

# Design and Implementation of a Functional Foods Program in an Innovative Teaching Model



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**Abstracts:** With the rise of health consciousness and the rapid development of the functional food market, functional food courses have become a key discipline in higher education to cultivate professionals and promote the development of students' theoretical and practical abilities. This paper discusses the design and implementation strategies of a functional food course under an innovative teaching model, emphasizing the importance of incorporating modern educational concepts and techniques, such as case-based pedagogy, project-based learning, interactive discussion, and collaborative learning, the integration of skills and theories, as well as the use of modern educational technologies and assessment and feedback mechanisms. Through these strategies, the course aims to increase students' learning interest, promote the deep integration of knowledge and skills, and, thus, effectively improve the teaching quality and learning effectiveness of the functional food course.

**Keywords:** functional food course; innovative teaching mode; case teaching method; project-based learning

## Introduction

In the current rapid development of social background, functional food as an emerging discipline, for the promotion of human health has great significance. With the enhancement of consumers' awareness of health, the functional food market is rapidly expanding, thus putting forward higher requirements for professionals in related industries. Therefore, as an important course in higher education, a functional food program not only needs to teach professional knowledge but also should cultivate students' innovative abilities and practical skills. Under such an educational background, the introduction of innovative teaching modes has become the key to improving the quality and effectiveness of education. Through the implementation of innovative teaching strategies such as flipped classrooms and project-based learning, students' interest in learning can be more

effectively stimulated, and their problem-solving ability and independent learning abilities can be cultivated. Innovative teaching modes can also promote the updating of teachers' teaching methods and concepts, thus enhancing the vitality and adaptability of the entire education system. Therefore, it is of great significance to integrate the innovative teaching mode in the functional food course to cultivate high-quality talents who can adapt to the needs of the future society.

## 1. Content and Teaching Objectives of Functional Food Curriculum

### 1.1 Overview of the content of functional food course

Functional food course is a multidisciplinary and comprehensive course, aiming to introduce students to the concept, types, production process, health effects, and market trends of functional food. The course content revolves around the core knowledge of functional foods, starting from basic

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nutritional principles and exploring in detail different types of functional ingredients, such as dietary fiber, antioxidants, probiotics, etc., and how these ingredients work in the human body to promote health or prevent disease. The course also analyzes in-depth the R&D process of functional foods, including key aspects such as raw material selection, product design, production process, and quality control. Through case studies and market analysis, students will learn about the latest developments and future trends in the current functional food market, including consumer demand, regulations and policies, and marketing strategies. This course not only focuses on the transfer of theoretical knowledge but also emphasizes the cultivation of practical skills. Through teaching activities such as laboratory exercises, project design, and fieldwork, students will have the opportunity to apply theory to practice and gain an in-depth understanding of the R&D and evaluation process of functional foods. Through this course, students will acquire key knowledge and skills in the field of functional foods, laying a solid foundation for their future careers or further research.

### **1.2 Teaching objectives of functional foods course**

The pedagogical objectives of the Functional Foods course aim to develop students' comprehensive knowledge structure, critical thinking, practical skills, and creativity to cope with the development of the functional foods field and the needs of the industry. Firstly, the curriculum objectives include ensuring that students master the basic concepts, categorization, mechanism of action, and relationship with human health of functional foods so that they can understand and evaluate the scientific basis and health benefits of functional foods. Secondly, the course aims to develop students' critical thinking skills to enable them to analyze and solve problems independently. This includes critical analysis and judgment of scientific issues in functional food research and development, safety assessment, and marketing strategies. Again, the course also focuses on the development of practical skills, encouraging students to apply theoretical knowledge to real-world situations through

laboratory research, project design, and case studies, thereby improving their R&D and problem-solving abilities (Chen & Chen, 2021). Finally, the course objectives also include stimulating students' innovative consciousness and ability, encouraging them to explore new ingredients, products, and technologies of functional foods, and promoting students' innovative thinking and entrepreneurial ability in the field of functional foods. Through the realization of these teaching objectives, students will be able to demonstrate professional competence and leadership in the research, development, evaluation, and marketing of functional foods.

## **2. Connotation of Innovative Teaching Mode and its Guiding Role for Functional Food Courses**

### **2.1 Definition and characteristics of innovative teaching mode**

The innovative teaching mode is relative to the traditional teaching mode, which focuses on the adoption of novel teaching methods, techniques, and strategies to improve the efficiency and quality of teaching and to stimulate students' interest in learning and innovative thinking. This teaching mode usually emphasizes student-centeredness and encourages students to take the initiative to explore and learn, while promoting interaction and cooperation between teachers and students as well as between students and students. Among the innovative teaching models, methods such as flipped classrooms, project-based learning, collaborative learning, and contextual learning are widely used. The flipped classroom reverses classroom lectures and homework, allowing students to learn new knowledge on their own at home through videos and other materials, while classroom time is used for discussion, problems, and deepening understanding. Project-based learning learns relevant knowledge by engaging students in real projects, cultivating their problem-solving skills and teamwork. Collaborative learning emphasizes group work and promotes learning through mutual teaching and discussion among group members. Contextual learning, on the other hand, places learning in concrete and meaningful contexts and

helps students establish connections between knowledge and practical experience. The common features of these innovative teaching models are that they emphasize students' active participation and experience, encourage the cultivation of innovative and critical thinking, as well as strengthen the integration of knowledge and practice. Through these teaching models, functional food courses can be more vivid and effective, helping students to understand complex concepts and improve their ability to solve practical problems.

## **2.2 How innovative teaching models promote the learning effectiveness of functional food courses**

Innovative teaching modes greatly promote the learning effect of functional food courses by introducing diverse teaching methods and strategies. First, these modes stimulate students' learning interest and motivation by increasing interactivity and participation. For example, the flipped classroom model enables students to preview new knowledge at home and participate more in discussions and practical activities in the classroom, and this interaction and participation helps to deepen understanding and consolidate knowledge. Secondly, project-based learning and case-based teaching methods allow students to apply what they have learned in the process of solving real-world problems, and this learning-by-doing approach helps to improve student's practical skills and creativity. Through these methods, students not only learn the theoretical knowledge of functional foods but also gain practical and research experience, which is invaluable for their future careers or further academic research. Again, the innovative teaching model also encourages teachers to adopt multimedia and information technology tools to make the teaching content more vivid interesting, and easier for students to understand. For example, virtual laboratories and online interactive platforms can provide more opportunities for practicing without the constraints of time and place. It can be seen that the innovative teaching mode effectively enhances the learning effect of the functional food course by improving the interactivity, practicability, and interestingness of

teaching, helping students to establish a solid knowledge base and cultivate their analytical and problem-solving abilities (Wang et al., 2021).

## **3. Design and Implementation Strategies of Functional Foods Course**

### **3.1 Application of case teaching method**

The case teaching method plays a crucial role in the design and implementation of functional food courses, which can combine theoretical knowledge with real-world situations to improve students' practical understanding and problem-solving skills. Through specific, real-world case studies, students can gain an in-depth understanding of practical applications in the functional food field, including product development, marketing, regulatory compliance, and many other aspects (Cheng et al., 2022). In the application of the case teaching method, the teacher first introduces students to the background knowledge, then presents specific case problems and guides students in group discussions to analyze the problems and propose solutions. This teaching method encourages students to actively participate in the discussion and develops their critical thinking and innovation ability. In the discussion process, students not only need to apply the theoretical knowledge they have learned but also need to mobilize their personal experience and logical reasoning ability to seek solutions together in the form of teamwork. Case studies can also help students establish interdisciplinary knowledge connections. Through the analysis of cases from multiple perspectives, students can understand the scientific, technological, commercial, and legal knowledge involved in the development of functional foods. This teaching strategy not only deepens students' understanding of the functional food field but also improves their ability to apply their knowledge in real-world problem-solving, laying a solid foundation for their future careers or higher-level studies.

### **3.2 Implementation of project learning**

Project-based learning allows students to learn and apply new knowledge in depth as they explore

and solve real-world problems. In a functional foods course, the implementation of project-based learning allows students to explore, apply, and integrate the theoretical knowledge they have learned in real-life contexts, resulting in deeper understanding and stronger practical skills (Liu et al., 2024). Teachers can issue a project-based learning task with the theme "Special physiological functions of amino acids, active peptides, and active proteins". Students need to work in groups to design functional foods containing specific active peptides or active proteins to address specific health concerns, such as improving immunity, promoting muscle growth, or improving sleep quality. Each group needs to study the physiological functions of different amino acids, active peptides, and active proteins, based on which they will select suitable ingredients, design product formulations, predict their health benefits, and consider factors such as the production process, cost, and market acceptance. The ultimate goal of the project is to produce a complete functional food design proposal, including the scientific basis of the product, production process, potential health benefits, and market analysis. Students are required to apply not only the scientific knowledge they have learned but also skills such as project management, teamwork, problem-solving, and innovative thinking in the process. In this way, project-based learning allows students to deepen their understanding of functional food science in real-world applications and enhances their comprehensive quality and practical ability.

### **3.3 Interactive discussion and cooperative learning**

By encouraging interaction and cooperation among students, it can encourage students to engage in knowledge sharing, which is conducive to the development of critical thinking and communication skills. In functional food courses, teachers can design activities and discussions that enable students to explore issues together and learn from each other, thus deepening their understanding and application of course content (Song et al., 2023). Educators can organize an interactive discussion and collaborative

learning activity on the topic of "commonalities and specificities between the health functions of marine resources and terrestrial organisms". The activity could begin with a group discussion in which each group explores the uniqueness of marine resources, such as seaweeds, fish, and crustaceans, in terms of their health functions and how they compare with terrestrial resources. Students will need to research the health care components provided by different marine organisms, such as omega-3 fatty acids, marine collagen, etc., and the potential benefits of these components on human health. In the process, students can work collaboratively to integrate their studies into a comprehensive report containing a comparative analysis of marine and terrestrial health resources. This interactive discussion not only helps students gain a deeper understanding of the specific health functions of marine organisms but also promotes the development of teamwork and communication skills. Through such activities, students can better understand the potential and value of marine organisms in functional food development, as well as enhance their research and collaboration skills.

### **3.4 Teaching by combining skills and theories**

The teaching strategy of combining skills and theory aims to deepen students' understanding of theoretical knowledge and their ability to apply it through practical activities. This teaching method not only allows students to understand the practical meaning behind theories but also improves their operational skills and problem-solving abilities. Combining theory and practice is particularly important in functional food programs because the knowledge involved in this field is not only extensive but also practical (Pahati et al., 2023). Encouraging students to participate in competitions can help to combine skills with theory. Take the microbiological testing module competition as an example, in such a competition, students need to apply the theoretical knowledge they have learned in the functional food course, such as the principles of microbiology, food safety standards, etc., to complete a series of laboratory skills tests. The competition includes

colony counting operation and result reporting, Gram staining and microscopy operation, and pathogenic bacteria testing ability. Such competitions not only test students' basic laboratory skills but also require them to be able to accurately understand and interpret laboratory results, as well as test their ability to work under pressure and solve problems. By participating in such competitions, students can deepen their understanding of the importance of microbiological testing in practice, improve their laboratory skills, and learn how to apply this knowledge and skills in the real world. This not only helps students to transform theoretical knowledge into practical skills but also stimulates their interest in scientific research and food safety.

### 3.5 Utilizing modern educational technology

Utilizing modern educational technology can greatly enhance the interactivity and diversity of teaching and improve students' learning interests and efficiency. Modern educational technologies such as online learning platforms, virtual laboratories, multimedia presentations, and interactive software provide rich resources and tools for teaching functional foods, making the teaching content more vivid and easy to understand. Through online learning platforms, teachers can release teaching videos, lecture notes, related literature, and real-time feedback surveys, and students can access these materials at any time for independent learning (Liu et al., 2022). Virtual laboratories allow students to perform experimental operations in a simulated experimental environment to deepen their understanding of experimental techniques and principles, especially when resources are limited, virtual laboratories provide unparalleled learning opportunities. Multimedia presentations and interactive software can visualize complex data and concepts in the form of graphics, animations, and simulation demonstrations, enhancing students' understanding and memory. Modern educational technology also supports interactive communication among students and between students and teachers. Through forums, discussion groups, and instant messaging tools, students can discuss problems and

share information, and teachers can answer students' queries and provide feedback promptly. This instant interactivity not only facilitates the establishment of learning communities but also motivates students' motivation and participation in learning. In short, the use of modern educational technology can make the teaching of functional food courses more efficient, flexible, and personalized, help students better master the course content, and develop their independent learning and critical thinking skills.

### 3.6 Establishment of assessment and feedback mechanism

The establishment of an assessment and feedback mechanism is an indispensable part of the design and implementation of the functional food course, which is of great significance in monitoring students' learning progress, improving teaching quality, and promoting students' learning. A good assessment mechanism should include both formative and summative assessment, the former helping students to understand their learning status and make adjustments accordingly, and the latter evaluating students' performance and achievements in the whole learning process. In functional food courses, formative assessment can be carried out in a variety of ways such as assignments, quizzes, class participation project progress reports, etc. These assessments not only allow students to understand their mastery of the course content but also enable teachers to keep abreast of the student's learning status and adjust their teaching strategies according to their needs (Xiao, 2021). Summative assessments, on the other hand, may include final exams, final submission and presentation of course projects, and assessment of practical skills, etc. These assessments reflect students' understanding and mastery of the overall content of the course. In addition to assessment, it is also crucial to establish an effective feedback mechanism. Teachers should provide timely, specific, and constructive feedback to help students identify their strengths and areas for improvement. Also, mutual assessment among students can be encouraged to promote peer learning and critical thinking. Ultimately, these assessment

and feedback mechanisms should be integrated into the design of the course to ensure that students can grow and progress in an ongoing learning process.

### Summary

The design and implementation of a functional foods course is particularly important within today's rapidly evolving food science field. Through the use of innovative teaching models, the program cannot only increase students' interest and engagement but also deepen their understanding of specialized knowledge and enhance their practical and creative skills. Innovative teaching modes such as project-based learning, case-based teaching methodology, interactive discussion, and other strategies can effectively promote students' active learning and develop critical thinking and problem-solving skills. With the advancement of technology and changes in educational needs, the teaching methods of functional food courses need to be constantly updated and improved. Educators should be committed to exploring more innovative teaching methods and technologies to meet the diverse learning needs of students and new developments in the field of food science. Ultimately, these efforts will help to produce highly qualified professionals who can play an important role in the field of functional foods and contribute to the advancement of food science and the health and well-being of society.

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### Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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