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Provincial Top Undergraduate Major Construction Point — Exploration and Practice of Food Science and Engineering Major Construction in East University of Heilongjiang

Jing Zhao, Jing Yao*, Hongmei Wang, Hongyan Fu, Yun Zhang

School of Food Engineering, East University of Heilongjiang, Harbin 150066, Heilongjiang, China
**Corresponding author*

Abstract: *The construction of top undergraduate majors is a crucial direction in the current development of higher education, holding significant importance in enhancing the quality of talent cultivation and elevating the overall strength of universities. With the development of the socio-economic landscape and the improvement of people's living standards, the field of Food Science and Engineering is gaining increasing attention. As an integral part of the construction of provincial top undergraduate majors, addressing the core issues in major development and improving the quality of talent cultivation and academic standards are pressing challenges. This article takes the Food Science and Engineering major at East University of Heilongjiang as a case study to explore how to construct a provincial top undergraduate major. It focuses on the core issues in major development, proposes corresponding solutions, and shares relevant experiences and practices, providing valuable insights for the construction of the Food Science and Engineering major in the context of top major development.*

Keywords: *Food Science and Engineering major; Provincial top undergraduate major construction point; Major construction*

1. Introduction

In recent years, the Ministry of Education has successively issued documents such as "Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensive Improvement of Talent Cultivation Capability" and "Notice on Implementing the 'Double-10,000 Plans' for the Construction of Top Undergraduate Majors" (referred to as the "Double-10,000 Plans") [1], comprehensively promoting the construction of undergraduate education. Particularly, the "Double-10,000 Plans" aim to establish 10,000 national top undergraduate major points and provincial top undergraduate major points by 2021 within a three-year period. For institutions and majors successfully designated as "Double-10,000," certain support is provided in terms of funding and policies. The advancement of the "Double-10,000 Plans" undoubtedly injects a strong impetus into undergraduate institutions. Seizing this strategic opportunity, the Food Science and Engineering major at East University of Heilongjiang actively prepared and organized the application process, successfully obtaining approval as a provincial top major construction point. This article systematically summarizes the experiences and practices of the university (major) in the creation of a provincial top major construction point, aiming to provide reference for institutions in other regions.

2. Major Positioning and Historical Evolution

In 1994, our university established the first "Dairy Processing Technology Specialist" in Heilongjiang Province. In April 2000, in collaboration with Heilongjiang University, we began enrolling undergraduate students majoring in food science. In April 2003, East University of Heilongjiang was upgraded to a regular undergraduate institution, and the Food Science and Engineering major became one of the first private undergraduate majors approved by the Provincial Department of Education. Since the establishment of the major, it has adhered to a student-centric approach, implementing a model of integrated construction of disciplines and specialties. It has successively obtained approval as a provincial key specialty in Food Science and Engineering, a

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provincial key construction discipline in the storage and processing of agricultural products, a provincial comprehensive reform pilot for majors, a provincial teaching team for basic courses in the major, a provincial fine course in Food Microbiology, and a national-level extracurricular engineering practice education center for university students. In 2011, approval was obtained to offer master's degree education in the field of food engineering, making it one of the first five private universities in the country to be qualified for the cultivation of master's degree graduates. In 2019, the Food Science and Engineering major was granted the first batch of provincial top undergraduate major construction points, marking a new milestone in major development. In 2021, the "Feihe Dairy Industry Modern Industry College" was established, and in 2022, it was approved as one of the first industrial college construction points in Heilongjiang Province. This development provides a guarantee for deep integration of industry and education, as well as collaborative student development.

The major, starting from the advantageous resources of environmentally friendly food in Heilongjiang Province, leverages regional strengths to closely integrate major development, talent cultivation, and the development of the food industry in Heilongjiang. Centered around the food industry chain, covering food raw materials, processing technology, product testing, quality management, food logistics, market marketing, and consumer terminals, the major has established a professional cluster supported by the discipline of food science. With food safety at its core, the major focuses on research and development in green processing and modern detection technology. Relying on the high-quality milk source of Heilongjiang, it features the development of green food and functional dairy products. The major conducts comprehensive high-level applied talent cultivation. Since its establishment, the major has cumulatively trained and supplied over 2,000 qualified high-level applied talents for the development of the food industry in Heilongjiang and across the country.

3. Specific Practices

3.1. Focusing on the development direction of the food industry and enterprise demands, continuously optimizing and adjusting the training major

Since the 18th National Congress, China has entered a new era, experiencing significant changes in its economic and social landscape. The food industry has also exhibited new characteristics, with continuous advancements in food science and technology. Safety production requirements have reached unprecedented levels, and the integration of the food industry with the internet, intelligent manufacturing, and other industries has become more closely intertwined, presenting new demands for professionals in the field. Against this backdrop, undergraduate institutions offering food-related majors must adhere to research on the knowledge and skills required by modern food industry professionals. This research should serve as the basis for continuously revising and optimizing talent training majors. Before revising training majors, surveys and discussions involving stakeholders such as enterprises, industries, and graduates should be conducted. This ensures a comprehensive understanding of the changing trends in the domestic and international food industry, as well as the evolving demands of enterprises for talent, providing a basis for adjusting and optimizing training majors. It is essential to further refine the goals of graduate education, incorporating new industry technologies and requirements into the undergraduate teaching curriculum. Emphasis should be placed on enhancing practical, innovative, and comprehensive skills. By conducting outcome-oriented applied engineering education, engaging in in-depth school-enterprise cooperation, implementing models such as "Feihe Industry College" classes and the "mentor system," students can be cultivated to possess a solid knowledge base and excellent engineering practical abilities, demonstrating the potential to become outstanding engineers.

The Food Science and Engineering major relies on the "Provincial Top Undergraduate Major Construction Point" and "Provincial Key Undergraduate Major" status. In teaching, it establishes three platforms that synergistically nurture students through renowned expert professors, senior technical talents from enterprises, and collaborative education in research and innovation. The major integrates talent cultivation with the local regional food industry, training plans with engineering certification, teacher research with industry projects, and further combines postgraduate education with innovative employment. With a focus on improving students' practical and innovative capabilities, it establishes a distinctive "four-stage progressive" practical teaching system. The major collaborates with well-known domestic and international large food enterprises such as Feihe, Miqi, Qiulin, Jiusan Oil & Fat, Yili, and McCain through school-enterprise cooperation. The curriculum system revolves around the complete industry chain demands of food enterprises, establishing a "fully traceable theoretical and

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practical teaching model" for the entire industry chain.

3.2. Implementing the educational philosophy of "alternating learning and doing, learning for practical application" to cultivate students' engineering practical abilities

The positioning of the Food Science and Engineering major at East University of Heilongjiang is to cultivate high-level applied technical talents with engineering practical capabilities for the local food industry [2]. To achieve this teaching objective, particularly in enhancing students' application and practical abilities, the university has proposed the educational philosophy of "alternating learning and doing, learning for practical application." In response to practical teaching, the university has increased investment, allocating a total of ten million yuan for the purchase of various teaching facilities and equipment for undergraduate experiments and practical teaching. The establishment of a pilot production practice base for dairy processing has provided essential conditions for cultivating students' engineering practical abilities. Currently, the major has a nationally recognized extracurricular engineering practice education center for university students co-built with enterprises. In the talent training major, there are dedicated practical teaching sessions such as food professional skills training and comprehensive food processing skill training. Firstly, efforts are intensified to enhance the collaboration between the university and enterprises, co-constructing off-campus training bases, and increasing students' participation in social practice internships, focusing on cultivating students' social practice capabilities. Secondly, by arranging for students to directly participate in the production practice process, the major aims to cultivate students' ability to solve complex engineering problems. Thirdly, through product development training, students' innovation capabilities are trained. Based on training in the development of new products, students engage in the industrialized processing production design of products. This involves designing production processes, conducting material balance calculations based on annual production volumes, selecting supporting equipment, designing production workshops, and conducting technical and economic analyses. Through these projects, the major fully aims to cultivate students' abilities to solve practical problems.

3.3. Innovating the "Industry-Education Integration, Mutual Promotion of Innovation and Entrepreneurship" Talent Training Model to Enhance Students' Engineering Innovation Abilities

For the training of applied undergraduate talents, innovative practical abilities are crucial for their future career development. Our university, through further strengthening the integration of industry and education, promotes the deep integration of education and production practice, jointly develops challenging practical projects, and guides students' full participation, effectively enhancing their innovation capabilities. Firstly, "Industry-Education Integration" involves hiring industry experts to participate in the construction and evaluation of the curriculum system, co-building training bases and research platforms, targeted training, and other approaches to promote the deep integration of teaching and practice. The major has successively established the "Yili Dongfang Y Class" in collaboration with the Yili Group Yogurt Division and the "Feihe Class" in collaboration with Heilongjiang Feihe Dairy Co., Ltd. Through school-enterprise cooperation in these classes, students' engineering innovation capabilities have significantly improved. The major has also jointly established the "Food Safety Analysis and Testing Experimental Platform (Co-built Laboratory)" with Agilent Technologies Co., Ltd. It collaborates with the third-party testing organization Zhongnuo, establishes training bases on campus, co-builds a training room with Kunshan Xinlai Fluid Equipment Co., Ltd., and collaborates with the Institute of Spices and Beverages Research of the Chinese Academy of Tropical Agricultural Sciences to co-build the "Tropical Food Functional Development Joint Research Institute." Secondly, "Mutual Promotion of Innovation and Entrepreneurship" means that, based on co-built laboratories, research institutes, and training bases, the school arranges for students to participate in the research and development of important projects for enterprises, participate in provincial and municipal innovation and entrepreneurship competitions, and undergo practical and innovative training to enhance their practical and innovative capabilities. At the same time, the school has specifically established special funds to support the construction of joint laboratories and innovative projects for the major, encouraging students to boldly innovate and develop.

3.4. Enhancing Faculty Strength through the "Borrowing External Strength to Strengthen Internal Strength" Measures for Faculty Development

The faculty team is the foundation and guarantee for the development of professional construction. The capabilities and qualities of the faculty directly determine the ability and level of talent cultivation

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[3]. East University of Heilongjiang's Food Science and Engineering major adheres to the view that cultivating the faculty team is a crucial task and employs a series of measures to strengthen faculty development. Firstly, it adopts the approach of "borrowing external strength to strengthen internal strength." On the one hand, it introduces senior engineering and technical personnel with master's degrees or above from enterprises according to the needs of talent cultivation, enhancing the cultivation of students' practical abilities and enriching the "double-qualified" faculty team. Secondly, it emphasizes disciplinary exchanges, promotes interdisciplinary integration, enhances the overall quality of teachers, and provides support for solving complex problems in student education. Thirdly, it strengthens the training of the existing faculty team, focusing on engineering education professional certification, Outcome-Based Education (OBE), and other content. It employs a combination of online and offline methods to organize professional skills training, improving the quality of the faculty team. Fourthly, it conducts actions to enhance the quality of young teachers, employing methods such as senior mentoring junior teachers, establishing mentor-mentee relationships, and carrying out paired assistance to ensure that young teachers quickly assume major responsibilities. Arrangements are made for teachers to enter enterprises for practice and training, participate in enterprise project research and development, invite industry experts to the university for exchange and training activities, etc., to enhance the practical abilities and levels of young teachers. Particularly, the university and enterprises jointly formulate practical exercise tasks. After the completion of the practice, a defense presentation is conducted in the college, and only those who complete the tasks satisfactorily are considered qualified. The college also strengthens guidance for teachers in applying for engineering and applied projects, encourages teachers to jointly apply for horizontal projects with enterprises to address real-world problems, further promoting university-enterprise cooperation, and enhancing the practical experience and level of teachers.

4. Professional Development Achievements

4.1. Further Clarification of Talent Cultivation Objectives, Aligning Closely with the Development of Food Specialties

Through a series of reforms, the objectives of talent cultivation for the Food Science and Engineering major have been clarified. The goal is to cultivate individuals who meet the needs of socialist modernization, serve the requirements of regional economic and social development, possess a sense of social responsibility, and have comprehensive development in morality, intelligence, physical fitness, aesthetics, and labor. Graduates should systematically master the fundamental theories in food science, food engineering, and food quality and safety management, reaching the basic standards of food engineers. They should have practical engineering capabilities, operational skills, as well as the ability to analyze, research, and solve engineering problems. These graduates should be capable of working at a high level of innovation, versatility, and applied technology in various fields related to food, including food production technology management, quality and safety control, inspection and testing, marketing, product development, engineering design, education, teaching, and scientific research.

Within approximately five years after graduation, students are expected to achieve the following objectives:

Objective 1: They can master the fundamental engineering science, professional technical skills, and management knowledge in the field of food science and engineering.

Objective 2: They can understand and be able to apply appropriate theoretical and practical methods to solve practical problems in food production and processing.

Objective 3: They can engage in work related to the production technology management, quality and safety control, inspection and testing, marketing, product development, engineering design, education, teaching, and scientific research of food and related products.

Objective 4: They can possess an innovative spirit, concepts of sustainable development, effective communication, organizational management, and a sense of teamwork, becoming individuals capable of solving complex engineering problems in food production and project management.

Objective 5: They can successfully carry out work in the field of food and related areas after graduation, continuously learn and adapt to development, and become technical backbone and engineers.

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Simultaneously, according to talent cultivation, further refinement and decomposition are conducted to form graduation indicators for graduates, integrating them into the entire teaching process, including daily teaching, course examinations, lab internships, and graduation design. This creates a clear mapping relationship that supports the achievement of graduation requirements in the curriculum system.

4.2. Strengthening the Construction of the Professional Teaching Quality Assurance System, Leading to Improved Teaching Quality

"Cultivating innovative thinking" should be taken as the main line to ensure the improvement of students' ability. It is necessary to reform the traditional mode of book knowledge indoctrination and integrate innovative thinking into classroom teaching. Teachers should highlight the discovery process and the latest progress in the teaching of basic principles. Simultaneously, it's important to encourage the team of teachers to integrate ideological and scientific research elements into classroom teaching, so as to enhance students' interest in learning and innovative thinking ability. In recent years, students have achieved multiple awards in innovation competitions.

It is necessary to start with "reforming the teaching methods" to ensure the quality of personnel training. Combined with the construction of new engineering and professional certification, reforming the teaching mode and updating the teaching content in time are more in line with the requirements of the training of applied talents. It is important to track the employment quality of graduates so as to adjust the teaching contents and teaching methods and optimize the curriculum so that the trained students can better meet the needs of the society.

It is necessary to take "process management monitoring" as the guarantee to ensure the quality of education and teaching. The school should construct the management and supervision system of "Educational Affairs-Teaching steering Committee-academic Committee". It is helpful to closely supervise and manage the curriculum audit, teaching plan audit, teaching process supervision, student graduation thesis design, student satisfaction survey, teaching quality evaluation, teaching quality feedback, graduate research and so on. This can ensure the quality of education and teaching for this major. In the past three years, the graduation rate of students reached 99%, the postgraduate entrance examination rate reached 22.4%, and the employment rate reached 83.4%.

4.3. Significant Improvement in the Quality of Graduates' Talent Cultivation

According to data from the past three years, the average initial employment rate of graduates has reached 83.4%, ranking at the forefront among similar colleges in the province. The main employment directions are large and medium-sized food enterprises and third-party testing companies. The rate of graduates finding employment in their related field is close to 76%, with a stability rate of 76%, and a satisfaction rate of 86%. The satisfaction of graduates with their employment and the alignment with their career expectations show an increasing trend. The average rate of pursuing further education (graduate studies) is 22.4%. From various employment-related data, it can be observed that the quality of graduates trained in this major is excellent, consistent with the goals of the professional training, and the employment quality is good. In 2003, the collaboration with the National Quality and Technical Supervision Vocational Skills Appraisal Center led to the implementation of the "dual certificate" system for graduates. In 2009, training content related to vocational qualification certificates was integrated into the talent cultivation major. In the past three years, the certification rate of students obtaining the food inspector qualification certificate has exceeded 70%. In 2013, the cooperation with Agilent Technologies University under the "Chunhui Plan" incorporated Agilent training into the talent cultivation major, enabling students to obtain certificates for operating large instruments. Graduates generally feedback that the most beneficial aspects during their school period were practical teaching and skill training. Based on the feedback from graduates on the effectiveness of professional training, nearly 90% of graduates are satisfied with the professional education and teaching work.

5. Conclusion

Currently, our university lacks rich experience in building top undergraduate majors. The exploration and practice of constructing the Food Science and Engineering major is a long and continuously evolving process. In this process, we need to conduct in-depth research and analysis on student needs, industry development trends, and teaching and research in various aspects. Looking

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ahead, our university will always adhere to advancing with the times, staying true while innovating, closely following the future development trends of the food industry and enterprise needs. We will further refine the professional characteristics, continuously improve the talent cultivation major, optimize the curriculum system, deepen industry-academia-research cooperation, enhance the professional connotation, and ensure the quality of professional talent cultivation.

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