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Exploration and Practice of OBE Teaching Philosophy and BOPPPS Teaching Model in the Reform of NoSQL Database Technology Course

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Abstract: With the rapid development of Internet technology, NoSQL database technology has demonstrated significant advantages in handling large-scale unstructured data. However, traditional teaching modes of NoSQL database technology courses face numerous issues, such as monotonous teaching methods, low student engagement, and unsatisfactory learning outcomes. This paper reforms and practices the NoSQL database technology course based on the OBE (Outcome-Based Education) teaching philosophy, combined with the BOPPPS (Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary) teaching model, aiming to enhance students' interest in learning, strengthen their practical abilities, and improve teaching effectiveness.

Keywords: OBE Teaching Philosophy; BOPPPS Teaching Model; NoSQL Database Technology.

1. Introduction

NoSQL database technology, as an important means of handling large-scale unstructured data, is widely used in fields such as cloud computing, big data, and the Internet of Things. However, traditional teaching modes of NoSQL database technology courses often focus on the imparting of theoretical knowledge, neglecting the cultivation of students' practical abilities, leading to low student interest in learning and weak practical skills[1]. Therefore, reforming the NoSQL database technology course and introducing advanced teaching philosophies and models is of great significance.

The OBE teaching philosophy emphasizes a student-centered approach, with learning outcomes as the orientation, focusing on cultivating students' practical and innovative abilities. The BOPPPS teaching model emphasizes enhancing student participation and initiative[2], which aligns well with the student-centered idea of OBE. NoSQL database is a practice-oriented professional core course. This paper combines the OBE teaching philosophy with the BOPPPS teaching model to explore its application and practice in the reform of the NoSQL database technology course. With OBE as the core guiding ideology, clear learning objectives for each chapter are set, and then the BOPPPS teaching model is adopted for classroom design to guide the specific teaching process. For example, mastering the basic and advanced operations of MongoDB and Redis databases is taken as the knowledge objective, being able to select the appropriate NoSQL database according to the characteristics of different NoSQL databases for different business needs and application scenarios to solve practical problems is taken as the ability objective, and cultivating students' innovative thinking is taken as the quality objective. By combining various aspects of BOPPPS to carry out specific teaching activities, the core idea of "learning outcomes-oriented" in OBE is implemented throughout the classroom.

2. Analysis of Existing Teaching Modes

2.1. Analysis of Teaching Methods and Learning Situations

Currently, the teaching mode of NoSQL database technology primarily relies on traditional lecture-based teaching. This teaching mode is relatively monotonous, teacher-centered, and explains the concepts, principles, technical characteristics, and specific usage methods of NoSQL databases. However, this traditional teaching method often ignores students' subject status and individual differences, failing to fully stimulate students' interest and enthusiasm in learning [3]. In fact, in the teaching of "NoSQL Database Technology", students need a certain degree of initiative and exploratory spirit to deeply understand and master each database theory and technology. Therefore, the existing teaching mode may not align well with the teaching philosophy of "student-centered, teacher-led."

Furthermore, in traditional teaching modes, teachers often find it difficult to obtain real-time feedback on students' learning and questions, making it impossible to adjust teaching strategies in a timely manner to meet students' individualized needs; students lack opportunities for effective interaction with teachers and other classmates, making it difficult to form a positive learning atmosphere.

Therefore, choosing a teaching mode that combines OBE and BOPPPS returns the classroom to students, highlights their subject status, fully exerts students' subject role and individual differences in the teaching process, and establishes an effective feedback mechanism to promptly understand students' learning situations and problems, thereby enhancing students' learning motivation and effectiveness.

2.2. Analysis of Teaching Effectiveness

NoSQL database technology is an extremely operational and practical core professional course that requires students to have practical operation and problem-solving abilities. However, previous teaching modes did not clearly distinguish between theory and practice, making it difficult for students

to apply the knowledge learned to actual projects or problems. Specifically, they emphasized the imparting of theoretical knowledge too much while neglecting the cultivation of students' practical abilities; or practical operations were mostly based on students following along, lacking opportunities for independent thinking and exploration. This contradicts the idea of cultivating applied talents. Therefore, choosing a teaching mode that combines OBE and BOPPPS can strengthen the integration of theory and practice, rationalize the setting of teaching links, and provide students with certain practice time in participatory links, allowing students to digest and consolidate knowledge through practice, improving their independent thinking abilities and knowledge application abilities.

3. Design of Teaching Mode Based on OBE and BOPPPS in NoSQL Courses

The core idea of OBE, "learning outcomes-oriented" can guide the analysis and determination of the teaching objectives of this course, and then the various aspects of BOPPPS can be reasonably designed to facilitate the smooth implementation of the NoSQL database technology course under this integrated mode. According to the characteristics and content of NoSQL database technology, the design mode of the BOPPPS teaching link based on the OBE concept is shown in Figure 1 below.

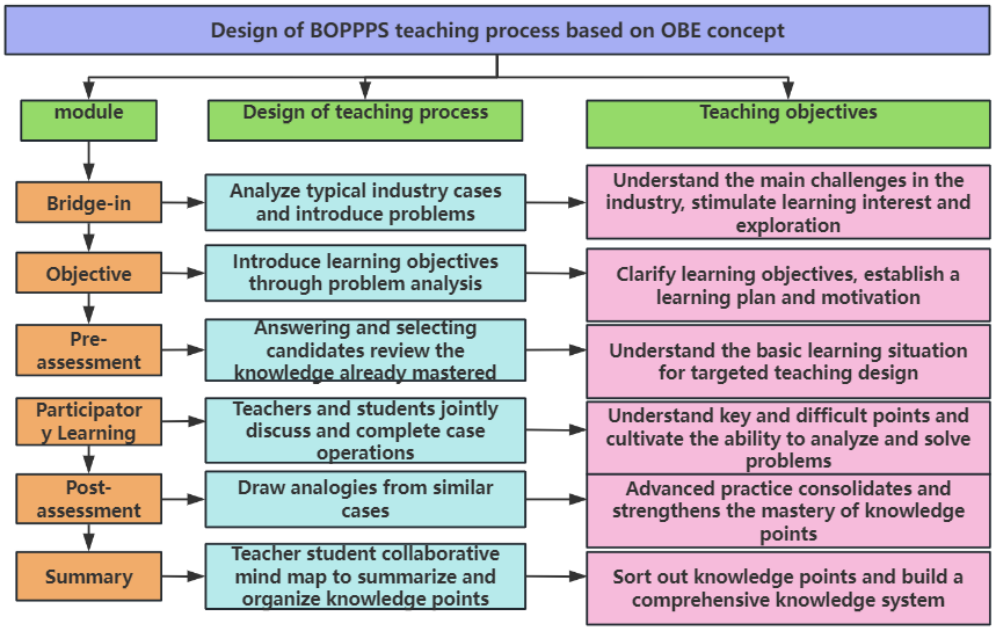

Figure 1. Design pattern of BOPPPS teaching process based on OBE concept

Centering on the above overall design mode, the various aspects of BOPPPS are carried out as follows.

3.1. Bridge-in

In the BOPPPS teaching mode, a good bridge-in can enhance the learning atmosphere of the entire class. Traditional teaching modes often directly present problems and give answers to introduce the classroom theme[4]. However, in the teaching design of BOPPPS, cases such as the development history of the big data industry and typical problems encountered by relational databases when solving some massive data storage or access issues can be used to introduce the main problems of the current class, stimulating students' thinking and interest in learning each class. For example, when learning the concept of MongoDB database, the case of the "12306" system being prone to crashes during early ticket-buying peaks can be used to lead students through case analysis, further guiding students to think about the advantages and disadvantages of relational databases and introducing the concepts and characteristics of MongoDB.

3.2. Objective

The objective part is a very important link in the BOPPPS teaching mode. In this link, teachers need to clarify the learning objectives of the course to better design each course link and promptly understand students' mastery[5]. At the same time, this link can emphasize the key and difficult points of the course, helping students establish a preliminary learning plan. The learning objectives of the course can be naturally introduced in combination with the problems in the bridge-in part of the current class. For example, when learning MongoDB distribution, by analyzing and comparing the insufficient flexibility of the fixed structure of relational databases, the characteristics of MongoDB and the convenience and flexibility of basic operations can be introduced. Letting students learn with goals can enhance their learning motivation and exploration desire.

3.3. Pre-assessment

Effectively designing the pre-assessment link can more authentically and effectively grasp the basic knowledge and abilities that students already possess. In the pre-assessment part of this course, teachers can use functions such as questioning and quizzing on Superstar Learning Through to understand students' understanding and application of other database characteristics. For example, questions such as "Can relational databases store data with inconsistent structures?" and "Which databases have data backup and automatic failover functions?" can be asked to understand students' grasp of basic database concepts and knowledge. Then evaluate students' answers and reasonably formulate the teaching plan for this class.

3.4. Participatory Learning

Participatory learning can enhance teacher-student interaction, help teachers promptly grasp student differences, and provide targeted guidance and strategies. NoSQL databases are diverse and widely used, so in the teaching process of this course, the characteristics of the course can be fully utilized to design diversified cases and adopt diversified teaching forms to engage students in the classroom. For example, group discussions can strengthen students' team collaboration abilities and promote brainstorming; case analysis can improve students' logical thinking abilities and problem-solving abilities. When learning the aggregation operations of MongoDB, taking the storage and query of commodity information on e-commerce platforms as a typical case for students to practice is conducive to students mastering the applicable scenarios of MongoDB and enabling students to quickly and efficiently master the basic operations of aggregation operations.

3.5. Post-assessment

The post-assessment part can provide a clearer understanding of students' mastery and application of key and difficult knowledge points, promoting the optimization and improvement of course teaching. In the post-assessment link of this course, students can be asked to practice by assigning cases of equivalent difficulty to test their mastery of this part of the knowledge. The test can provide a basis for subsequent review and consolidation by understanding students' learning effects. At the MongoDB aggregation operation stage, employee information management can be used as an advanced case to help students further consolidate basic knowledge and expand the application of knowledge.

3.6. Summary

The summary section can adopt diversified methods based on the characteristics and content of the course, all aiming to help students deepen their understanding and memory of knowledge and construct a comprehensive knowledge system. According to past teaching experience, students often exhibit a noticeable phenomenon when learning NoSQL database technology: they grasp individual databases or specific knowledge points well but tend to confuse the overall knowledge points. The primary reason is that students lack a proactive process of combing through and summarizing knowledge points, making it difficult for them to grasp the connections and differences among knowledge points. Additionally, this course involves multiple different relational databases, with knowledge points presented to students mainly through PPT slides in each class. The abundance and complexity of knowledge points hinder students' systematic mastery and technological selection[6]. Therefore, in the summary segment of each class in this course, teachers and students can collaboratively construct mind maps to sort out and summarize the knowledge points of the current class, enabling students to understand not only the content but also the reasoning behind it, thereby truly constructing a complete knowledge system. Figure 2 depicts the knowledge mind map jointly created by teachers and students by the end of the course.

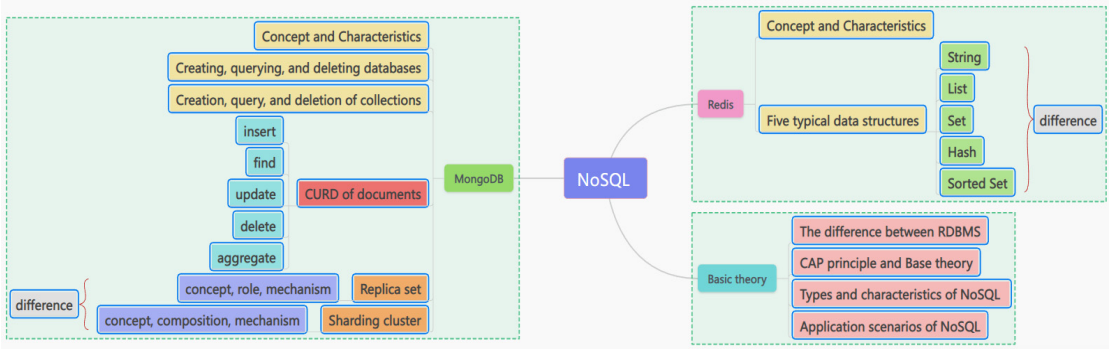

Figure 2. Knowledge point mind map jointly drawn by teachers and students

4. Teaching Reform Effectiveness and Reflection

The BOPPPS teaching improvement approach based on the OBE teaching philosophy has significantly enhanced teaching effectiveness and student learning enthusiasm. In the theoretical sections such as introduction and objectives, students are more willing to follow teachers in thinking and analyzing problems. During the participatory segment, students demonstrate strong enthusiasm and a sense of participation. In the post-test segment, most students eagerly try to apply what they have learned. During the summary stage, through the collaborative construction of mind maps by teachers and students, students have a clearer understanding of the structure and system of knowledge points. Additionally, some students have expressed that the types of practical cases are not sufficient, and the case scenarios lack novelty. Therefore, further strengthening the construction of the teaching resource library and introducing flipped classrooms and other methods to further enrich classroom teaching forms are necessary during the subsequent course development process.

5. Conclusion

The application of the OBE teaching philosophy and BOPPPS teaching model in the reform of the NoSQL database technology course has demonstrated that this teaching model can effectively improve students' learning interest and practical abilities, enhancing teaching effectiveness. In the future, we will continue to deepen teaching reforms, improve the construction of teaching resources, enhance teachers' teaching abilities, and cultivate students' autonomous learning abilities, contributing to the cultivation of more high-quality NoSQL database technology talents.

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