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Exploration of Project-based Teaching Mode for Business Major Courses in Private Universities Empowered by Digital Technology

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Abstract: *This paper takes the empowerment of digital technology in the teaching of business courses in private universities as the background, draws on the successful experience of cooperation between professional clusters and industry chains in the field of education, and explores a project-based teaching model based on digitalization and industry education integration. By constructing a teaching system centered on practical teaching, the concept of reform and innovation in practical teaching, the construction of project-based teaching models based on digital technology and network platforms, and the implementation of blended online and offline project-based teaching have been proposed. This model breaks the boundaries between knowledge learning, program design, and innovative practice in traditional teaching, strengthens the practical ability, innovation ability, and teamwork ability of business majors, and promotes the ability to solve complex business problems in a multidisciplinary context, providing theoretical basis and practical reference for the innovative development of business education in private universities.*

Keywords: *Digitalization; Integration of industry and education; Practical teaching; Project-based teaching*

In the wave of digitalization, the deep integration of digital technology and education is reshaping the educational ecosystem. Business programs at private universities bear the responsibility of cultivating applied talents, but traditional teaching models face challenges such as disconnection from industry needs and weak practical components. The rise of digital technology offers new solutions to these issues. Project-based teaching, centered on students, enhances their practical and innovative abilities through real projects. Leveraging digital technology and online platforms, it enables blended online-offline project-based teaching, promoting a shift from traditional teacher-led instruction to an inquiry-based learning model involving teachers, businesses, and students. By using methods like project-driven learning and case analysis, it stimulates students interest and creativity, fostering their ability to solve practical problems and develop teamwork skills.

1. Research status

In recent years, innovation in educational models driven by digital technology has become a focus of academic attention. Jin Xinquan et al. revealed the evolutionary mechanism of digital technology alienation on students with learning difficulties through dynamic thematic modeling, and emphasized the necessity of multimodal knowledge mapping and human-machine collaboration in academic governance [1], providing a theoretical framework for the risk prevention and control of digital education. Yang Wenzheng et al. further focus on the potential of precise service of generative artificial intelligence and propose the resource adaptation path under the perspective of supply and demand coupling [2]. However, his research mainly focuses on the basic education scenario, and the adaptability to the professional courses of higher education has not been deeply explored. Ku and Qiang et al. reconstruct the teaching paradigm of mathematics from the three levels of ontology, epistemology and methodology, and propose the classroom ecology of "digital empowerment and resonance coexistence" [3]. It confirms the general trend of digital transformation in subject teaching, but the practical path in the field of business still needs to be explored.

In the aspect of restructuring the teacher-student relationship, Li Tengzi pointed out that digital technology has broken the traditional subject-object binary structure and promoted the evolution of

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interactive scenes to the integration of virtual and real [4]. However, its interpretation of the collaborative mechanism between schools, enterprises and teachers and students in the context of industry-education integration is still insufficient. Jing Anlei et al. systematically argued the four-dimensional empowerment mechanism of digital technology in industry-education integration: "breadth-coordination-degree-depth" [5]. However, the effectiveness of the new business model has not been verified by specific curriculum models. Tang Dan et al. emphasize that the new business model needs to rely on industrial colleges and virtual teaching and research rooms to realize digital and intelligent transformation [6]. However, the innovation path under the resource constraints of private colleges and universities still needs specific schemes to support it. It is worth noting that Li Juan et al. implemented the mixed teaching mode in the data structure course [7], which provides a methodological reference for the reform of business education courses. However, there is still room for improvement in the depth of industry-education integration and interdisciplinary integration. This paper focuses on business programs at private universities, exploring a project-based teaching model that leverages digital technology to enhance industry-education integration. By establishing a teaching system centered on practical instruction, it proposes the concept of innovation and reform in practical teaching, the construction of project-based teaching models based on digital technology and online platforms, as well as the implementation of blended online-offline project-based teaching, providing a reference for the digital transformation of private universities.

2. Construction of the concept of innovation and reform in practical teaching

2.1. Establish the concept of "student-centered" education: basic premise

In the wave of digitalization, the drawbacks of traditional teaching models in business programs at private universities have become evident, with a disconnect from industry needs and weak practical skills. The "student-centered" philosophy is key to reversing this situation. It fundamentally transforms educational values, focusing on students individual needs and learning characteristics. In project-based teaching, tasks are assigned according to students strengths, stimulating their proactive exploration and enhancing their overall competence, laying the foundation for adapting to social development.

2.2. Strengthen the integration of industry and education to meet industrial needs: core objectives

Private universities business programs aim to cultivate applied talents, making the integration of industry and education inevitable. Inviting corporate experts to participate in teaching and introducing real projects allows students to practice under the guidance of both corporate mentors and on-campus teachers. Encouraging student participation in corporate practices and promoting cooperation among industry, academia, and research ensures that teaching closely aligns with industry needs.

2.3. Play the synergistic role of "online-offline" and "in-class-outside class": an important means

Digital technology expands teaching platforms. Online platforms offer vast resources to meet personalized learning needs; offline classrooms focus on face-to-face guidance. In-class instruction imparts knowledge and skills, while extracurricular practice reinforces application. For example, project-based learning, online self-study, offline discussions and presentations, and participation in corporate internships outside of class, all work together to enhance teaching effectiveness.

2.4. Cultivate innovation ability and team spirit: key task

The complex business environment requires business students to have the ability of innovation and collaboration. Project-based teaching sets up innovative tasks to stimulate students to break through the stereotype. Projects are promoted in a group form, students divide work and cooperate with each other, and teachers guide team building to improve the ability of collaboration and communication.

2.5. Relying on digital technology to improve the modernization of teaching methods: an important support

Digital technology helps practical teaching. Online platforms and management systems are used to realize digital teaching management, and personalized teaching is realized through data analysis to improve the quality and efficiency of teaching.

ISSN 2663-8169 Vol. 7, Issue 3: 1-6, DOI: 10.25236/IJNDE.2025.070301

3. Construction of project-based teaching mode based on digital technology and network platform

Focusing on the core concepts of "moral education" and "practical talent cultivation," adhering to the OBE philosophy, and meeting the demands of new business education, the curriculum for business majors, such as the course "Data Structures and Algorithms" in the Big Data Management and Application program, has reformed its teaching model from five aspects: creating a "living classroom" to align with industry needs; putting students at the center to enhance practical innovation; closely integrating theory with practice; promoting interdisciplinary integration to broaden perspectives; deepening industry-education collaboration to achieve collaborative talent development. A project-based teaching model based on digital technology and online platforms has been established, as shown in Figure 1.

In practical teaching, the course design phase involves teachers selecting real-world industry cases closely aligned with course knowledge to guide students in analyzing cases, building models, and designing solutions. This integrates professional talent development plans to strengthen both foundational and innovative aspects. Professional project practices deeply integrate real cases, emphasizing "two aspects and one degree," guided by joint school-enterprise efforts. Students form teams to solve complex business problems, enhancing various skills and qualities. Comprehensive project practices involve students participating in interdisciplinary corporate projects, jointly guided by schools and enterprises. Leveraging digital technology platforms, students from different majors collaborate to address complex challenges in the digital domain, improving their overall capabilities. The work presentation and summary exchange establish a self-assessment model for "products," with dual supervision from school and enterprise mentors. This forms a data circulation ecosystem mechanism, relying on an online system to build a cooperative framework and implement a mutual evaluation and examination system, deepening school-enterprise cooperation. This practical teaching model follows the laws of capability progression and comprehensive development, achieving a leap in students abilities from basic to comprehensive, from simple application to deep integration, and from practical operation to innovative thinking and problem-solving.

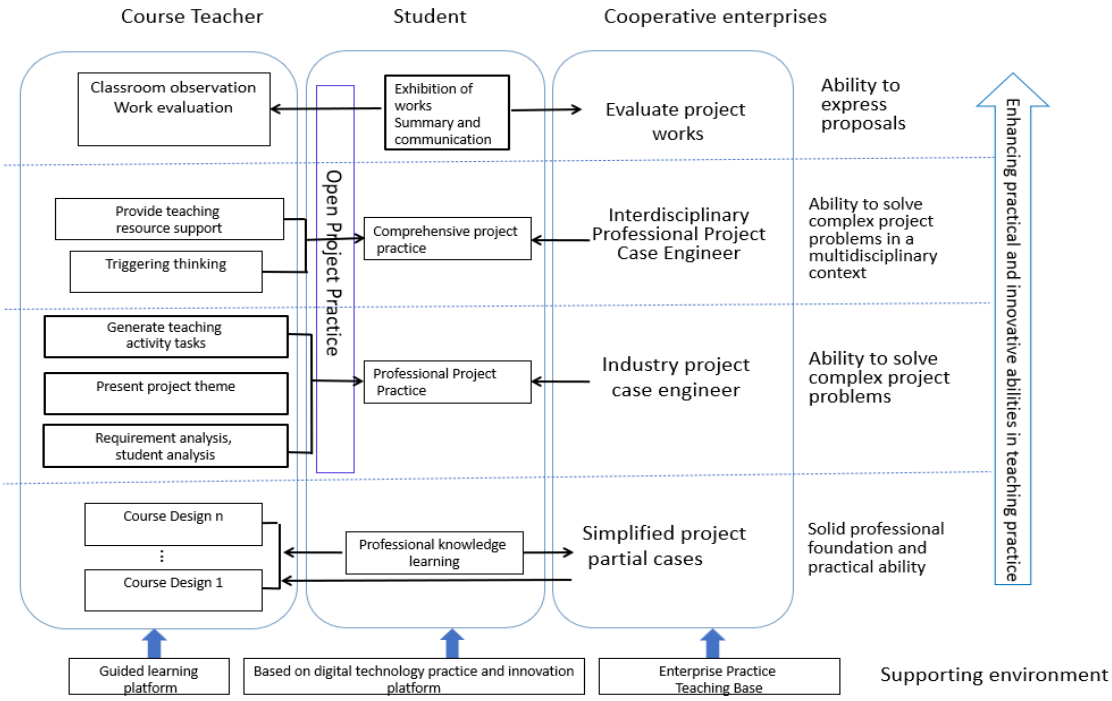

Figure 1: Project based teaching mode based on digital technology and network platform

4. Implementation of project-based teaching with a mixture of online and offline teaching

4.1. Analysis of the implementation status of data structure and algorithm course practice

Data structure and algorithm course is the core course of big data and application major, which requires high algorithm thinking and programming practice ability of students, but students often feel

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tired in learning and find it difficult to find an entry point in practice, resulting in accumulated frustration and affecting learning effect. The main reasons are as follows:

(1) Interdisciplinary integration teaching is difficult

The major of big data involves many fields such as data science, information technology and business management. Interdisciplinary teaching requires close collaboration of the teaching team to overcome the barriers of knowledge integration and ensure the quality of teaching.

(2) Lack of real cases in practice

Most of the practical projects in the school are virtualized, and students lack the opportunity to participate in large-scale data processing. It is necessary to deepen the cooperation between schools and enterprises, integrate real projects into the curriculum, and improve practical experience.

(3) Single practice mode

Traditional practical teaching is limited to the classroom, with a monotonous form and lack of diversity and in-depth exploration. There is a lack of extracurricular resources and limited interaction among students, which makes it difficult to stimulate innovative thinking and collaborative ability.

(4) The evaluation and feedback mechanism is not perfect

The evaluation focuses on reprogramming assignments and ignores algorithm design and efficiency optimization; the feedback is not timely or general, which makes it difficult to help students improve accurately and limits the ability improvement.

4.2. Implementation process

The implementation of blended online and offline project-based teaching is supported by digital technology. By integrating online resources with offline practices, it forms a closed-loop teaching model of "pre-class guidance—in-class exploration—post-class extension." The specific implementation process generally includes six stages: "resource integration—task-driven—classroom inquiry—practical collaboration—cloud feedback—final evaluation by enterprises," as shown in Figure 2.

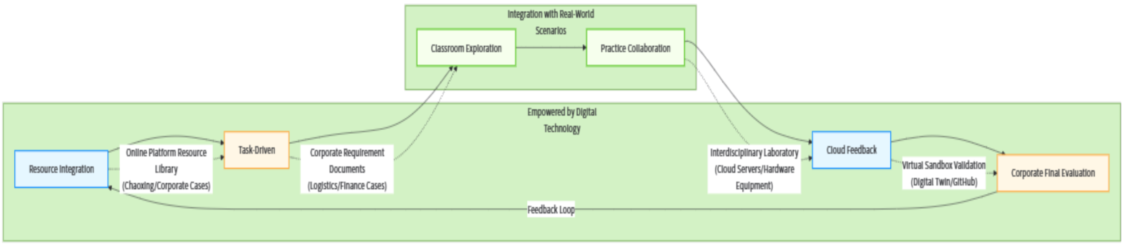

Figure 2: The implementation process of online and offline hybrid project teaching

(1) Online resource integration and task-driven

Digital platform construction: Relying on online teaching platforms (such as Chaoxing, Yuclassroom, etc.) to build a course resource library, integrating theoretical courseware, case library, algorithm visualization tools, enterprise practical project documents, etc., to form modular learning resources.

Task release and self-study: Teachers release project task book and study guide in advance, students learn relevant theories through online platform, complete basic knowledge test, and conduct initial algorithm training through virtual simulation tools (such as LeetCode, etc.).

Online intervention of enterprise mentors: Inviting enterprise mentors to explain industry cases through online meetings or recorded broadcasts, clarify the background and requirements of projects, and enhance students understanding of practical application scenarios.

(2) Deepening offline classroom and practical collaboration

Case analysis and scheme design: offline classroom focuses on the in-depth analysis of real cases. Students brainstorm in groups and design algorithm schemes using whiteboard, flowchart tools and other tools. Teachers guide students to break through thinking bottlenecks through "problem chain".

Group Practice and Multi-Role Simulation: Adopt an "enterprise-style" team division model, such as setting up roles like project manager, algorithm engineer, data analyst, etc., to simulate real corporate workflows. Offline labs provide computational support (such as Alibaba Cloud, Huawei Cloud resources), allowing students to complete code writing, performance testing, and optimization.

Interdisciplinary collaborative workshop: joint practice with students from finance, logistics and other majors to solve complex problems across fields (such as the application of dynamic programming algorithm in supply chain path optimization) through offline workshops to promote the integration of multidisciplinary knowledge.

(3) Online and offline linkage feedback and iterative optimization

Real-time data monitoring and dynamic adjustment: Using the learning situation analysis function of the online platform (such as learning progress, code submission quality, test results, etc.), teachers can track students practical progress in real time, and carry out online live answering or push customized learning resources for common problems.

Cloud display of phased results: Each group shares code and documents through online collaboration tools (such as GitHub, Tencent Document) to report in the cloud at the phased stage, accept joint evaluation by enterprise mentors and teachers, and iterate and optimize the plan according to feedback.

Virtual sandbox and real scene docking: Through digital twin technology to build a virtual business environment (such as simulated e-commerce user behavior data set), students can verify the algorithm in the virtual scene, and finally migrate the optimization scheme to the real enterprise system for stress test.

(4) Diverse evaluation and ability closed loop

Process evaluation: The online platform records data such as students independent learning, code submission and collaborative discussion, accounting for 40% of the total evaluation score; offline classroom evaluates algorithm design and team collaboration ability through defense and practical assessment, accounting for 40%.

Final evaluation by enterprises: The final evaluation is conducted by enterprise mentors based on the practicality, innovation and commercial value of the project results, accounting for 20%.

Feedback loop mechanism: Use AI to analyze learning data to generate personalized learning reports, push weak links for intensive training content (such as dynamic planning special exercises), and form a closed loop of "learning-practice-feedback-improvement" for ability improvement.

5. Effect evaluation

5.1. Effectively improve students comprehensive ability

Students' ability to apply data structures and algorithms in real projects has significantly improved. In the "Logistics Distribution Path Optimization" project, 85% of the teams were able to independently design and implement multi-objective optimization algorithms, resulting in a 30% increase in code efficiency compared to traditional teaching methods. In interdisciplinary collaboration projects, students integrate business knowledge with technical tools such as Python to form comprehensive solutions. A survey shows that 90% of students believe that interdisciplinary collaboration enhances the global perspective of problem analysis. Through stress testing in real enterprise scenarios (such as high concurrency data processing), students' innovative thinking and resilience to complex problems have significantly improved, with an average reduction of 40% in project iteration optimization times.

5.2. Improve teaching quality and effectiveness

Evaluating teaching effectiveness based on Kirkpatrick's four level model [8] :

Reaction layer: Student satisfaction (93% practicality, 88% school enterprise collaboration) was collected through the Wenjuanxing platform (120 questionnaires were distributed, with an effective questionnaire response rate of 95%), Cronbach's $\alpha=0.89$，Good reliability. Learning layer: Quantitative evidence is formed by the frequency of online resource access (2.3-fold growth) and the quality of code submission (45% improvement in GitHub automatic rating system's excellent rate). Behavioral layer:

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Feedback from enterprise mentors shows that the problem-solving time for students has been reduced by 40% (SD=12.3), which meets the agile development capability standards. Achievement level: Applied for 3 research projects, obtained 2 copyrights, published 4 related papers, reflecting social benefits.

6. Conclusion

This study innovatively integrates online and offline resources with real industrial chain scenarios by constructing a project-based teaching model empowered by digital technology for industry education integration. By introducing real projects and cases, strengthening the integration of industry and education, the transformation from traditional teaching mode to student-centered practical teaching mode has been achieved. Teaching practice has shown that this model significantly enhances students' interdisciplinary practical ability and innovative thinking through the school enterprise collaborative education mechanism and multi-dimensional ability cultivation system, forming a virtuous cycle ecology of "teaching practice industry", and providing reference for the digital transformation of private universities. Future research can focus on personalized learning path generation assisted by artificial intelligence, immersive teaching practices in metaverse scenarios, and sustainable development mechanisms of industry education integration ecosystems to further promote innovative development in business education.

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