focus on the elaboration of theory but are insufficient in providing practical operation projects, which leads to the lack of an effective combination of theoretical learning and hands-on practice. Online teaching resources provide students with a convenient way for them to learn, but they also face some challenges. First, given that these resources need to cater to a wide range of users, the universal online course content cannot accurately match the specific needs of students from different universities. Secondly, the development and update of online resources need a lot of time and capital investment, and it is difficult to synchronize with the latest developments in the industry, which may lead to the separation from students' current learning needs. Third, data mining and analysis learning need to deepen understanding and master skills through sufficient practical operations. However, online courses often lack real-time interactivity and cannot provide quick question answers and personalized support, which may affect learning efficiency. Finally, due to the large number of online resources available, students may find it difficult to select the best materials for their needs.

2.4 Teachers' Teaching Ability Needs to be Improved

The course of Data Mining and Data Analysis aims to closely combine the theoretical learning and big data technology of each major and then puts forward higher requirements for the comprehensive teaching ability of the teachers. On the one hand, teachers need to master a solid theoretical knowledge foundation and have rich teaching experience, so that the core concepts, principles, and technical means of data mining and data analysis can be vividly taught to students. On the other hand, teachers must also have practical experience and be able to combine abstract theory with practical applications to ensure that students not only understand the basic knowledge of data mining but also develop their practical skills to use these techniques to solve practical problems. Furthermore, considering the close connection between the course content and the specific application scenarios of different majors, teachers also need to have an interdisciplinary knowledge background, to better meet the diversified needs of modern data-driven fields.

3. Project-style Teaching Reform Measures

3.1 Analyze the Needs of Students and Enterprises, and Clarify the Ability Training Objectives

Get recruitment website and related forum information through network crawler, using text analysis methods, through the field investigation and questionnaire, obtain the ability demand of enterprises for data mining and data analysis talents. Questionnaires were distributed to students, and many in-depth interviews were conducted to obtain students' knowledge needs. On this basis, focus group discussions are used to identify the gap between the requirements of employers and the students' abilities. On this basis, the direction of case selection and ability training objectives of the course project of "Data Mining and Data Analysis" are clarified, so as to provide the direction for bridging the gap between college education and practical demand and the implementation of teaching reform.

3.2 Introduce the Actual Projects to Meet the Real Needs

In the background of the rapid development of the new generation of information technology, colleges, and universities should make full use of the existing and newly obtained project resources, carefully select those practical projects that frontier content, fit the professional development trend, and are popular with students, and integrate them into the project-based teaching process. Guided by the OBE concept, starting from the final learning results that students should obtain, and following the principle of "derived from textbooks, used for practice, expansion and innovation", this program selects appropriate cutting-edge knowledge to supplement [1]. With "a company financial management data analysis system" as an example, the project not only lets the students learn financial theory and big data technology such as cluster analysis, support vector regression, and data visualization combined with practical application, but can let them analyze the company's financial data, identify and optimize the key problems in budget and cost management, and provide effective improvement strategies.

By integrating such projects into the teaching scope, students can be encouraged by spontaneous learning and enjoy the fun of active exploration, which can help to break the limitations of traditional learning, transform students from passive knowledge recipients to active explorers, and significantly improve their analytical and understanding ability and learning enthusiasm. In addition, given that these projects originate directly from the needs of real-world enterprises, teaching practices can be actively supported and supported by the industry. By establishing close contact with the enterprise, the enterprise specially appoints mentors to provide project guidance and resource support; at the same time, these enterprise mentors will regularly supervise the project progress, check and accept the phased results, and provide professional guidance to ensure that the students' work results meet the actual needs of the enterprise. Through such close collaboration, the teaching content is seamlessly linked with the needs of enterprises, which further improves the adaptability and effectiveness of education.

3.3 Reset the Teaching Structure to Realize the "Teaching" Transposition

According to the project teaching needs, pay attention to students' higher level ability training, combing the knowledge, breaking the previous data mining and data analysis, teaching order rearranged teaching module, the required basic grammar, the third library application, data mining method knowledge into the project teaching practice, design by the shallow curriculum structure, match the project, and the development of video, case library, teaching materials, teaching resources, such as expanding course influence.

In the teaching process, the whole task is decomposed into challenging sub-tasks, and multi-disciplinary / multi-person collaborative learning is emphasized. Through the establishment of groups to complete the project tasks, students' multidisciplinary knowledge background is enriched and their communication and cooperation ability is cultivated. Make full use of information technology, from pre-class preview, classroom practice, and review after class multiple dimensions reshape the teaching process, promote curriculum by teachers "teaching" as the center to students "learn" and "do" as the center of the shift, let the student from the try, through group cooperation and exploration, complete understand the whole process of project implementation, teachers from "protagonist" to "supporting" role transposition, improve students' self-study ability, innovation ability, cultivate high-quality applied talents.

3.4 Improve the Effect Evaluation and Continuously Improve Teaching Quality

The scientific and perfect teaching effect evaluation mechanism is an important guarantee for curriculum construction, which can not only objectively evaluate the results of curriculum construction, and understand the teaching level of teachers, but also have the reverse incentive and supervision effect on students' learning. Therefore, it is necessary to implement the process assessment mechanism of project-based teaching.

First, the assessment indicators should be clarified and quantified, so that the proportion of normal scores and final examination scores should be appropriately reduced, guide students to pay attention to the cultivation of project promotion and the ability to solve practical problems from the scoring setting, and avoid the disadvantages of traditional examinations such as forced memory, sudden review, and lifelong examination. Second, enterprise experts are invited to evaluate the implementation effect of the project, find the shortcomings of project-based teaching, constantly close to the actual needs, and improve the teaching content of the project. Third, collect real-time feedback from students and evaluate after the course, invite teaching supervisors and senior teachers to evaluate the teaching process, and constantly improve teaching methods and teaching ability through team discussion, collective learning, course demonstration, and other methods. In addition, the application of knowledge of students after employment, and the evaluation of employers. Through multi-source data analysis, promote the continuous improvement of project-based teaching and form a logical closed loop.

4. The Expected Effect of Teaching Reform

4.1 Improve Students' Ability of Data Analysis and Cultivate Applied Talents

Project-based education focuses on being student-centered and emphasizes the importance of the learning process over mere learning outcomes. It encourages students to practice in

the context of solving real-world problems. Through this process, they can not only master the basic knowledge and skills of data analysis and data mining but also exercise the key problem-solving ability and tenacity in facing challenges. In addition, project-based learning also enhances students' spirit of independent learning and active participation, thus significantly improving teaching effectiveness.

Companies seek talent that can address the challenges facing the organization, and the demand for such talent is constantly evolving, with higher levels of requirements. Through integrated project-based learning, we can bring real business scenarios and problems into the classroom, thus realizing the transformation from a subject center to an industry demand center. Students are exposed to the latest issues of the industry, develop key skills, and strengthen professional ethics. At the same time, students hone their data analysis skills in real communication and operation situations, which promotes the comprehensive development of core qualities. Through this way of education, the applied talents with both professional and technical ability and innovative spirit and social responsibility will be cultivated, and the employment competitiveness of students will be significantly enhanced.

4.2 Enrich Teaching Resources and Improve Teachers' Teaching Ability

By integrating a series of practical projects into the classroom, and the design of teaching resources, scientific and reasonable, practical, popular, high value of project teaching courses, not only let students establish correct professional cognition, understanding and applying the basic principles and concept of data mining, improve students' problem-solving ability, also can enrich school teaching resources, and through online curriculum development, teaching publishing, expand influence, for project teaching reform, promote the first-class professional construction to provide a solid foundation. At the same time, the introduction of the actual project, will also reverse transmission teachers out of their ivory towers and comfort zones, keep communication with the enterprise, constantly strengthen the study of new knowledge, and new skills, update their knowledge system, through the training of project implementation to keep pace with The Times, improve curriculum development ability, teaching level, practice ability, scientific research level, and comprehensive quality, realize "teaching-learning".

4.3 Promote Professional Transformation and Promote the Construction of New Liberal Arts

With the technological innovation in the new era and the continuous promotion of the construction of new liberal arts by the Ministry of Education, cutting-edge technologies such as the "Great Wisdom Cloud Area" are having a profound impact on the liberal arts majors, accelerating the transformation of these fields to digitalization and intelligence. In this context, the talent training mode of higher education urgently needs to keep pace with The Times to adapt to the new challenges brought about by technological development. The project-based teaching of "Data Mining and Data Analysis" not only fits the latest guiding spirit of the educational administrative department but also meets the urgent need to strengthen the university education system in China. Through the window of project-based teaching, the concept of "OBE" is integrated into the teaching process, which can better understand the social development and the needs of the industry, provide a basis for the construction of teaching staff, curriculum system, and the revision of talent training program, and effectively promote the transformation and development of various majors in the business school.

5. Conclusion

The project-style teaching method with projects as the main line, teachers as the guidance, and students as the main body, naturally fits in and is internally consistent with the goal-oriented and student-oriented OBE concept, which can effectively promote the innovation of the teaching method of "Data Mining and Data Analysis" and solve the current problems. The project-based learning method not only promotes the students' self-directed learning and problem-solving ability but also improves their application ability and employment competitiveness. This is in line with the new needs of the Ministry of Education for the construction of new liberal arts and talent training, especially the importance of integrating the concept of achievement-oriented education (OBE) into the teaching process. The advantage of this teaching mode lies in that it can promote

students' understanding of social development and industry needs, so as to promote the construction of teachers, and the scientific construction of curriculum system, and boost the transformation and development of majors. Looking into the future, we look forward to the continuous deepening of education reform, constantly optimizing the education model, meeting the new challenges of social development, and cultivating more compound talents with both theoretical knowledge and practical ability.

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References

[1] Huang Wei, Zhao Hongxia. Exploring the Python language teaching mode of "mass entrepreneurship and innovation" education under the perspective of new liberal arts. Computer Knowledge and Technology, 2023, 19(22): 150-152.

[2] Song Zhenyu, Yan Xuemei, Jiang Min. Exploration of the basic course teaching mode of data mining under the concept of OBE. Computer Knowledge and Technology, 2021, 17(29): 194-196.

[3] Wei Dongmei, Wang Ying, Zhong Shifen, et al. Teaching practice of Python programming course based on CDIO model. Computer Education, 2018, (02): 129-131.

[4] LIU Man-Lan, LI Jian-hui, GUAN Cheng-bin. Exploration of OBE concept based hybrid teaching method for “Python programming language” course. Computer Engineering & Science, 2019, 41(S1): 203-206.

[5] Li Zhiyi. Analyze the achievement-oriented concept of engineering education professional certification. CHINA HIGHER EDUCATION, 2014, (17): 7-10.

[6] Zuo Weigang. Research on the application of CDIO in the teaching of Python programming course. Computer Era 2019, (08): 78-80+96.

[7] Wang Jiping, Wang Yuyang. Research on Blending Learning of Python Language Programming Course Based on Rain Classroom. Modern Information Technology, 2023, 7(24): 0170-05.

[8] Sun Jian, Xu Shuo, Li Jian. Python Mixed teaching reform of language programming. Computer Education, 2023, (10): 0082-05.

[9] Liu Yifeng, Li Yuan. To explore the reform of the teaching mode of Data Mining and Analysis for the integration of industry and school. Zhongguancun, 2023, (07): 112-113.

[10] Pang Ting, Zhao Yunfang, Zhu Jingjing. Research on business curriculum reform and teaching practice based on the OBE concept and data mining. Time-honored brand marketing, 2023, (09)-188-190.

[11] Li Mei, Chen County, Cheng Bao State. Exploration of the mixed teaching mode of "business intelligence and data mining" based on OBE. Education Modernization, 2019, 6(74): 34-36.