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Research Article

Reforms and Innovations in Practical Teaching in the Undergraduate Major Food Quality and Safety

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Abstract: This study reviews the reform and innovation in the practical teaching system, content settings and off-campus practice of food quality and safety. The establishment of modules such as internship base and substituted post exercitation is also investigated to gain practical teaching experience and improve teaching skills for food quality and safety.

Keywords: Food quality and safety, practical teaching, practice, reform

INTRODUCTION

Food quality and safety affect the physical health of citizens as well as the security and stability of the society. Governments worldwide regard food quality and safety as a core security problem of national development. China has solved the problem of food and clothing; nevertheless, the crucial nature of food quality and safety has aroused increasing concern. Economic globalization has rendered food safety a significant aspect of national security. Considering social needs, the Ministry of Education of China approved the establishment of food quality and safety as a major in 2001. In September 2002, Northwest A&F University was the first university in China to officially enroll students in this major. After nearly 15 years of development, around 120 universities across China now offer this major. The development of a major at a speed such as that of food quality and safety is rare in China. However, differences in disciplinary background cause universities to have varied understanding of objectives in terms of talent cultivation and emphasis on specialized training plans. In general, cultivation modes feature regional characteristics and are affected by disciplinary background (Yu *et al*., 2009; Xu and Wang, 2015; Hobbs, 2007). This article provides an overview of the reforms and innovations at Northwest A&F University in practical teaching of the food quality and safety major.

MATERIALS AND METHODS

Objective of the major: The food quality and safety major is under the college of engineering. Oriented to social needs, the major has the following objectives:

- To enhance the comprehensive adaptation ability and individual psychological traits of students
- To realize the harmonious development of knowledge, ability and quality and enable students to develop morally, intellectually and physically
- To master basic knowledge on chemistry, biology, food sciences and engineering and management science
- To command the basic theories and practical skills related to food safety science, food nutrition and hygiene and food quality and safety monitoring and control
- To familiarize students with food technology as well as food standards, laws and regulations
- To culture students as advanced practical professionals with innovative spirit and practical ability in detecting, controlling and managing food quality and safety in food companies, state organs and teaching and scientific research departments (Contu and Willmott, 2003).

REFORM MEASURES OF PRACTICAL TEACHING

Practical teaching includes the following six parts: Course experiment, curricular practical training, teaching practice, production practice for graduation, thesis writing and extracurricular scientific and technological practice activities (Bai *et al*., 2014; Contu and Willmott, 2003). In the present study, we establish four modules, namely, research-oriented experiment teaching, off-campus practice base, scientific research skill training and substituted post exercitation, to intensify practical teaching and expand practical

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teaching contents. The research-oriented experiment teaching system is designed to widen the content of the comprehensive design- and research-oriented experiment when enhancing the basic experimental skills of students. The establishment of an off-campus practice base helps students gain practical operating skills and occupational qualities. Approving the scientific research projects of students and encouraging them to assist in the research projects of their teachers help students enter their major's research field immediately and enhance their scientific innovative consciousness. Substituted post exercitation increases the comprehensive quality of students by involving them in modern large-scale food production and safety control.

RESULTS AND DISCUSSION

Reforms and innovations in practical teaching content: Considering the practices over the recent years, we design the content of practical teaching based on the idea of realizing the whole-process control "from farm to fork," which allows students to understand that the management and control of food safety relate to all of the aspects of "from farm to fork." Students should master the safety technology and control systems about material production, food processing, storage and transportation, packaging and supervision (Yang and Chu, 2005).

The adjustment of basic and experiment courses in this major concerns integrated design experiments. Centering closely on the safety control of the entire food cycle, experiments are designed for different specialized courses. For example, experiments in the course "Food Microbiology" focus on food-borne microorganisms. Comprehensive experiments are designed from links such as the production, characteristics, detection and prevention of food-borne microorganisms. These experiments allow students to master biological concepts and methods in food safety control. The course "Food Analysis" regards the food safety index as the main knowledge point in designing and arranging experiment content. This course enables students to understand the importance of food chemistry safety. Aside from testing food physical properties, the course "Physical Properties of Food" also designs some comprehensive experiments to detect the physical danger of food. Time devoted to experiments is also prolonged to highlight their importance. Experimental teams in each class are designated to allow each student to participate in experiments. Exams are mainly about practical manipulative ability.

Internship is arranged with a clear internship aim. The food industry is characterized by varied product categories and safety modules. Therefore, specific jobs after graduation are also characterized by large differences. Moreover, the content of the internship program should be governed by the safety control system, which covers the process "from farm to fork" and combines the advanced platform of the college (Fig. 1). Enough opportunities should be provided such that students engage themselves in the whole system. Internship at the entire college learning stage should be comprehensive to allow students gain the necessary practical experience for future study and work.

Collaborations with food factories, research and development institutions and quality supervision institutions should be promoted. Teaching content should be arranged in accordance with the safety management system of "from farm to fork." Production and learning perspectives should be combined during education to improve the practical ability of students. In

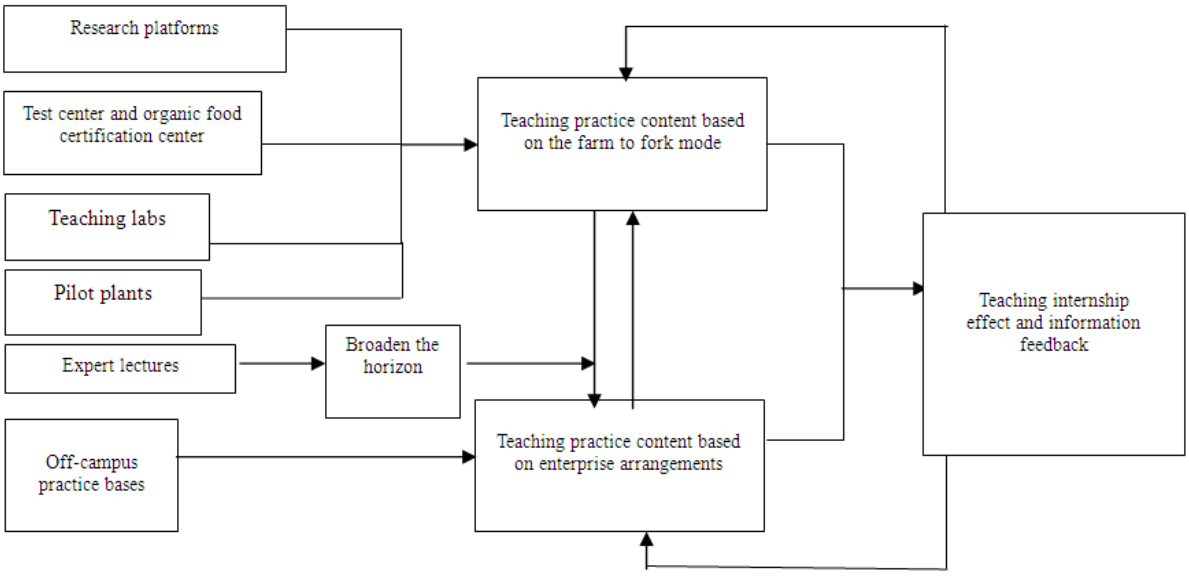

Fig. 1: Teaching practice arrangement mode

specific, visit internship, novitiate internship and substituted post exercitation in off-campus practice base are organized. Internship can also be carried out in the form of scientific research project or thesis by maximizing the available instrumentation in the college. We also widen the horizon of students in terms of food safety practice by inviting experts to lecture about the control and supervision of food safety. Students can also communicate with these experts.

Quality of technological innovation training: Scientific research innovation training is crucial in practical teaching and in culturing innovative talents. Along with the increasing input from the country and the college, 60-70% of students partake in 1-2 years of scientific and innovative activities. The implementation of scientific and innovative projects is indispensible in producing students with innovative ability and scientific research quality. After almost a decade of development, the college has established an effective management system. Scientific and innovative projects are managed throughout the process by following four steps, namely, project approval, project implementation, mid-term examination and project conclusion. All of these steps are important for talent training and are performed in accordance with the national scientific research project management mode. This "small but complete" project system enables students to experience each step of scientific research. This system also lays the foundation for future study and work. The management of each scientific and innovative project includes tracking and guidance from the approval stage to the conclusion (MacFarlane and Gourlay, 2009).

Project approval: Sources of topics may include classroom discussions, academic papers, or research projects participated in by the applicants. Applicants will defend their proposed projects in front of a panel of experts from various specialties. After a thorough discussion among themselves, the experts will approve the establishment and sponsorship of these projects depending on whether or not the projects have promising futures. Projects are divided into two types: innovative projects and entrepreneurial ventures. Projects with different levels of significance, e.g., national key project, institutional key project and ordinary institutional project, are treated with different priorities. Some projects can be allowed to apply as a national key project only after a year of successful operation and after receiving a favorable response from the experts during the defense. Such a practice stimulates the improvement and successful operation of projects. A strict standard on evaluation and defense helps students understand the difficulty of acquiring funds for scientific innovation and encourages them to maximize their opportunities. During the preparation, application and defense of a project, cohesiveness among members of the project team is gradually developed. Furthermore, members and their tutors develop improved communication, which promotes project realization. With such a practice, the fundamental purpose of scientific project approval is achieved.

Mid-term examination: The management of project implementation includes guidance from supervisors, further implementation of the project by students, development of innovation ability, promotion of practical ability and establishment of team spirit. The cycle of a common science and innovation project is 1-2 years. The college will hold a mid-term examination when the project has accomplished half of the workload. The examination includes process record, written statement and reply. The main purpose is to check project development and problems. Reviewers may also provide some opinions and suggestions, as well as supervise and encourage students whose projects have yet to be developed. Aside from supervision at the technology level, examination for reasonable fund use is also included. This practice can train students in terms of finance and schedule management.

Project conclusion: Project conclusion includes the summarization and reporting of achievements. The relevant administrative department should check and accept the project. For a single project during the conclusion period, the person in charge, supervisor and student team should work together, restructure and summarize the project from all aspects and organize experts with different backgrounds to check the project in accordance with the set goals. Conclusion is allowed for projects that meet the requirements while postponed for those that fail to meet the requirements. This approach is beneficial in developing the comprehensive ability of students. In recent years, more than 2/3 of research teams in the national and key college projects have published academic papers and have participated in the science and technology forum for undergraduates. Some of these students won titles in the "Challenge Cup" science and technology competition. These activities give the necessary advantage for students aspiring for international studies, postgraduate recommendation and postgraduate entrance examination.

Establishment of off-campus internship bases: An internship base with enterprises is established by applying for scientific research projects or cooperating in research and development institutions, thereby forming a mechanism of production-learning-research cooperation. With the deepening of cooperation, enterprises have built food safety research centers or laboratories in our campus and founded technical centers in their own enterprises under the support of our university; such establishments help them grow into high-tech enterprises (Shao *et al*., 2014). Considerable

attention is paid to the practical teaching of food quality and safety, which improves the skills of both faculty and students. The internship base can offer favorable conditions for internships within this major. The college has established over 20 fixed internship bases around the province via the mechanism of production-learning-research cooperation and the excellent performance of graduates in relevant enterprises over the recent years. More than 100 trainee positions will be offered for students during each summer and winter vacation. Students can directly participate in the production process, research, inspection and safety control of food. Moreover, students gain work experience and basic skills from practical education, which provides a transitional platform toward the workplace and increases the employment opportunity for graduates. Practical education also helps students transform their employment ideas and accurately orient their career. After graduating, excellent students can work in the company where they have interned. The principal part of students in production-learning-research practical teaching can be emphasized by maximizing the production-learning-research cooperation between colleges and enterprises, which is supplementary for in-campus practical teaching. The cooperative base of practical teaching has been founded on the basis of the production-learning-research cooperation and covers all aspects "from farm to fork," namely, from the production base and the food industry to circulation and consumption. Off-campus internship bases have various internship forms and unified arrangement or single activities are both feasible. In accordance with the interests and requirements stated in the syllabus, students can select jobs as exercitation and training to compensate for the weak classroom instruction and in-campus internship as well as to strengthen their practical capacities. Through learning and practice, students can develop excellent labor quality and expand their knowledge about the society. Moreover, they can assimilate into jobs in modern food production and security control upon graduating.

Substituted postexercitation: According to the undergraduate training scheme revised by the Ministry of Education of China, the proportion of practical teaching courses has reached 25%. However, not all practical teaching courses can carry out tangible internship because of restrictions in curriculum system and practical teaching base. In limited internships, some students cannot bear the hardship or the labor strength needed for the production process. These students may be unwilling to practice by themselves but may conduct regular visits. As a result, graduates who have low practical ability cannot adapt to their jobs quickly. Therefore, some graduates may face an embarrassing situation with respect to some aspects in their jobs. In general, enterprises prefer to assign postgraduates scientific research positions and vocational students' production and management positions. Undergraduates who are recruited for production and management positions are possibly valued for their hardworking spirit and practical ability. Food quality and safety is a major with high practicability (Yang and Chu, 2005); therefore, practice is emphasized in teaching and undergraduates need to improve their competitive skills (Fang *et al*., 2014; Zemblyas, 2006). We have recently initiated the teaching program of substituted postexercitation with a known dairy enterprise. Students continually work for 10 days and are under the company's management while working. Interns are trained to acquire professional and career qualities. They will understand the enterprise management system and learn how to cooperate with others and surpass themselves. They will also gain appreciation, experience hardship and develop enhanced manipulative ability. Students can experience every detail when working by themselves and acquire more knowledge from experiential teaching, which relies on food production and safety control practices, compared with learning from visit internships. These interns can fully grasp specialized theoretical knowledge. Overall, substituted postexercitation can improve the employment competitiveness of students.

CONCLUSION

Practical teaching plays an important role in higher education. Reforms in practical teaching have increased the willingness of students to participate in classroom teaching, practical teaching and social practice. These reforms have also markedly improved the practical and creative abilities of students. In recent years, statistics show that nearly 20% of undergraduates have published papers, some of which have even been included in the Science Citation Index and the Engineering Index. Students have also won titles in the "Challenge Cup" innovation contest among Chinese college students. According to a tracking survey of university graduates in the last 5 years, both enterprises and graduate schools have provided positive feedback on the comprehensive qualities, solid basic knowledge, practical ability and creativity of our university graduates. Educational reform is not instantly achieved; rather, it undergoes gradual improvement. Universities should carry out reforms and innovations in accordance with features specific to their facilities to explore a teaching system of food quality and safety suitable to their students and faculties, contributing to the diversity and development of talents in food quality and safety in China.

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