



International Journal of Literacy and Education

E-ISSN: 2789-1615
P-ISSN: 2789-1607
www.educationjournal.info
Impact Factor: RJIF 5.7
IJLE 2025; 5(1): 11-13
Received: 23-10-2024
Accepted: 26-11-2024

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Curriculum reform of "Food Additives" based on outcomes-based education concept

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DOI: <https://dx.doi.org/10.22271/27891607.2025.v5.i1a.244>

Abstract

In the context of engineering certification, the outcomes-based education (OBE) model is used to promote engineering education and practice activities in the field of food science and engineering. The reform and practice of the "Food Additives" course improved students' practical skills, innovation awareness, and ability to solve complex engineering problems and cultivated their learning ability, innovation ability, engineering design ability, and research and development ability. Based on teaching practice, this article discusses the course objectives, teaching contents, assessment methods, teaching methods and organizational forms, as well as teaching characteristics, in order to promote the practical activities of "engineering education" in food science and engineering and improve the adaptability of college students to engineering education under the OBE mode.

Keywords: Curriculum reform, OBE concept, food additives

Introduction

OBE concept is based on the concept of student-centered, outcome oriented, and continuous improvement ^[1]. It is determined by the needs of national social and educational development, industry and industry development, school positioning and development goals, and student development. It focuses on the training mode of students' learning outcomes achieved through the educational process ^[2].

"Food Additives" is an elective course for food engineering majors, and it is a technology that food engineering students must master in the face of the development of modern food industry when they enter the food industry in the future ^[3]. However, traditional classroom teaching currently suffers from the common phenomenon of teachers lecturing while students do not listen, greatly reducing the achievement of teaching effectiveness goals. In addition, the teaching contents of the "Food Additives" course involve a wide variety of food additives, with scattered knowledge points. Students can generally only learn some "fragmented" professional knowledge, but cannot systematically grasp the knowledge, making it difficult to grasp the overall structure of the course and fail to meet teaching requirements ^[4].

Based on the OBE concept and the characteristics of the "Food Additives" course, we have put students at the center and results as orientation. We have applied the OBE concept to the teaching process, carried out teaching reforms from the aspects of reconstructing teaching objectives, enriching teaching resources, improving teaching methods, and optimizing the evaluation system, effectively solving the problems existing in traditional teaching of this course, fully mobilizing students' enthusiasm and subjective initiative, cultivating their ability to think independently, raise questions, and solve problems, improving students' self-learning ability and innovation consciousness, and thus enhancing the quality of course teaching.

Curriculum objective reform

The OBE concept emphasizes 'what learning outcomes we want students to achieve' ^[5, 6]. According to the training plan for the food engineering major, we have optimized the teaching objectives of this course.

Engineering and Sustainable Development

Students can master the basic concepts, classifications, production, characteristics, applications, laws and regulations of food additives; Students are able to select appropriate

food additives and their corresponding usage methods based on the specific characteristics of food and food additives in various types of food additives. Through the study of this course, students will be able to accurately describe the main contents of laws, regulations, and standards such as the standards for the use of food additives, general rules for composite food additives, and detailed rules for the review of food additive production licenses. They will also be able to explain the background of their formation.

Ethical and professional standards

Students are able to objectively analyze and evaluate specific cases based on the specific characteristics of food and food additives. Through the study of this course, students will be able to apply knowledge of food additive toxicology, correctly explain the impact of food additives on public safety, health, well-being, and environmental protection, possess the literacy of consciously complying with relevant laws, regulations, and standards, and select food additives reasonably.

Teaching content reform

Adding ideological and political contents to the curriculum

By selecting recent hot food safety issues through case studies and introducing them into classroom teaching, we analyzed food safety related cases to identify the causes of the problems, the degree of social harm, solutions and measures and thus introduced the Food Safety Law. We enabled students to intuitively understand the food safety issues caused by food additives, which are not only moral issues for food industry personnel, but also involve legal aspects, thus strengthening the indoctrination of positive thinking. Through case studies, we helped students understand the importance of safe use of food additives, establish honest and trustworthy moral qualities, and foster legal awareness of food safety.

Adding an application section and explaining food additives in conjunction with food labels

Contrary to the teaching philosophy of OBE, the theoretical knowledge of the "Food Additives" course is very unappealing, and students have low efficiency in attending classes and weak learning initiative. Food additives are closely related to people's daily lives. We selected food that students usually like and used their food labels as a case study to explain the role, significance, dosage range, and safety of food additives in this type of food. We taught students to understand the food additives on food labels, discover the secrets behind deliciousness, and scientifically choose food. We will also add homework outside of class, allowing students to research and understand the processing technology of foods with certain types of food additives. By increasing the content of the application section, not only will it increase students' interest in learning the course, but it will also help them innovate and develop food formulas.

Reasonably increasing the contents of teaching practice

At the beginning of each semester, different modules are designed for food research and development projects related to food additives. Each project consists of 4-5 students in a group, who designed the selected module and used food additives to solve the main problems in food research and development, improved the quality of food, and completed

the project before the end of the course. In the last week, the project reports were submitted in groups and presented. In addition, we also encouraged selected students to participate in research projects in the field of food additives, such as the College Student Innovation Experiment Program, the development of new food additives, and the development of compound food additives, to stimulate students' innovative thinking and cultivate their creativity in practice.

Teaching method reform

The OBE concept emphasizes 'how to effectively help students achieve these learning outcomes' [4, 7].

Problem driven method

Problem driven teaching method is student-centered, with problems in the field of food as the core, allowing students to seek solutions around problems [8, 9]. In the chapter on antioxidants, five questions were raised: what is food oxidation, what are the hazards of food oxidation, what methods are used to prevent oxidation, what are the advantages of antioxidants, and what are the types of antioxidants. This leads to the content being discussed.

Heuristic and guided teaching methods

We selectively taught teaching contents. At the same time we inspired and guided students to constantly think and broaden their thinking during the listening process as well as closely link food additives with other courses, so as to enable students to concentrate and listen attentively, improve listening efficiency. Moreover, we adopt effective methods, and cultivate students' ability to learn detailed content independently. We used mind maps during the teaching process, which effectively helped students organize the course content framework, connect scattered knowledge points, and have a clear understanding of the key or difficult points of the course contents.

Interactive teaching methods

In the era of artificial intelligence and the Internet, we broke the space limit of learning interaction through group discussions, teacher comments, student mutual comments, student self-evaluation and other ways. We completed classroom teaching through complementary online and offline methods, utilizing diversified online teaching platforms such as Rain Classroom, Study Pass, QQ Voice. We also utilized the above platforms for more classroom interactions, such as random roll calls, buzzer calls, thematic discussions, classroom questioning, and problem lectures, in order to liven up the classroom atmosphere and improve teaching effectiveness.

Student centered teaching model

Traditional teaching methods are generally teacher centered, with little communication between teachers and students. Students passively receive knowledge, and classroom teaching is dull and often lacks student participation and interaction. Students lack the ability to identify and analyze problems, making it difficult to cultivate their innovative thinking. The student-centered teaching model adopts various forms such as inspiration, participation, and flipped courses. Teachers explain the basic knowledge points in the course learning. Under the guidance of teachers, students gradually occupy the main position. Students will think independently, discover problems, propose problems, and

then analyze and design solutions. The students' learning enthusiasm is significantly improved. Both the specific teaching design and implementation are aimed at promoting students to achieve learning outcomes. For example, we ask a question: Apple juice has turned brown after processing, please explain the reason for the browning and write down the solutions. In order to find the correct answer, students conduct extensive literature review and in-depth study of textbooks, gaining a sense of achievement and stimulating their interest in the "Food Additives" course.

Assessment method reform

The OBE concept emphasizes "how to know that students have achieved these learning outcomes" [10]. Continuously optimizing the evaluation system is particularly important, especially in testing the effectiveness of course teaching. Design appropriate evaluation criteria based on the proportion of grades, the proportion of different forms, and the goals that the teacher of this course aims to achieve. We set the regular grade for students in this course at 40%. Among them, classroom Q&A, online learning, teacher-student interaction, attendance, etc. each account for a certain proportion. Offline grades are mainly based on final exam scores, accounting for 60%.

Conclusions

As one of the core courses in the food major, "Food Additives" have been reformed and practiced in terms of teaching objectives, teaching contents, teaching methods and means, and teaching evaluation under the guidance of OBE concept and systematic theory of work process. This teaching reform has been implemented among students majoring in Food Engineering in 2022. After the curriculum reform, students' interest in learning has increased, their hands-on ability has improved, their teamwork ability has been enhanced, and they are more familiar with their professional positions.

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