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Research and Practice on Blended Teaching Reform of Database Technology and Applications for Higher-Order Competency Development

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ABSTRACT
In response to the prominent issue of insufficient cultivation of higher-order competency in previous teaching practices, the course team drew on relevant theoretical and practical achievements to systematically develop a teaching reform plan for the Database Technology and Applications course. This plan encompasses five dimensions: teaching objectives, content and resources, methods and tools, instructional activities, and assessment and feedback. Additionally, a novel three-stage teaching model was designed to facilitate the implementation of the reform. Practical results demonstrate that the teaching reform has achieved significant success, effectively resolving the aforementioned prominent issues in previous teaching practices.

KEYWORDS
Higher-order objectives; Tiered teaching; Flexible assessment

1 Introduction

Before 2020, the teaching objectives of the "Database Technology and Application" course for the Finance major at Qilu University of Technology primarily focused on three dimensions: basic theory, core technology, and superficial application, without clear requirements for higher-order goals such as comprehensive application ability, humanistic literacy, and intellectual interest and sentiment. This setup led to the prominent issue of insufficient cultivation of higher-order competency in past teaching practices, specifically manifested as: students' comprehensive application ability being relatively weak, structural obstacles in cultivating critical thinking and innovation ability, and a noticeable lack of immersion in humanistic literacy and cultivation of intellectual interest and sentiment.

To resolve the prominent issue of insufficient cultivation of higher-order competency in the "Database Technology and Application" course, the course team initiated the "Blended Online and Offline Teaching Reform Project for 'Database Technology and Application'" in 2021, aiming to systematically enhance students' higher-order competency.

2 Basic Principles Followed in the Teaching Reform

Through systematic literature research, the course team drew on relevant theories and practical achievements to establish the basic principles for this teaching reform.

2.1 Theories Underpinning the Teaching Reform

This teaching reform adheres to the following series of theories: Constructivist theory advocates creating learning environments for students, providing teaching resources, and implementing comprehensive, ongoing multiple evaluations and feedback; Connectivism focuses on building learning platforms and implementing project-based tasks; Mastery learning theory pays attention to individual student differences, suggesting the design of differentiated teaching activities based on detailed teaching objectives to help each student achieve academic success; the First Principles of Instruction emphasize using real-world problems as drivers, guiding students through the learning process of "activating prior knowledge—demonstrating new knowledge—applying practice—integrating and mastering"; Deep learning theory advocates cooperative learning based on authentic contexts to cultivate students' critical thinking, creative thinking, and complex problem-solving abilities; Active learning theory focuses on "learning by doing" based on knowledge and scenarios to enhance students' innovation ability; Blended teaching theory advocates the systematic integration of teaching objectives, content, methods, activities, and evaluation through both online and offline channels.

2.2 Advanced Practical Experiences Referenced in the Reform

This teaching reform draws on the following advanced practical experiences: Liu Huan et al. (2024) used a five-step teaching method based on "focusing on problems—activating prior knowledge—demonstrating new knowledge—

applying new knowledge—integrating and mastering" to address the insufficiency in cultivating higher-order competency; Lu Keqing et al. (2020) proposed designing course objectives based on a taxonomy of significant learning; Zhou Fu'an (2020) emphasized that instructional design should focus on organizing teaching content from multiple comparable perspectives; Zheng Yongyan (2019) promoted the integration of online and offline teaching through mechanisms of "online-offline discussion cycles" and "online-offline evaluation cycles"; Zheng Yongyan (2020) proposed that academic assessment should follow the principle of "alignment consistency" to achieve unity among objectives, activities, and assessment.

2.3 Basic Principles Established for the Reform

Based on the aforementioned theoretical achievements and successful practical experiences, the course team established the basic principles to be followed in this teaching reform: systematically construct an overall plan covering the five dimensions of teaching objectives, teaching content and resources, teaching activities, teaching methods and tools, and assessment and feedback, and design a matching teaching model to promote implementation.

Simultaneously, the course teaching philosophy must undergo a fundamental shift, moving entirely from the original paradigm of "basic objective orientation, unified teaching system, rigid assessment mechanism" to a new paradigm of "higher-order objective orientation, tiered teaching system, flexible assessment mechanism".

3 Reform of the Teaching Plan

Adhering to the basic principles of teaching reform, the course team systematically constructed the basic plan for this reform.

3.1 Reform of Teaching Objectives

Before the implementation of the reform, the teaching objectives of "Database Technology and Application" primarily revolved around three lower-order dimensions: "Basic Theory," "Core Technology," and "Learning for Application." Specifically, the "Basic Theory" objective emphasized the mastery of core concepts, basic principles, and fundamental data; the "Core Technology" objective focused on training students' skills in areas like database and data table creation, querying, and maintenance; the "Learning for Application" objective aimed to cultivate students' preliminary ability to use database technology to solve simple practical problems.

After the reform, the course team, drawing on the design framework proposed by scholars like Lu Keqing (2020), systematically expanded the original teaching objectives into six dimensions. While retaining the original basic objectives of "Basic Theory, Core Technology, Learning for Application," three new higher-order objectives were added: "Humanistic Literacy," "Intellectual Interest and Sentiment," and "Learning to Learn." The new objective system not only focuses on the imparting of professional knowledge and training of skills but also emphasizes guiding students to shape a scientific spirit of rigor and truth-seeking and a craftsman's character of excellence, stimulating their professional passion and sense of national identity, and cultivating their lifelong learning ability at both individual and group levels, ultimately achieving the comprehensive educational goal of integrating knowledge, ability, literacy, and values.

3.2 Reform of Teaching Content and Resources

After the reform, based on the course design experience of Zhou Fu'an (2020), the course team constructed dual-context teaching content and resources featuring both Access and SQL Server. This design aims to guide students to deepen their knowledge understanding, enhance application ability, while simultaneously cultivating the humanistic literacy and nurturing intellectual interest and sentiment through systematic comparative learning.

3.3 Reform of Teaching Methods and Tools

After the implementation of the teaching reform, adhering to the core concepts of "higher-order objective orientation, tiered teaching system," and closely integrating the characteristics of teaching content and resources, the course team systematically introduced the following three types of teaching methods and supporting tools:

3.3.1 Blended Teaching: Restructuring Classroom Structure and Process

Breaking through the previous teaching model dominated by offline instruction, various learning paths such as "purely online," "purely offline," "online-online," "online-offline," "offline-online," "offline-offline," and "online-offline-online" were

systematically designed based on the difficulty differences of knowledge points and ability points, reshaping the classroom structure and teaching process and effectively implementing the tiered teaching concept.

3.3.2 Problem-Centered Five Star Method of Instruction: Integrating Ability and Interest in Authentic Contexts

To support higher-order teaching objectives, the course implements the Five-Star Instructional Framework of "focusing on problems—activating prior knowledge—demonstrating new knowledge—applying new knowledge—integrating and mastering," carrying out project-based teaching within learning communities. This method not only effectively enhances students' comprehensive application ability in real-world situations but also subtly cultivates their professional interest and humanistic sentiment, achieving deep education.

3.3.3 Teaching Intervention Based on Mastery Learning Theory: Ensuring Every Student's Attainment

Guided by mastery learning theory, teaching adheres to the basic belief that "everyone can master," decomposing learning tasks into continuous, self-regulatable micro-tasks, helping each student steadily advance based on a solid grasp of the previous stage's content, thus achieving true ability accumulation.

3.4 Reform of Teaching Activities

This reform has systematically restructured the teaching activities of the course, with the specific details as follows:

3.4.1 Pre-reform: Framework of Offline "Prescribed Activities"

Before the reform, all teaching activities were offline "prescribed activities," where students needed to complete teacher-assigned tasks according to unified requirements within specified time frames. The main teaching activities included textbook-based offline preview, classroom lectures in classrooms, preset experiments in laboratories, and textbook-based homework, overall focusing on achieving the three foundational teaching objectives of "Basic Theory, Core Technology, Learning for Application."

3.4.2 Post-reform: Blended Online-Offline Framework of "Prescribed Activities + Optional Activities"

After the reform, teaching activities were designed using a blended online-offline framework of "Prescribed Activities + Optional Activities":

First, Pre-learning Activities (online Rain Classroom + offline textbook), focusing on the understanding of concepts, principles, and data.

Second, Classroom Activities (offline classroom), focusing on the application of principles, techniques, and data and the cultivation of scientific spirit.

Third, Laboratory Activities (offline laboratory), focusing on cultivating students' technical application ability and craftsman spirit.

Fourth, Extended Learning Activities (online Chaoxing Course + offline textbook), aiming to achieve theoretical sublimation, technical expansion, and enhancement of lifelong learning ability.

Fifth, Comprehensive Laboratory Activities (offline small groups + online network course), striving to stimulate students' professional interest in "using data to speak," career aspiration of "serving finance," collaborative sentiment of "helping each other," and pattern and mindset of "success need not be attributed to me."

Among the five types of activities, Pre-learning, Classroom Activities, and Laboratory Activities are prescribed tasks, requiring all students to complete them on time with quality; Comprehensive Laboratory Activities are open tasks, where students can independently determine the experiment topic and presentation form of results; Extended Learning Activities are optional open tasks, where students can decide whether to participate or not.

These activities do not exist in isolation. The course team, drawing on Professor Zheng Yongyan's (2019) idea of deep integration of teaching activities, organically integrated various activities:

First, for theoretical knowledge points, use the path of "online pre-learning → offline classroom activities" to achieve deep integration from knowledge understanding to deepening and internalization.

Second, for technical knowledge points, use the path of "classroom activities → laboratory activities" to achieve deep integration from method learning to practical application.

Through the above systematic design, the post-reform teaching activities, while ensuring the achievement of the three basic objectives of "Basic Theory, Core Technology, Learning for Application," further support the realization of the three higher-order objectives of "Humanistic Literacy," "Intellectual Interest and Sentiment," and "Learning to Learn."

3.5 Reform of Assessment and Feedback

This teaching reform completely abandoned the previous rigid assessment model of "homework + final exam," constructing a dynamic cycle mechanism of "assessment-feedback-improvement" that runs through the entire teaching process. This mechanism not only provides multiple, optional paths for grade improvement but also focuses on helping students accurately identify problems, adjust learning strategies, and continuously improve through immediate, diagnostic academic feedback and subsequent practical opportunities, thereby achieving step-by-step growth in academic ability.

4 Reform of the Teaching Model

To facilitate the smooth implementation of the teaching reform plan for "Database Technology and Application," the course team deconstructed and reshaped the original structured teaching framework, constructing a three-stage teaching model consisting of "Teacher-Led Stage, Cooperative Learning Stage, and Autonomous Learning Stage."

4.1 Teacher-Led Stage

The Teacher-Led Stage is the most crucial learning phase in the "Database Technology and Application" course, encompassing three main types of activities: pre-learning, classroom learning, and laboratory learning. While adhering to the student-centered approach, this stage is led by the teacher, focusing on the three basic objectives of "Basic Theory, Core Technology, Learning for Application" to lay a solid disciplinary foundation for students.

4.2 Cooperative Learning Stage

The Cooperative Learning Stage is the second learning phase of this course, with the core task being the Comprehensive Laboratory Activity. This activity is carried out in small group format, emphasizing teamwork, hence the name Cooperative Learning Stage. The Comprehensive Laboratory Activity includes steps such as cooperative topic selection, scheme design, experiment implementation, self-evaluation and peer evaluation of results, aiming to enhance learners' comprehensive application ability of database technology by solving complex problems in real-world contexts, while simultaneously cultivating their autonomous learning, group learning, organizational communication, and coordination skills, thereby cultivating their humanistic literacy and intellectual interest and sentiment.

4.2 Autonomous Learning Stage

Autonomous Learning is the third stage of this course, aiming to guide students from "passive acceptance" to "active construction," emphasizing "active learning" and "systematic learning," and deepening understanding through the cycle of "learning by doing" and "doing while learning." The specific task arrangement in this stage is as follows:

(1) Systematic Theoretical Learning: Relying on Super Star online course, systematically master core knowledge points, promote the integration and mastery of knowledge and the enhancement of theoretical level, laying a solid theoretical foundation for the final exam.

(2) Comprehensive Project Practice: Independently complete the design and implementation of a real database project, achieving breakthroughs in autonomous learning ability and comprehensive application ability in practice, and deeply cultivating humanistic literacy and technical sentiment in this process, while simultaneously accumulating skill foundation for the final exam.

(3) Result Exchange and Mutual Evaluation: Publish project results in the learning exchange group, enhance communication and collaboration skills within the group by receiving peer reviews and conducting mutual appraisal, achieving collective progress.

5 Teaching Reform Practice and Effectiveness

After finalizing the reform plan and teaching model, the course team carried out the teaching reform practice, achieving remarkable results.

5.1 Significant Grade Improvement

The reform practice was implemented in the Spring semester of 2025, targeting five parallel teaching classes, Finance 24-1 to Finance 24-5. Among them, Finance 24-1 to 24-4 were the experimental group, taught based on the reform plan,

while Finance 24-5 was the control group, continuing using the previous teaching method. After the course concluded, the course team uniformly organized the final exam across all five classes to comprehensively assess the achievement of both lower-order and higher-order objectives. Grade analysis showed that the average score of the experimental group (Finance 24-1 to 24-4) was significantly higher than that of the control group (Finance 24-5) at the 5% significance level, indicating a positive promoting effect of the teaching reform on student grades.

5.2 Significant Effectiveness of Comprehensive Application Experiment

Questionnaire surveys showed that most students (97.37% "very helpful" + 2.63% "somewhat helpful") believed that the Comprehensive Application Experiment was very helpful in enhancing their comprehensive application ability of database technology. Additionally, students generally believed that this activity played an important role in enhancing learning ability, communication and coordination skills, and cultivating humanistic literacy and intellectual interest and sentiment.

5.3 Significant Effectiveness in Critical Thinking and Innovation Ability Training

Questionnaire surveys indicated that most students (94.08% "very helpful" + 5.92% "somewhat helpful") highly approved of the critical thinking and innovation ability training activities, reflecting the significant effectiveness of the relevant teaching design in cultivating students' higher-order competency.

5.4 Significant Effectiveness of Humanistic Literacy Immersion

In the questionnaire survey, up to 97.37% of students (92.11% "very good" + 5.26% "relatively good") believed that during the course teaching process, their own scientific spirit and craftsman character were effectively honed, reflecting a high achievement level for the humanistic literacy immersion objective.

5.5 Significant Effectiveness in Cultivating Intellectual Interest and Sentiment

Questionnaire surveys showed that the vast majority of students (96.05% "very willing" + 2.63% "relatively willing") were willing to use database technology to solve practical problems in the digital economy. This result fully demonstrates that the course has achieved remarkable results in stimulating students' professional interest and service sentiment.

6 Conclusion

Aiming at the long-standing issue of insufficient cultivation of higher-order competency in previous teaching, the course team implemented systematic reform in the "Database Technology and Application" course with the core concepts of "higher-order objective orientation + tiered teaching system + flexible assessment mechanism," significantly improving this problem. This paper is one of the phased achievements of the Qilu University of Technology teaching research project "Research and Practice on Blended Online and Offline Teaching Reform of 'Database Technology and Application'." We extend our gratitude to Xu Changtao, Cao Feng, Guo Enqi, and other teachers and students for their support and contributions to this research.

References

[1] Liu Huan, Jin HongBin, Liu JunKai, et al. Teaching Reform of Anti-missile Early Warning Radar Detection Technology Course under the First Principles of Instruction [J]. Journal of Air & Space Early Warning Research, 2024, 38(04): 309-312.

[2] Lu KeQing, Wang Wen, Wang HuYing, Chen ZhanFeng. A Method for Constructing Curriculum Objectives Based on Meaningful Learning Taxonomy—Take "Engineering Graphics" as an Example [J]. Education Teaching Forum, 2020(13): 341-342.

[3] Zhou FuAn. Building Gold Courses Requires a Comprehensive Upgrade of the Understanding of Effective Teaching [J]. Beijing Education (Higher Education), 2020(01): 58-61.

[4] Zheng YongYan. A Study of the Learning Effects of a SPOC Blended English Academic Writing Course [J]. Foreign Language Education Technology, 2019(05): 50-55.

[5] Zheng YongYan. Blended Course Design and Student Academic Assessment. [EB/OL]. https://mooc1-1.chaoxing.com/mycourse/studentstudy?chapterId=341630563&courseId=214145583&clazzid=31092760&enc=8388395361686bee9daef9c669d3c9bd.