

Teaching-reform of Comprehensive Training of Food Physical and Chemical Inspection in Applied Undergraduate Colleges

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Abstract—Comprehensive training of food physical and chemical inspection is an important practical course for students majoring in food quality and safety. Students were required to master sample collection, pretreatment and use various analytical instruments to detect nutrients, harmful ingredients and additives in food, master data processing and analysis methods, furthermore, to master quality control. In view of the problems existing in the traditional food physical and chemical experiment, The teaching reform of comprehensive training of food physical and chemical were explored and practiced, which to a certain extent trains students' ability of correct observation, independent thinking, comprehensive analysis and scientific thinking.

Keywords—Comprehensive training of food physical and chemical; Food quality and safety; Teaching-reform Introduction

Xuzhou University of Technology is an application-oriented undergraduate college, which is guided by the concept of "big application view, big project view, big life view and big culture view", devotes itself to cultivating "high-quality application-oriented talents with social responsibility, innovative spirit, professional knowledge and practical ability to meet the needs of economic and social development". The major of food quality and safety is devoted to cultivating students with good professional ethics and humanistic scientific literacy to meet the needs of food industry and social development. They have mastered the basic theory and knowledge of modern food safety and quality control. They have practical skills in safety monitoring and quality control in the whole food process, including raw material production,

food processing, storage, transportation and consumption. Moreover, they should well know the food standards and regulations to engage in food quality inspection and control, food safety risk monitoring, food quality audit and certification and quality management in food production enterprises, food circulation enterprises, foreign trade enterprises or food safety management departments. The comprehensive training of food physical and chemical inspection is a course to check whether they have learned the analysis principles and methods of various physical and chemical indexes in food, whether the students have mastered the basic skills of experimental operation, whether they can correctly use various common instruments in the experiment, whether they have learned to correctly process and tabulate the measured data, and whether they have rigorous scientific attitude and good work style, as well as independent thinking, analysis and problem solving ability. Through the training of this course, students are required to master scientific research and experimental methods, so as to lay a solid foundation for their future participation in production and scientific research.

I. MAIN PROBLEMS IN THE TEACHING OF FOOD PHYSICAL AND CHEMICAL INSPECTION EXPERIMENT

Through teaching summary and feedback from students in recent years, the main reasons for the unsatisfactory achievement of the teaching objectives of the practical training course are: (1) In the past teaching, the course was arranged in the fifth semester, and the experiment could only be arranged in spare time that lead to no concentrated time. Because of the short experimental time, in order to save time, the

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experimental contents were taught to student, the teacher grouped and prepared the relevant reagents and instruments before class, and some experiments even pretreated the samples well. When in class, the teacher quickly explained the purpose, principle, steps and precautions of the experiment. This model result in bad effect, that the students just "draw the gourd", repeated the experiment process mechanically, and do not need to use their brains basically [1,2]. (2) One experiment item only involves to determination of one index of a sample, but other items are not related to it, which makes the content lack of systematicness. As a result, when students were required to determine and analyze the actual samples, they even can't design a complete and scientific testing program, and showed poor independent working ability. (3) In the experiment course, the students basically complete the testing operation independently, and seldom involve the process of discussion and division of labor among the classmates. In addition, the students with strong practical ability can complete the operation within the prescribed time, while the students with poor practical ability may not be able to complete the operation, which also lead to poor communication and organizational ability for the students. When communicating with students, it is found that many students simply do not understand the mechanism and principle involved in some experimental steps, and students generally reflect that they have not gained much through this training. Many students said that they had forgotten the experiment steps and principles when just finished it. When correcting the experimental report, it can also be seen that the experimental report were completed in a coping manner, and the data recording and processing were confused. When guided their graduation paper design, it was also found that many students were confused about the design research scheme and the choice of experimental analysis methods, and have no way to start the subject. After fully understanding the requirements of employers for inspection personnel and the problems faced by graduates in their work, we carried out some reforms and practices in the course of Comprehensive Training of Food Physical and Chemical Experiment [3].

II. THE NECESSITY OF TEACHING REFORM IN COMPREHENSIVE TRAINING OF FOOD PHYSICAL AND CHEMICAL EXPERIMENT

The items and contents of food physical and chemical inspection are complex. Each item involves the process of formulation and selection of methods, sampling, pretreatment, determination, data processing, result analysis, report writing, audit and judgment the results. It not only needs to master the principles and methods of determination of samples, but also needs to be deepened and improved abilities through the practical activities. However, the traditional teaching contents and teaching process only pay attention to the determination processing, but neglect the method formulation and selection, sample processing, data analysis and other links [4], which cannot meet the requirements of graduation of students and the needs of employers at the present stage. As a highly practical course, the comprehensive training of food physical and chemical experiment is responsible for further consolidating students' professional knowledge and improving students' experimental operation skills, independent working ability and

to solve complex problems capacity, and strengthening the training requirements of team spirit and comprehensive analysis, scientific thinking and innovation ability. Therefore, the construction of more scientific teaching contents, teaching process and curriculum assessment methods can enable students to have a better understanding of the teaching objectives and contents, master more effective learning methods, and better achieve the teaching objectives of this course [5].

III. REFORM AND PRACTICE OF COMPREHENSIVE TRAINING FOR FOOD PHYSICAL AND CHEMICAL EXPERIMENT

Project teaching method is a student-centered teaching method [6], which had been applied by many educators in the reform of many experimental courses, and had achieved good results. This method requires the students to complete the whole process of a project under the guidance of the teacher. Through the implementation of the project, the students can re-integrate the previous knowledge, form a relatively complete knowledge chain, achieve a true understanding of knowledge, realize the ability to analyze and solve problems with the knowledge, what's more, this mode can also train the students to master the necessary employment skills, such as practical operation ability, comprehensive analysis ability, communication and cooperation ability, develop their expand thinking and response ability.

In view of the problem that without concentrated time for this course, the curriculum arrangement of food quality and safety specialty was adjusted in the revision of the training outline of the 2015 edition. The original seventh semester was moved forward appropriately, and the practical courses such as "Comprehensive Training of Food Physical and Chemical Testing" were concentrated in the seventh semester, and four weeks were arranged for special training. This ensures that students have enough time for training.

A. Design of Teaching Content for Comprehensive Training of Food Physical and Chemical Experiment

The teaching objective of this course is to improve students' vocational adaptability and ability by letting them experience the whole process of food inspection, and to solve the contradiction between students' skills training and the actual needs of enterprises. According to this purpose, we drew lessons from the Project teaching method, and designed the teaching reform plan of this course. That is to say, relying on the "big project", the course designed "the determination and evaluation of fruit wine quality", "the determination and evaluation of dairy product quality", "the examination and evaluation of vegetable oil physical and chemical", "the measurement of physical and chemical index of Chinese sausage". Each item contains several indicators. These indicators cover the commonly used inspection methods of food physical and chemical inspection, as well as the basic operation and skills. Each student must complete at least four of these projects.

B. Teaching Process Design of Comprehensive Training for Food Physical and Chemical Experiment

For this course, we designed a practical teaching process chart, as shown in Fig. 1.

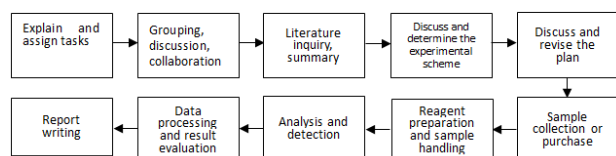


Fig. 1 Teaching process chart of comprehensive training for food physical and chemical experiment

(1) Explaining and assigning tasks

One week before the beginning of the course, all the students in this major will be concentrated on the explanation, explaining the course's teaching objectives, teaching contents, implementation plan and assessment methods. Then assign tasks according to the syllabus, students are grouped freely (4 persons each group), and select a leader for each group.

(2) Discuss the teaching content, divide the work reasonably, and determine the experimental scheme.

After the teacher sends the training contents and requirements to the students, student in each group participate in discussing, divides each big project into several sub-projects, students should consult the literature and formulate the experimental scheme respectively, and the group leader should sum the experimental scheme. After that one group is randomly selected to elaborate the whole scheme. Other groups participate in the discussion and exchange ideal, and the teacher guides the students to consult the information again in view of various questions. Solve the problem and instruct the students to revise the plan. If there are different experimental schemes for the same index, students are encouraged to use different methods to determine the same index, and national standard analysis method were necessarily selected for each index for 2-3 groups.

(3) Sampling, pretreatment and determination

According to the revised experimental scheme, each group completed the teaching content by its own division of labor and cooperation. Firstly, each group should purchase the corresponding samples, prepare the glass instruments, calculate the amount of various reagents, and make up the samples, pretreat the samples, familiarize with and debug the operation of the instruments and equipment, and determine the samples. During the whole processing, the teachers only organize and coordinate the work, discuss and analyze the problems encountered with the students. In order to make each group have enough time for experiment, the laboratory adopts access control system, which authorizes students to use laboratory to do their jobs. Students can enter the laboratory at any time within the prescribed four weeks to carry out their work.

(4) Data processing, judging results and writing reports

After the completion of a "big project", students are required to process the data, collect the data of each index of each group for analysis and comparison, all students were

concentrated for discussion. Teachers guide students to use statistics, error analysis and other methods to process the results, and analyze the reasons for data differences. For the obviously wrong results, the students in the group are required to re-test or verify them by other methods, so as to guide the students to evaluate the results by referring to the national security standards of various samples. Finally, the students are required to write a complete inspection report and summarize the training process.

In a word, this course simulates the procedures and requirements in the process of practical inspection and analysis, and tries to make students experience the specific process of physical and chemical inspection.

C. Teaching and Assessment Method of Comprehensive Training for Food Physical and Chemical Experiment

Traditionally, the assessment method of the experimental course was based on the students' attendance, operation skill, and experiment report and course examination. However, this method neglects the students' ability to retrieve, summarize literature and design experiment plan, oral expression ability and team cooperation spirit. Therefore, in view of this course, we have carried out the reform on the basis of investigating the relevant colleges and universities and listening to the opinions of the students. The evaluation of the course has been changed to final exam accounts for 50% and usual performance accounts for 50%. The final examination is based on the completion of the experimental report, including the design of the scheme, literature review, discussion and analysis of the results, etc. Usual performance includes two parts: experiment attendance (20%) and experiment operation (30%). Discipline performance is assessed according to the basic requirements of the experimental task and compliance with the rules and regulations, and experiment operation performance is based on comprehensive evaluation, including masters the experiment principle, method, procedure and experimental operation skill.

IV. SUMMARY

After a period of practice, the teaching reform of comprehensive practical training of food physical and chemical experiment has achieved certain results, such as the students' ability of literature retrieval and induction has been significantly improved, and the experimental data processing and analysis has become more scientific and standardized. But some other problems have arisen, such as teacher should spend more time for guidance, and that without enough teachers in our teaching group. Sometimes we must through WeChat or QQ to answer students' questions and guide them to do their jobs. At the same time, due to the lack of instructors, it is difficult to take into account all students and less guidance for students who are not active enough. Through questionnaire surveys, most students are satisfied with the teaching effect, but some problems in the teaching process also let us know that there is still considerable room for reform. Next step, we will carry out further reform and exploration according to students' feedback.

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REFERENCES

- [1] Pao L I , Yi-Qing D , Lei J . Discussion on Course Teaching of Food Physical and Chemical Analysis[J]. Guangzhou Chemical Industry, vol. 45, pp. 116-117, August 2017. (references) In Chinese.
- [2] WU Yong-hua, CHEN Shang-long, LIU Enqi,et al.Exploration on Action - oriented - based Teaching Method in the Food Chemistry Experiments[J]. Horizon of Science and Technology, vol. 234, pp. 57-59, December 2018. In Chinese.
- [3] CHEN Chao, MO Kaiju, TIAN Cheng, et al. Exploration of Practical Training Teaching Process of Food Physical and Chemical Analysis and Inspection [J]. Education Teaching Forum, vol. 15, pp. 99-100, April 2015. In Chinese.
- [4] DAI Juanxiu, LIU Yuguo, ZHAI Lu, et al. The problems existing in the experimental teaching of food physical and chemical inspection and its reform and experience [J]. Education Teaching Forum, vol. 47, pp. 108-109, November 2015. In Chinese.
- [5] CHEN Tiebi, LIU Dongmin, CHEN Moling, et al. Research on the teaching reform of food physical and chemical inspection [J]. Education Teaching Forum, vol. 11, pp. 108-109, March 2016. In Chinese.
- [6] LIU Yun. Application of project teaching method in food physical and chemical examination -- taking "determination of vitamin C content in fresh orange juice on market" as an example [J]. Theory Research, vol. 11, pp. 108-109, February 2013. In Chinese.