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A Review of the Blended Teaching Reform in Nutritional Physiology Based on the "Project-Driven + Competition-Empowered" Model Under the OBE Concept

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Abstract: ***Nutritional physiology, as a core course in the fields of food science and nutrition, serves as a crucial bridge connecting basic physiology with clinical nutrition practice. However, traditional teaching models have long faced practical challenges such as lagging content updates, monotonous teaching methods, disconnection between theory and practice, one-sided assessment and evaluation, and insufficient integration of ideological and political education. These issues make it difficult to meet the demands of the new era for cultivating interdisciplinary and innovative nutritional talents. To address these teaching dilemmas, this study, fundamentally guided by the Outcome-based Education (OBE) concept, systematically constructs a blended teaching model characterized by "Project-Driven + Competition-Empowered" learning. This model clarifies course competency objectives through backward design, uses progressive real-world projects as the driving mainline, leverages disciplinary competitions as the high-level outcome output, and relies on online-offline blended teaching environments to provide comprehensive support throughout the process. This article systematically reviews relevant literature on teaching reform, arguing for the scientific validity and feasibility of this model from three aspects: theoretical connotation, practical pathways, and implementation framework. Practice indicates that this model can effectively stimulate students' intrinsic learning motivation, significantly enhance their comprehensive abilities such as knowledge integration, practical innovation, and teamwork, thereby providing a referable paradigm for applied course reform.***

Keywords: OBE Concept, Project-Driven, Disciplinary Competition, Blended Teaching, Nutritional Physiology, Teaching Reform.

1. Introduction

Against the backdrop of advancing the construction of "Emerging Engineering Education" and "Emerging Medical Education" and the implementation of the "Healthy China" strategy, higher education curriculum teaching is undergoing a profound transformation from "teaching-centered" to "learning-centered." The Outcome-based Education (OBE) concept, which emphasizes designing courses and teaching backwards based on the final competencies students should acquire, has become a core philosophy guiding teaching reforms in fields such as engineering, medicine, and even food and nutrition [1]. Nutritional physiology, as a key course bridging fundamental theory and nutritional practice, sees its teaching quality directly impacting the cultivation of innovative talents in fields like food science and preventive medicine. However, this course commonly faces challenges such as outdated content, monotonous teaching methods, and a disconnect between theory and practice [2]. Traditional didactic teaching is inadequate for fostering the comprehensive literacy required to solve complex nutritional and health problems.

To resolve these dilemmas, systematic reform integrating various advanced teaching models is imperative. Project-Driven Learning (PBL) promotes knowledge integration and ability transfer through authentic tasks [3]; disciplinary competitions serve as high-level practical platforms, playing a significant role in stimulating innovative potential and honing comprehensive qualities [4]; blended teaching provides a flexible, interactive supportive environment for the aforementioned activities [5]. In light of this, this study proposes constructing a "Project-Driven + Competition-Empowered" blended teaching model for nutritional physiology under the OBE framework. It aims to achieve the organic unity of knowledge, ability, and quality cultivation through systematic instructional design, providing theoretical reference and practical pathways for similar course reforms.

2. Theoretical Foundation and Literature Review

2.1 The Connotation of the OBE Educational Concept and Its Leading Role in Teaching Reform

Since its explicit proposal by Spady and others in the 1990s, the OBE concept has become the core philosophy of international engineering education accreditation (e.g., the Washington Accord) and has gradually permeated multiple disciplines including medicine and sciences. Its core connotation can be summarized as "one center, three orientations, four principles": that is, student-centered; outcome-oriented, goal-oriented, demand-oriented; and adhering to the four principles of "Clarity of Focus, Backward Design, High Expectations, Expanded Opportunity" [1]. This means the primary task of instructional design and implementation is to clarify "what learning outcomes students should ultimately achieve," then work backwards to deduce the course content, teaching strategies, and evaluation standards needed to achieve these outcomes, and provide all students with sufficient time and opportunities to attain

high-standard learning goals.

In higher education teaching reform practices, the introduction of the OBE concept often leads to systemic reshaping. For instance, Zhang Zhiqiang, in reforming the "Food Packaging" course, strictly followed OBE backward design logic. First, aligning with industry needs and graduation requirements, he clarified core competency goals for students in solving complex packaging engineering problems. Subsequently, the course content was restructured into five modules: market research, material selection, process design, innovative practice, and professional literacy. Enterprise authentic cases were used throughout for project-based teaching, ultimately constructing a three-dimensional evaluation system of "process + practice + comprehensive," achieving significant teaching effectiveness [6]. Zhu Zhenzhu integrated the OBE concept into the "Analytical Chemistry" course by restructuring content to closely support analytical competency requirements in the food safety field and building a visual interactive teaching platform, enhancing teaching quality and strengthening students' professional identity [7]. In medical education, Tan Yingying et al. constructed a new teaching system for Medical Microbiology characterized as "one core, two wings, three integrations, four drives" based on the OBE concept, effectively integrating the cultivation of knowledge, abilities, and biosafety literacy, providing a model for course reform under the Emerging Medical Education context [8]. These successful cases collectively indicate that the OBE concept is not only a guideline for macro curriculum design but also a powerful theoretical tool guiding precise reform and quality-efficiency improvement for individual courses.

Li Ning et al. further point out that the OBE concept, "guided by the generation of academic outcomes as learning goals, student creativity development as the foundation, employing reverse innovative thinking learning methods," naturally aligns with the cultivation of applied talents [1]. Implementing the OBE concept in the Nutritional Physiology course means shifting the starting point of teaching activities from "what the teacher teaches" to "what the student can do"—that is, focusing on cultivating core professional competencies such as conducting individual and group nutritional assessments, designing dietary intervention plans, and carrying out nutrition education and health promotion. This forms a closed loop between course teaching, professional training objectives, and societal talent demands.

2.2 Innovative Practices of Project-Driven Teaching in Food and Nutrition Courses

Project-Driven Teaching is a key instructional strategy for achieving the "ability outcome" goals within the OBE concept. It introduces one or more driving questions or project tasks, allowing students to actively construct knowledge, design solutions, and explore practice in authentic or simulated contexts through group collaboration, ultimately producing concrete outcomes. This method transforms learning from passive knowledge reception to active problem-solving, greatly promoting the cultivation of higher-order thinking and practical abilities.

Innovative practices of Project-Driven Teaching are increasingly abundant in food science and engineering courses. For example, Wu Zhangfei et al., in the "Fruit and Vegetable Storage and Processing" course, innovatively combined project-driven learning with the BOPPPS model, guiding students to complete full-process projects from research to product evaluation, effectively enhancing students' autonomous learning and engineering practice abilities [9]. Zuo Tingting et al., in the "Introduction to Green Food" course, adopted a "development team-style" project-based teaching method, simulating enterprise product development processes. This not only deepened students' systematic understanding of the industry chain but also cultivated their teamwork and innovative practice abilities [3]. These experiences provide direct reference for designing progressive projects centered on "Nutritional Assessment - Intervention Design - Health Promotion" in Nutritional Physiology.

2.3 Disciplinary Competitions as a High-Level Platform for Cultivating and Validating Innovative Talents' Abilities

Disciplinary competitions are an important component of the practical teaching system in higher education. Their essence is a comprehensive test and tempering of students' ability to synthesize and apply knowledge, innovative thinking, practical skills, and psychological resilience in environments approximating reality or presenting high challenges. In recent years, the role of disciplinary competitions in cultivating innovative talents has received increasing attention, regarded as an important engine for promoting teaching reform and empowering student development.

Research by Yu Yunyun and Tao Ye reveals that competition award winners generally possess solid professional foundations, outstanding innovative thinking, excellent teamwork, and stress resilience [10]. Wang Zhengsong et al.'s practice goes further. They constructed a "disciplinary competition-driven" full-chain training model in the automation major, integrating competition requirements backwards into courses and project practices, achieving a significant leap in talent cultivation quality [4]. Aligning competitions such as the National Undergraduate Life Science Competition or Nutrition and Health Creativity Competitions with the Nutritional Physiology course not only provides an authoritative platform for showcasing and validating students' excellent project outcomes but also, through clear competition goals, stimulates students' intrinsic motivation for excellence, forming a virtuous cycle of "learning-practice-competition-reflection." It is necessary to avoid the "separation of competition and teaching" and establish mechanisms for deep integration [11].

2.4 Blended Teaching Model Provides a Supportive Ecosystem for Integrating Multiple Pedagogies

Blended teaching is not merely a mechanical combination of online and offline instruction. Rather, it is a new teaching paradigm that redesigns teaching content, resources, activities, and environments to organically combine the flexibility and autonomy of online learning with the deep interaction of face-to-face teaching, aiming to achieve optimal learning outcomes. It provides an ideal implementation platform and

resource guarantee for complex teaching activities such as project-driven learning and competition preparation.

The practice of Fan Xingjun et al. in a preventive medicine course demonstrates that an online-offline blended model outperforms traditional teaching in improving students' academic performance, autonomous learning motivation, and self-efficacy [5]. For the "Project-Driven + Competition-Empowered" model, the online platform can serve as a project resource library, collaborative space, and process management tool; the offline classroom focuses on high-level interactive sessions such as experimental operations, in-depth discussions, and project presentations. Li Qian and Li Ning, when optimizing teaching methods for Nutritional Physiology, also emphasized the importance of enriching teaching methods and assessment approaches [2]. Blended teaching is precisely the modern pathway to achieve this goal.

3. Core Construction of the "Project-Driven + Competition-Empowered" Blended Teaching Model

3.1 Three-Level Competency Goal System Based on OBE Backward Design

First, aligning with professional graduation requirements and occupational standards, the overall course objective is defined as: cultivating students' ability to systematically apply nutritional physiology knowledge, scientifically assess and intervene in nutritional problems, and possess innovative thinking and teamwork skills. Subsequently, this overall objective is decomposed into specific competency modules such as "Nutritional Assessment," "Mechanism Application," "Intervention Design," and "Health Education," with measurable behavioral indicators set. Finally, these competency indicators are concretized into evaluation criteria for each project task sheet and the targeted competitions, ensuring every step of teaching activity precisely targets the intended learning outcomes.

3.2 Progressive Project Chain Design Throughout the Course

Adhering to the principles of "authenticity, comprehensiveness, and progression," a project chain running through the entire course is designed. Project One (Basic) focuses on "Dietary Survey and Assessment for University Students," training basic data collection and analysis skills. Project Two (Comprehensive) requires completing a "Nutritional Intervention Plan Design for a Specific Population," promoting knowledge integration and comprehensive application. Project Three (Innovative) involves planning and implementing a "Community Nutrition and Health Promotion Activity," comprehensively honing innovation, execution, and social collaboration abilities. This design resonates with the project-driven BOPPPS model used by Wu Zhangfei et al. in "Fruit and Vegetable Storage and Processing" [9] and the "development team-style" project-based teaching implemented by Zuo Tingting et al. in "Introduction to Green Food" [3], all emphasizing driving ability internalization through a complete practical process. Project tasks are synchronized with theoretical teaching progress, ensuring theoretical learning can immediately support and be applied to practical exploration.

3.3 High-Level Empowering Platform Driven and Validated by Disciplinary Competitions

Disciplinary competitions are the key hub connecting course teaching with innovative practice, possessing multiple functions of "promoting learning, innovation, and validating effectiveness through competition." On one hand, competitions serve as a powerful external driving force and outcome outlet, effectively stimulating students' sense of honor and intrinsic motivation. Clear national or provincial competition goals (e.g., National Dietitian Skills Competition, Henan Provincial University Student Nutrition and Health Creativity Competition, etc.) motivate students to refine their course project outcomes to higher standards, pushing learning from "task completion" to "pursuit of excellence." Wang Zhengsong et al.'s "disciplinary competition-driven" model in automation confirms that systematically integrating competition requirements backwards into courses and project practices can significantly enhance students' innovative application abilities and talent cultivation quality [4]. On the other hand, competitions also serve as authoritative validation of students' comprehensive abilities. Research by Yu Yunyun and Tao Ye indicates that competition award winners generally exhibit common traits such as solid professional knowledge, outstanding innovative thinking, excellent teamwork, and stress resilience [10]. By participating, students' project outcomes are tested on a broader platform, and their abilities to solve complex problems, communicate, express, and adapt under pressure receive genuine feedback and improvement. To avoid "separation of competition and teaching," a "course-competition integration" mechanism should be established, integrating competition guidance into teaching and incorporating competition awards into the course overall evaluation as a form of "value-added assessment," forming a virtuous closed loop of "learning-practice-competition-reflection" [11].

3.4 "Online-Offline" Blended Supportive Teaching Implementation Ecosystem

To support project learning and competition preparation, a deeply integrated blended teaching environment needs to be constructed. Online, smart teaching platforms are utilized to build resources like micro-lectures, virtual experiments, and case libraries, and serve as spaces for project collaboration, process management, and asynchronous discussion. Offline, classrooms are transformed into project workshops and case study halls, focusing on conducting depth-interaction activities such as experimental operations, solution argumentation, and simulation roadshows. The practice of Fan Xingjun et al. in preventive medicine courses indicates that such blended models can effectively enhance students' autonomous learning ability and academic performance [5]. Li Qian and Li Ning, when optimizing nutritional physiology teaching, also emphasized the necessity of innovating teaching methods and enriching assessment approaches [2]; blended teaching is precisely the modern path to achieve this goal.

3.5 Value-Oriented Education Integrating Ideological and Political Elements and a Diverse Comprehensive

Evaluation System

Elements of ideological and political education, such as the "Healthy China" strategy, social responsibility, and scientific spirit, are organically integrated into various stages of the projects to achieve value cultivation. This follows a path similar to that advocated for ideological and political integration in the "Food Safety" course, aiming for a subtle, nurturing effect [12]. Simultaneously, a four-in-one diversified evaluation system is established: "Process Evaluation (Learning Participation, 30%) + Project Outcome Evaluation (Core Competencies, 40%) + Competition Value-Added Evaluation (Excellence Orientation, 10%) + Comprehensive Evaluation (Knowledge Integration, 20%)." This system comprehensively assesses students' knowledge, abilities, and qualities, particularly emphasizing the incentive for practical innovation ability and outstanding outcomes through project evaluation and competition bonuses, fundamentally changing the one-sided nature of traditional assessment.

4. Summary

Under the era background of a new round of technological revolution, industrial transformation, and the deepening advancement of the Healthy China strategy, teaching reform for the Nutritional Physiology course is imperative. The "Project-Driven + Competition-Empowered" teaching model, constructed under the overarching guidance of the OBE concept by organically integrating the practicality of project-driven pedagogy, the challenge of disciplinary competitions, and the modernity of blended teaching, represents an important direction in current higher education teaching reform. It is not merely a technical adjustment of teaching content and methods but a profound transformation of educational philosophy, teacher-student roles, and teaching evaluation.

Through systematic design characterized by "determining input by output, driving learning by projects, promoting excellence by competition, and strengthening support by blending," this model holds the potential to fundamentally invigorate the Nutritional Physiology course, making the learning process one where students actively construct knowledge, develop abilities, and shape values. Although numerous challenges will be faced during implementation, as long as the principles of student-centeredness and outcome-orientation are adhered to with continuous improvement, this model is bound to contribute significant educational wisdom and practical solutions for cultivating outstanding nutritional talents with solid theoretical foundations, outstanding practical abilities, strong innovative awareness, and a high sense of social responsibility. Future research could further focus on evaluating the specific implementation effects of this model across different institutions and student groups, as well as process data mining based on learning analytics technology, to continuously optimize the model and promote its maturity and widespread adoption.

Projects

Exploration and Practice of Ideological and Political Education Construction under the Background of "First-Class Courses" - Taking "Food Nutrition" as an Example (2023XJGLX121); Henan Agricultural University Model Course - Food Nutrition (2023KC61); Henan Province's Second Batch of First-Class Undergraduate Courses: Food Nutrition.

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