Exploration of AI+OBE-Based Blended Teaching Mode: A Case Study of the Course "C# and Database Practice"

Hong Li

City Institute, Dalian University of Technology, Dalian, 116600, China

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Abstract: In the era of intelligence, higher education has entered the "first year of smart education". Based on the AI+OBE-oriented C# and Database Practice blended teaching reform, empowered by AI large model technology, according to the ability cultivation goals and output requirements of the C# and Database Practice course, and with reference to enterprise project cases, the teaching objectives, output requirements, process evaluation, and assessment methods of online and offline courses are reverse-designed, and a feedback and continuous improvement mechanism is established. Combined with online Superstar platform, QQ groups, and classroom interaction, the goal is to effectively improve the teaching effectiveness of programming practice courses.

1. Introduction

In April 2018, the Ministry of Education issued the Notice on the Issuance of the Artificial Intelligence Innovation Action Plan for Higher Education Institutions, proposing that in the future, a new professional training model of "Artificial Intelligence + X" will be formed [1]. In 2019, UNESCO officially released the Beijing Consensus on Artificial Intelligence and Education, which is the first important document to provide guidance and recommendations for achieving the 2030 Education Agenda through artificial intelligence technology. It primarily focuses on the integration of artificial intelligence and education, how artificial intelligence can be applied to education and teaching, how to improve the teaching methods of teachers and students both in and out of the classroom, and the use of educational big data. A mobile learning week was designed for related activities [2].

The rapid development of contemporary society and the continuous advancement of science and technology have brought great convenience to people. Modern teachers also need to continuously learn new technologies and apply them in the classroom, carrying out constant teaching reforms to adapt to student learning conditions. C# and Database Practice is a core professional practice course for the major of Information Management and Information Systems. This course specifically includes the use of SQL Server databases to store data, and the design of WinForms programs using the C# language to implement operations such as addition, deletion, querying, and modification of data in the database.

2. OBE

OBE (Outcome-Based Education), also known as results-oriented education, competency-based education, goal-oriented education, or needs-oriented education, is a course system construction concept that is oriented by outcomes, student-centered, and adopts reverse thinking. It is an advanced educational philosophy [3].

The discussion of OBE by domestic scholars began with theoretical research in 2003 and transitioned to applications in 2012, indicating that the OBE concept has played a significant role in talent cultivation in higher education, educational and teaching reform, and professional development.

In terms of professional development based on OBE: Qu Lili and Zhai Jun (2021), in Exploration and Practice of Innovation and Entrepreneurship Talent Training Model for Information

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Management Based on OBE Concept, introduced the integration of outcome-based education models into the cultivation of innovation and entrepreneurship capabilities of information management talents. A complete, continuous, and progressive talent training path was formed, along with the design of corresponding talent training systems, multi-level curriculum systems, reconstruction of course content, and evaluation systems centered on goal achievement. Various measures such as software and hardware resources, diversified teaching staff, and effective incentive mechanisms were adopted to ensure the normalized development of innovation and entrepreneurship education for information management.

In terms of course construction, teaching design, and teaching reform based on OBE: Zhu Jihong (2024), in the article Teaching Reform of the Course C# Programming and SQL Database Application Based on OBE Concept, pointed out that the integration of theory and practice under the outcome-based teaching concept, the reform of teaching methods through a project-driven approach, the reform of practical teaching by combining autonomous and team-based methods, and the adoption of comprehensive and multi-level evaluation methods can enhance students' abilities to solve complex engineering problems. Zhang Yunhe (2024), in Exploration of Innovation Ability Training for Information Talents under OBE Concept, introduced the reform and practice of broad-based practical courses for electronic information majors based on the OBE concept. Zhou Chunyue et al. (2016) researched and discussed the optimization design of experimental teaching and diversified evaluation models at three ladder levels based on outcome-oriented OBE for basic skills. Wang Jiao (2018) used the mechanical design course as an example to explore the effective integration of learning outcome-based education models and the development of new engineering disciplines. Wu Tao et al. (2018), based on the CDIO and OBE engineering teaching practices of Shantou University, proposed a hierarchical teaching method that integrates discovery-based and reception-based teaching. Although there is a relatively large body of literature on teaching design and teaching model reform based on OBE, most of it still focuses on engineering courses. From the perspective of research content, although the OBE concept has been proposed, there is still relatively little operable research that has been truly implemented in teaching practice.

3. AI Assistance

AI tools are used to improve programming development efficiency. For example, guiding and utilizing AI to assist in code generation from diagrams or text. Tools such as Kouzi AI, Wenxin Yiyan, 360 Zhinai, and Baidu AI can be used to implement functions like creating basic tables, using C# to implement GridView control data filling, adding, modifying, deleting, and querying data. Based on the answers provided by AI tools, students further process and apply the results. In this process, on one hand, students' comprehensive abilities are reflected. If the fundamentals are not solid, directly copying the AI-generated code will lead to program failures. Students must think independently, inject their own logic, reference and apply their existing knowledge to modify the AI-generated code in order to successfully implement the required functions.

4. Blended Teaching

4.1 Main Content of Teaching and Learning Mode Reform Plan

First, the teaching mode of this course is reformed from traditional offline teaching to a hybrid online + offline mode. Both online and offline are utilized for theoretical teaching. During offline classes, videos of theoretical lectures are recorded and uploaded to the Superstar platform to build the course and add teaching classes. Advantage one: for knowledge points in offline courses that students may not have fully understood or when reviewing at the end of the semester, they can refer to the corresponding points in the online course on the Superstar platform to fill in the gaps. Advantage two: it helps cope with emergencies or force majeure situations where offline teaching cannot proceed, such as during pandemics or when students take leave due to illness.

Second, course hours and content are reasonably planned, making full use of the 32 teaching hours.

Referring to real-world cases provided by demand-side employers such as a company's OA system or hotel management system, programming implementations such as database connection and table data operations are integrated into a student management system. The interface design and code standards align with actual enterprise cases. Course ideology and politics are incorporated into the classroom by planning actual enterprise cases, guiding students to value professional skill development and to establish correct values. Practical courses are more effective in testing the real effects of teaching and learning, helping both teachers and students understand what they are teaching and learning, and adjust their teaching and learning behaviors based on feedback to improve teaching quality.

Main Implementation Subjects: The course is targeted at second-year students majoring in Information Management and Information Systems.

4.2 Expected Outcomes

First, for students, through course learning and by designing the teaching content based on OBE outcome orientation, students can sequentially complete database design, use ADO.NET technology to access the database, design the main forms for administrators and students, realize student information query by name, and modify student information through a right-click menu in the GridView control, as well as query student information by grade. In this process, students can use AI tools to complete function design. Innovation is encouraged, and extra credit is given when students implement certain function points using their own approaches.

Second, for teachers, the practice section is reasonably designed, with key knowledge and skill points properly connected to project cases to complement each other. If students fall behind in offline courses, recorded videos on the Superstar platform allow seamless switching between online and offline teaching, ensuring that the teaching plan proceeds smoothly. The Superstar platform and QQ groups are fully used for attendance, assignment submission and collection, student learning time tracking, and interaction.

4.3 Execution Process of Teaching and Learning Mode Reform Plan

First, the teaching process is reasonably designed to fully stimulate student enthusiasm and develop their hands-on practical skills.

In offline classes, the student management system serves as the main thread, with the teacher guiding and encouraging students to answer and ask questions. Each class includes an interactive segment. The teacher steps off the podium to engage closely with students, gaining insights into how well students are following the lecture and paying attention, with an emphasis on hands-on practice. Extra credit is given based on the quality of student responses and questions to stimulate learning motivation. For some knowledge points, flipped classroom segments are designed where students explain the content, helping them to practice their expression skills and research spirit. In class, some SQL statements are introduced as pre-questions, and students with strong practical skills are invited to demonstrate on the teacher's computer to inspire others to strive for excellence, motivating those who are doing well to do even better and encouraging others to catch up.

Second, online + offline hybrid teaching is fully implemented using tools such as the Superstar platform, Tencent Meeting, and QQ groups.

Teachers upload teaching materials (syllabus, teaching calendar, PPT, etc.) to the Superstar platform, and add recordings of theoretical and some lab classes to ensure that emergencies do not disrupt normal teaching and to help students review and fill in gaps. Daily classes use the Superstar platform for attendance, and assignments are distributed and collected there. The QQ group plays a vital role during fully online teaching and final review. In lab classes, students are asked to submit screenshots of their assignments to the group, serving as a model and motivating other students to follow suit.

In practice classes, past knowledge points are reviewed first. Project cases serve as the main carriers. Tasks are assigned for each class, with pre-set problems. The teacher first demonstrates the overall function that the class needs to complete so that students have a goal. During the lecture, the teacher explains and demonstrates simultaneously, allowing students to observe up close and better

understand the content. Then, within a limited time, each student operates independently and organizes notes. Before the end of class, assignments are submitted through multimedia broadcast software, and students' usual lab performance is recorded based on their completion. Ideological and political education is occasionally integrated to instill positive energy and effectively prevent students from free-riding. If a few students try to slack off, indirect guidance is provided. Eight lab classes require eight assignment submissions. Based on student mastery, if a common issue is found among many students, a collective explanation of the problem is provided. Before the end of class, a brief summary of the session is given to help students focus on daily knowledge accumulation.

5. Reform Plan and Course Assessment Plan

5.1 Reform Plan

First, the teaching objectives are employment-skill-oriented, and the teaching content related to C# and databases is designed in reverse based on outcomes. At the same time, ideological and political content is integrated into the course, focusing not only on the improvement of knowledge and skills but also on cultivating students' soft skills such as problem discovery and problem-solving abilities, teamwork, and positive motivation.

Second, according to the teaching objectives, reforms are carried out on teachers' teaching methods and students' learning approaches. Project task sheets are introduced in advance to guide students to effectively utilize online resources, such as Superstar video courses, Bilibili, MOOC, etc. Various teaching methods are adopted, including project-based teaching and hybrid online-offline teaching. Students are encouraged to identify and participate in actual projects and are also encouraged to participate in innovation and entrepreneurship projects for college students, thereby improving their overall abilities.

Furthermore, the assessment methods and teaching feedback are improved, centering on students and promoting differentiated learning and diversified evaluation. These include but are not limited to classroom interaction and the realization of program functions in each class session, aiming to objectively evaluate each student's lab performance. Efficient course teaching feedback questionnaires are explored to understand the changes in teaching content and student emotions, thus determining the quality and level, effectiveness, and deficiencies of the teaching. Based on the feedback information, teaching and learning behaviors are adjusted to achieve the goal of improving teaching quality.

5.2 Course Assessment Plan

The course grade mainly consists of usual performance (20%), completion of lab content (60%), and final project (20%), with an emphasis on both process and outcome.

The standards for regular assessment are refined (See Table 1). For example:

Table 1. Scoring Criteria for This Program

Score	Sub-score	Item Description
20	Correctly Create Database Table	
	5	Design each field of the data table according to the assignment requirements
	6	Correctly set primary key (2 pts), NOT NULL constraint (2 pts), ID auto-increment (2 pts)
	4	Set two CHECK constraints on gender field and admission age field (2 pts each)
	5	Enter at least 5 test records
20	Main Form Design	
	2	Set as MDI parent form
	2	Form title: Student Information Management System
	5	Correctly place 5 menu items
	3	Form is maximized by default
	4	After clicking menu item “Information Query”, open the “Information Query” form in modal mode; 2 pts for opening, 4 pts for modal mode
	4	Click the “Exit” menu item to exit the system

50	"Information Query" Form	
	2	Correctly set the form title as "Student Information Query"
	11	Correctly place all 11 controls, including 2 GroupBox, 3 Label, 3 Button, 1 TextBox, 1 ComboBox, and 1 DataGridView. 1 point will be deducted for each missing control
	4	The form opens centered on the screen (1 pt), cannot be resized (1 pt), maximization is disabled (1 pt), minimization is disabled (1 pt)
	5	Correctly connect to the database; connection string is written correctly
	2	Verify whether query type is selected (1 pt) and query condition is entered (1 pt)
	12	Correctly complete four types of queries, 3 points for each
	3	Properly handle the case when no records match the query condition
	4	Appropriate exception handling for database connection and query; no points if not handled
	3	Click the "Exit" button to close the form
	4	After clicking the "Clear" button, clear all data in text boxes and combo boxes (2 pts), and restore the data grid view content to the initial state (2 pts)
10	Overall Programming Techniques	
	3	User interface is visually appealing, controls are neatly arranged
	3	Variable names follow conventions, code is readable, and properly commented
	4	Program compiles and runs correctly, required functions are implemented; no points if not functional
	Total	100

In the assessment of this course, the weight of regular assessment is increased. First, students' learning status is assessed through a trinity evaluation of attendance, classroom performance, and regular theoretical assignments. This aims to monitor and prevent absenteeism and inattentiveness, as well as to stop group free-riding behavior. Daily roll calls are conducted on the Superstar platform, and students' attendance and learning are randomly checked through questioning, to urge students to adjust their learning state. Second is process assessment. Quizzes are used to test knowledge mastery, while lab classes reinforce theoretical knowledge. Teacher-student interaction is increased through questioning, answering, discussion, flipped classrooms, student demonstrations, etc., which greatly stimulates students' enthusiasm and improves learning outcomes for most students in the class.

After the reform of academic evaluation methods, students' learning status has significantly changed, especially with the integration of ideological and political elements into the course. It is evident that students have become more positive and proactive in their learning. The influence of role models should not be underestimated. At the same time, the mastery of course knowledge has become more solid, the ability to solve problems using what they have learned has been strengthened, and their professional competitiveness has improved.

6. Conclusion

With the increasing demand for talents in society, professional teachers are compelled to promptly and appropriately carry out teaching reforms for their courses. The continuous development of network technology and the empowerment of AI technology, along with the result-oriented OBE approach, ensure that students achieve learning outcomes in each class, learn something useful, and break away from the traditional single offline teaching mode. At the same time, to deal with emergencies, hybrid online-offline teaching can effectively ensure the smooth progress of teaching and also facilitate students' consolidation and review with original resources to rely on. From the teaching process over a semester, it can be seen that students have a good grasp of these knowledge points, which also shows that the teaching reforms and evaluation method reforms have indeed achieved certain results.

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