

Outcome-Oriented and Dual-Wheel-Driven: Reforming Food Nutrition Education through “Project + Competition” under the OBE Concept

Ning Li, Yan Peng, Lianjun Song, Xiaoping Gao, Qian Li, Peijun Zhao,
Xianqing Huang, Tiange Li*

College of Food Science and Technology, Henan Agricultural University, Zhengzhou 450002, Henan, China

*Correspondence Author, litiange@henau.edu.cn

Abstract: *Current pedagogical practices in food nutrition education often suffer from a disconnect between theoretical knowledge delivery and practical skill development, low student engagement, and rigid assessment methods. To address these challenges, this study proposes a blended teaching reform model guided by the Outcome-Based Education (OBE) framework, integrating a “project-driven” and “competition-empowered” dual approach. The model incorporates practical task modules such as nutrition consultation and recipe development within a “online self-directed learning + offline collaborative inquiry” instructional pathway. Furthermore, it systematically integrates academic competitions, including the National Undergraduate Life Sciences Competition, into the curriculum to establish a closed-loop teaching system characterized by “project-guided learning, competition-enhanced learning, and outcome-verified learning.” This paper elaborates on the structural framework and implementation strategies of the model, covering the redefinition of course objectives, restructuring of content, blended teaching design, and dynamic assessment mechanisms. The proposed approach offers a student-centered, competency-oriented, and practically actionable reform perspective for food nutrition and related applied disciplines, with potential implications for enhancing educational outcomes and learner readiness in professional settings.*

Keywords: Outcome-Based Education (OBE), Project-driven learning, Competition-integrated learning, Blended teaching, Food and nutrition education.

1. Introduction

“Food Nutrition” is a core course in the undergraduate curricula of food science and engineering programs across Chinese universities, occupying a pivotal position within food-related disciplines. The Food Science and Engineering program at Ocean University of China has successfully passed international engineering education accreditation. In line with the principles of Outcome-Based Education (OBE), the program’s pedagogical design is oriented toward learning outcomes, tailored to students’ individual needs, and centered on student development. It emphasizes providing personalized instruction and establishing a scientific, effective evaluation system for learning outcomes to ensure continuous improvement in teaching quality [1–2]. With the proliferation of online teaching platforms, the potential of blended teaching-integrating online and offline modes-has grown substantially. This model not only facilitates the systematic use of online resources via learning platforms but also incorporates interactive activities in physical classrooms, thereby enhancing engagement and stimulating students’ interest in learning [3].

2. Current Situation and Problems in Teaching the ‘Food Nutrition’ Course

2.1 Predominance of Lecture-based Teaching, Resulting in Low Student Engagement

The traditional Food Nutrition course has long followed a teacher-centered, lecture-based instructional model, which prioritizes knowledge transmission over skill development. In this “teacher speaks, students listen” framework, learners often remain passive recipients, with limited classroom

interaction inhibiting effective participation and deep cognitive engagement. This one-way delivery approach not only diminishes student agency but also weakens sustained interest in the subject and the capacity for self-directed knowledge construction. Moreover, prolonged passive learning tends to result in divided attention, superficial understanding, and fragmented retention of content-factors that hinder the cultivation of critical thinking, autonomous learning, and innovative mindset. Hence, there is an urgent need to shift from a teacher-centered to a learner-centered pedagogy, enhancing student engagement and interactive processes to improve both learning outcomes and holistic competence.

2.2 Inadequate Practical Components, Hindering the Development of Key Competencies

The field of food nutrition is evolving rapidly, with new research findings and nutritional concepts continually emerging. However, traditional teaching methods often rely on fixed textbooks and content, making it challenging to update materials promptly or reflect the latest scientific advances, emerging nutritional perspectives, and consumption trends. Furthermore, there is limited coverage in conventional courses of current topical issues-such as functional foods, nutrition in chronic disease prevention, and dietary trends-which fails to satisfy students’ interest in socially relevant knowledge within the discipline. As a highly practice-oriented field, food nutrition requires students to acquire relevant competencies through hands-on experience. Yet traditional instructional approaches often overlook practical components. In course design, students seldom have opportunities to engage in activities such as nutritional assessment, dietary planning, food preparation, or analysis, hindering the translation of theoretical knowledge into applied

skills. Consequently, graduates may feel inadequately prepared for real-world work demands, leading to a prolonged adaptation phase upon entering the profession [4].

2.3 Over-reliance on Summative Assessment, Lacking Formative Feedback Mechanisms

The traditional evaluation system for the “Food Nutrition” course has notable limitations. It primarily relies on final written examinations as the key criterion for assessing student performance. This single-mode assessment approach suffers from several constraints: while it can partially test students’ retention of theoretical knowledge, it fails to provide a comprehensive or objective reflection of their engagement throughout the learning process, their developmental progress in practical competencies, and their ability to translate theoretical understanding into real-world application. Fundamentally, this form of assessment contradicts the diversified, process-oriented, and developmental evaluation principles emphasized by Outcome-Based Education (OBE), and thus falls short of meeting the demands of contemporary higher education in cultivating students’ holistic capabilities.

3. The OBE-Driven Reform Framework: Integrating Project-Based Learning and Competition Empowerment

3.1 Reconstructing Course Objectives under OBE Principles

The training objectives of the Food Science and Engineering major at Ocean University of China focus on cultivating well-rounded and innovative interdisciplinary professionals specialized in the comprehensive utilization of marine biological resources. Graduates are expected to acquire twelve core competencies, including engineering knowledge, problem analysis, design/development of solutions, problem-solving, use of modern tools, communication and collaboration, and lifelong learning [5]. The cultivation of these competencies must be supported by corresponding instructional components. The “Food Nutrition” course contributes to several key graduation requirement indicators, encompassing design/development capabilities, problem-solving skills, engineering and social awareness, as well as professional ethics and norms. Accordingly, the course objectives for “Food Nutrition” are designed in a reverse manner based on these intended learning outcomes.

Course Objective 1:

Students will be able to independently design and implement standardized dietary survey plans, master techniques for physical measurement and biochemical indicator evaluation, utilize nutrition software to perform dietary data analysis, write professional assessment reports, and develop scientific dietary plans tailored to the needs of different populations.

Course Objective 2:

Students will be able to conduct needs analysis and program design for school-based nutrition education activities, master the skills required to develop health education materials, demonstrate the ability to organize, coordinate, and evaluate

project implementation, and design differentiated nutritional intervention strategies for diverse target groups.

Course Objective 3:

Students will be able to collaboratively complete topic selection and program design for competition projects within teams, master the norms for writing research reports and creating academic posters/presentations, demonstrate professional communication skills in on-site defense and results presentation, and translate competition outcomes into practical applications.

Course Objective 4:

Students will be able to critically analyze controversial issues in nutrition, demonstrate innovative thinking and engineering perspectives in product development, understand ethical norms in food engineering, exhibit awareness of risk assessment and regulatory compliance, cultivate habits of continuous learning, and track domestic and international nutrition policies and research trends.

3.2 Designing Project-Driven Learning Tasks

The design of project-based tasks should align closely with real-world contexts, balancing both challenge and feasibility. Based on the course content, the following progressive project phases can be implemented:

Project Phase	Task Content	Key Competencies Developed
Phase I	Individual Dietary Survey and Nutrition Assessment	Data Collection & Analytical Skills
Phase II	Group-Based Recipe Design and Optimization	Team Collaboration & Innovative Design
Phase III	Community Nutrition Education Activity Planning and Implementation	Communication Skills & Organizational Coordination
Phase IV	Competition Project Submission and Results Refinement	Research Competency & Integrated Presentation Skills

3.3 Developing Competition-Embedded Learning Mechanisms

This mechanism aims to establish a virtuous cycle of “competition-promoted learning and teaching” through the systematic integration of academic competitions. The specific construction approach is as follows:

1) Curriculum-Competition Integration

Integrate competition content into course teaching to achieve “competition-oriented curriculum design.” By analyzing and deconstructing the requirements of leading academic competitions such as the National Undergraduate Life Science Competition and the Nutrition and Health Innovation Contest, they are translated into actionable course teaching modules. This enables students to naturally develop competition-related competencies while completing course projects.

2) Tiered Incentive System

Establish a hierarchical participation pathway suited to

students' diverse competency levels, forming a complete progression from departmental selection to national-level competition. Incentive policies, such as course credit substitution and special bonus points, are implemented to encourage active participation. A dual-mentorship system is also established, pairing students with both course instructors and competition-specialist advisors for comprehensive guidance.

3) Outcome Translation Mechanism

Systematically convert competition outcomes into teaching resources, creating a closed-loop process of "competition–feedback–improvement." Outstanding competition entries are developed into teaching cases and incorporated into the course resource library. Identified competency gaps observed during competitions serve as key inputs for curriculum refinement. Award-winning students receive opportunities for further development and advancement.

4) Resource Support System

Establish a comprehensive support system including dedicated funding, open laboratory platforms, and competition workshops. A course-competition steering committee is formed to oversee strategic planning and resource coordination, ensuring the effective implementation of the competition empowerment mechanism.

The establishment of this mechanism not only stimulates students' learning motivation and innovative potential but also, through the competition as a "practical platform," genuinely assesses the attainment of course objectives. This aligns with the OBE principle of being "outcome-oriented" and committed to "continuous improvement."

4. Development of a Blended Online-Offline Teaching Model

Against the backdrop of the New Engineering education initiative, this study addresses the key challenges in teaching Food Nutrition courses. Guided by the Outcome-Based Education (OBE) concept, it integrates the strengths of traditional offline instruction with the rich resources of online teaching to explore a blended learning reform. With a student-centered developmental orientation, the course framework and teaching activities are designed in a backward manner, structuring the instructional process into three phases: pre-class, in-class, and post-class. Innovative teaching models are implemented to expand the educational space of the course, foster students' self-directed learning abilities, enhance learning outcomes and professional competencies, and lay a solid foundation for cultivating high-quality, application-oriented professionals in food science and engineering who possess solid theoretical knowledge and strong practical skills [6].

4.1 Pre-Class Phase

When implementing instructional design based on the OBE concept, teachers can utilize digital teaching platforms such as the Superstar Learning Platform to systematically release chapter-based learning task packages before class. These

packages include various forms of pre-class materials, such as core presentations, visual resources, and micro-lecture videos. Guided by task instructions, students engage in self-directed learning to build a preliminary understanding of the content framework and identify key concepts and challenging points. Teachers should emphasize the integration of real-world case studies at this stage. For example, in the chapter on "Food Digestion and Absorption," open-ended inquiry tasks can be designed to guide students in conducting literature research and data analysis to scientifically evaluate and discuss common nutritional topics such as "The Effectiveness of the Ketogenic Diet for Weight Loss" or "The Relationship between Breakfast Habits and Gallstone Risk." Such stimulating, health-related questions can effectively spark students' interest and motivation for exploration, allowing them to enter classroom sessions with clear problem-awareness.

Using the monitoring features of the teaching platform, teachers can track students' pre-class progress, resource engagement, and interactive feedback in real time, promptly identifying difficulties encountered during independent study. Meanwhile, students are encouraged to actively submit questions through platform channels, establishing early teacher-student interaction. This outcome-driven pre-class design not only reinforces the focus and purpose of learning but also implicitly cultivates students' comprehensive abilities-such as independent inquiry, critical thinking, and information synthesis-thus laying a solid foundation for deeper in-class instruction.

4.2 In-Class Phase

In the offline classroom phase, the instructional focus lies on in-depth analysis and systematic construction of core knowledge. Drawing on feedback from pre-class learning data, teachers address key difficulties and deepen content understanding to help students build an integrated knowledge framework. To enhance student agency, the course can appropriately adopt a flipped classroom model, utilizing platforms such as Superstar Learning Platform to facilitate randomized group collaboration. Each group is required to complete assigned tasks and present their outcomes in class, followed by a multi-dimensional assessment combining peer evaluation and instructor feedback.

At the level of teaching interaction, teachers can flexibly employ various digital classroom tools via teaching platforms: "instant polling" to gauge overall comprehension, "random selection" to encourage broad participation, "timed Q&A" to stimulate active thinking, and "thematic discussion" to guide deeper inquiry. The strategic integration of these technology-enhanced teaching methods not only significantly increases classroom engagement and interest, but also fosters students' critical thinking and problem-solving abilities in a natural and implicit manner, ultimately contributing to the coordinated enhancement of both teaching effectiveness and learning efficiency.

4.3 Post-Class Phase

During the post-class consolidation phase, students can revisit and reinforce their understanding using the learning resources

available on the online teaching platform. Instructors utilize platforms such as Superstar Learning Platform to assign post-class homework and extended tasks. By monitoring real-time data on task progress and student performance, teachers are able to identify students who may be falling behind and provide timely, targeted support.

Students are encouraged to engage in interactive discussions within the platform's forum, sharing learning reflections and practical insights. Through such peer exchange, they broaden their cognitive perspectives and deepen subject understanding. This just-in-time feedback-based learning mechanism significantly facilitates the transfer and application of knowledge, effectively enhancing the overall learning outcomes of the course.

5. Implementation Path for the Teaching Reform

5.1 Innovation in Teaching Methods: Adoption of Diversified Instructional Strategies

Focusing on diverse instructional strategies, a five-dimensional teaching model integrating “case analysis–project-driven learning–collaborative inquiry–technology integration–competition empowerment” has been developed. The model is implemented as follows: real-world cases and socially relevant topics are introduced to cultivate students' critical thinking and evidence-based decision-making skills; progressive project tasks are designed to develop comprehensive problem-solving abilities from research to implementation; flipped classroom and group collaboration methods are employed to enhance teamwork and self-directed learning; online platforms and digital tools are utilized to strengthen interaction and information literacy; and connections with academic competitions are established to foster learning through competition, thereby stimulating innovative potential and awareness of outcome translation.

This student-centered system emphasizes competency integration and process engagement, enabling a systematic shift from knowledge transmission to competence development.

5.2 Enhancement of Practical Teaching: Synergistic Use of On-Campus and Off-Campus Educational Platforms

By focusing on “intra- and extra-campus collaboration”, a multi-dimensional practical education system has been established. This system is implemented through the following approaches: basic skills training such as nutritional assessment and recipe design is conducted within campus laboratories; internships and practical experiences are carried out in partnership with hospitals, enterprises, and communities to expose students to real-world professional environments; public service activities such as nutrition education and dietary survey projects are organized to foster a sense of social responsibility; participation in faculty research projects is encouraged to promote research-to-teaching feedback and innovation capacity development; and industry experts and authentic projects are introduced to enhance the alignment between course content and industry needs. Through integrated resources and scenario-based learning,

this framework achieves an organic synthesis of theoretical instruction, practical competence, and societal engagement.

5.3 Integration of Curriculum Ideology and Politics: Implicit and Coherent Value Guidance

The deep integration of curriculum-based ideological and political education into the “Food Nutrition” course aims to systematically explore points of convergence between value cultivation and professional knowledge, achieving the harmonious development of value guidance and competency enhancement in a natural and implicit manner. In practice, this integration can be structured around key dimensions such as the “Healthy China” national strategy, food safety ethics, and the heritage of Chinese dietary culture. Ideological and political elements—including professional ethics, social responsibility, and cultural confidence—are embedded organically within the course content. For example, when teaching food and nutrition policies, instructors can relate them to the National Nutrition Plan to illustrate the state's commitment to public health; when analyzing food labeling, students can be guided to reflect on integrity norms and corporate social responsibility; and when discussing traditional dietary structures, the Chinese wisdom of “homology of food and medicine” can be emphasized to strengthen cultural identity.

At the practical level, the approach advocates “starting from the details” through methods such as case immersion, situational simulation, and topic-based discussion. Teachers can leverage teaching platforms to establish a “curriculum ideological and political resource library” that integrates typical cases, policy documents, video materials, and other resources, guiding students to engage in independent pre-class learning and reflection. During class, flexible instructional methods such as inquiry-based learning, group discussion, and role-play can be employed—for instance, organizing discussions on real-world issues like “campus food safety incidents” or “nutrition improvement initiatives in rural revitalization.” This approach encourages students to internalize values and develop a sense of agency as they acquire knowledge, ultimately achieving the educational goal of integrating professional knowledge transmission, comprehensive competency development, and ideological-political education.

5.4 Reform of the Assessment System: Implementation of Diverse Process-Oriented Evaluation

Guided by the OBE concept, the teaching evaluation system is designed to span the entire instructional cycle—pre-class, in-class, and post-class—establishing a comprehensive assessment framework that covers the whole learning process and integrates multiple assessors and multidimensional criteria. This system adopts the following weight distribution: 20% for pre-class performance, 30% for in-class engagement, and 50% for post-class tasks and outcomes. Specifically, the pre-class stage evaluates the completion of preparatory tasks and the ability to engage in self-directed learning and information processing. The in-class stage assesses active participation, collaborative interaction, and performance in classroom tasks. The post-class stage comprehensively examines homework completion, practical achievements, and

final assessments. By emphasizing continuous process-based evaluation and feedback, this model shifts the focus of teaching from mere knowledge assessment toward competency development, genuinely realizing the student-centered educational goal oriented toward student growth.

6. Conclusion

Based on OBE theory, this study has developed a blended teaching model characterized by “project leadership and competition empowerment” for the food nutrition course, which has effectively enhanced students’ comprehensive competencies and overall teaching quality. In the future, further efforts should focus on optimizing project design, strengthening teacher training, and refining the assessment system to advance the reform of food nutrition education to a deeper and broader level. These steps will provide strong support for cultivating high-quality and innovative professionals in the field of food nutrition.

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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