

Mixed Teaching Mode of Simulation Experiment in Food Analysis Experiment Course

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Abstract: In recent years, the information teaching platform of Chinese universities has developed rapidly, and more and more universities regard it as the primary task of teaching reform. As a kind of increasingly mature network technology, virtual simulation technology began to be used more and more in college experimental teaching. This article takes the food analysis experiment course as an example. By introducing the virtual simulation experiment content into the classroom through the mobile app, through the construction of a new experimental course teaching system, the individualized teaching design of the applied chemistry major is targeted, combined with the online course learning platform, Established a multi-dimensional teaching evaluation system, and conducted a certain degree of research on the mixed teaching model of virtual simulation experiments in food analysis experimental courses, in order to provide new ideas for the reform of college experimental courses.

1. Introduction

Food analysis experiment is an important experimental course for undergraduates majoring in applied chemistry at Xijing University, and an important practical link in the course of food analysis theory. This course mainly analyzes and tests food nutrition ingredients, efficacy ingredients, limited additives and residual ingredients. A very technical subject, this course is offered in the second semester of junior year, mainly to improve students' practical ability and lay a solid foundation for the next graduation internship, so how to design as much as possible in the existing equipment in the laboratory Experiments related to actual food analysis work are very important to improve students' practical ability. By joining the virtual simulation simulation experiment project, the virtual experiment can be effectively combined with the practical operation, and more experimental teaching projects related to the actual food analysis experiment can be introduced at the same time.

The development and application of virtual simulation experiment teaching conforms to the spirit requirements of the Ministry of Education, and meets the development trend of the deep integration of experimental teaching projects and modern information technology and the practical needs of the cultivation of applied talents ^[1]. Practice has proved that virtual simulation experiment teaching effectively compensates for the shortcomings of traditional experimental teaching, optimizes experimental teaching resources, enhances the diversification of the teaching environment and the interactiveness of experimental teaching, and overcomes many limitations of the traditional experimental environment ^[2]. Created a safer experimental teaching atmosphere and improved the experimental teaching effect ^[3]

2. Application status of virtual simulation laboratory in experimental teaching

2.1 Advantages of virtual simulation laboratory

A virtual laboratory is a software system that can simulate a specific chemical laboratory. The

virtual simulation laboratory is the product of the deep integration of professional and information technology ^[4]. It uses modern information technology to expand the breadth and depth of experimental teaching content and extend the time and space of experimental teaching ^[5], emphasizing student-centered experiments Teaching philosophy, accurate and appropriate experimental teaching content, innovative and diverse teaching methods, advanced and reliable experimental research and development technology, stable and safe open operation mode, dedicated professional experimental teaching team, continuous improvement of experimental evaluation system and remarkable demonstration of experimental teaching effect. There are many advantages to using virtual laboratories to replace and supplement real laboratories in teaching:

(1) The virtual laboratory simulates some food analysis experiments that are difficult to achieve in the school laboratory, and can also model objects, processes, and phenomena that cannot be observed in reality.

(2) The virtual laboratory does not need a specific laboratory. As long as there is a computer, the virtual experiment operation can be carried out. Even only a mobile phone app is required, and the student can start the virtual experiment without time and space restrictions.

(3) Saving experimental costs: Some food analysis instruments (large-scale instruments) are often too expensive. Take the experiment of detecting volatile flavor substances in lamb products by GC-MS. The price of the GC-MS is too high. For the existing GC-MS in the laboratory, due to the scientific research tasks of the teachers in the school, it is often necessary to make an appointment in advance. At the same time, the price of the experimental equipment is expensive. The general domestic machine is about 700,000 yuan. Imported machines can even reach 1.1 million yuan, and the economic cost of conducting experimental teaching is too high, which is not conducive to the construction of experimental courses.

(4) For some experiments that are more tedious, require more experimental equipment, and have an excessively long experiment time, it is impossible for all students to participate in the sample test. Therefore, students often have varying degrees of mastery of the experiment and the teaching effect. At a discount, and using a virtual simulation laboratory to conduct experiments, only need to follow the relevant prompts on the students' respective computers or mobile phones, and multiple people can participate in the experiment at the same time.

(5) The interestingness of the virtual simulation experiment project can improve the students' initiative and learning efficiency, which is the full reflection of the effective teaching concept in the teaching.

2.2 Application status of virtual simulation experiment teaching items

In 1989, American scholar William Wolf first proposed the concept of virtual laboratory ^[6]. The construction of virtual laboratories in developed countries has been popularized, and universities and scientific research institutions have successively carried out the construction of virtual laboratories and applied them to teaching and scientific research ^[7-9]. The construction of virtual laboratory in our country is getting more and more attention. Since 2018, the first batch of 105 virtual simulation experimental teaching projects has been set as the first batch of national virtual simulation experimental teaching projects. So far, 3 national virtual simulation experimental teaching projects have been carried out consecutively. Various universities also actively responded to the call to develop virtual simulation laboratories for various majors, such as Tsinghua University, Peking University, Beihang University, Beijing Institute of Technology, etc. ^[10-13]. So far, 239 universities have joined the national virtual simulation experiment project sharing platform.

Dalian University of Technology Zhang Yongce et al. ^[14] designed and constructed 1,3-decadiene under anhydrous and anaerobic conditions for experiments under anhydrous and anaerobic conditions that are difficult to open due to high requirements and high costs in basic experimental teaching. Synthesis and characterization of virtual experiments. It clarifies the experiment content and development significance, and introduces the design idea, operation steps and application effects of the virtual experiment. Teaching practice feedback shows that students have increased their interest in hands-on practice through virtual experiment previews and operations, expanded

research horizons, and exercised innovative thinking and abilities. Teachers enrich the classroom content through virtual experiments, and at the same time, through active teacher-student interaction, they can further optimize instructional design.

Jiangsu University Zhang Wen et al. [15] introduced virtual teaching experiment methods as an important supplement to the traditional teaching methods. The virtual teaching environment is realized through the browser and server architecture (B / S architecture) and 3D simulation technology, and further through vivid image teaching environment. The flexible and detailed assessment plan has improved students' engineering practice skills and cultivated the ability to think independently and solve problems. Aiming at the teaching of more than 500 third-year undergraduates and first-year postgraduates in related majors, the goal of "dual-oriented engineering and scientific research" has been basically achieved.

3. "Food Analysis Experiment" Mixed Teaching Mode Design

3.1 Constructing a new system of food analysis experiment courses

The food analysis experiment course includes 6 items offline, including 4 offline experimental items, each offline experimental item has a teaching time of 3 hours, a total of 12 hours, and is employment-oriented. The actual case is introduced into the experimental course teaching. Through virtual teaching methods and methods, combined with online teaching, 2 online experimental projects are set up, each online experimental project has 2 hours, in order to strengthen students' practical teaching.

The author uses the "MLabs" mobile app as a tool to integrate the two experiments of zearalenone detection virtual simulation experiment and GC-MS detection of volatile flavor substances in lamb products into experimental teaching.

All the experimental contents of the above two experimental projects were moved to the online platform, and the proportion of the assessment results of the two experimental projects in the final grade of the experimental course was increased.

3.2 Personalized teaching design for applied chemistry major

Food analysis is actually the application of analytical chemistry in the food discipline. Most of its experimental projects will use the commonly used experimental methods in analytical chemistry experiments, such as extraction, steam distillation, chromatography, etc. Therefore, for students of applied chemistry. In terms of, the experimental methods used in the offline experimental project are not new, so it is particularly important to enrich the experimental content and increase the creativity and fun of the experiment. Introducing virtual simulation experiments into experimental teaching classrooms through the "MLabs" app can not only attract students' attention, but also increase the fun of experiments. The realization is mainly based on the offline experimental project (real), supplemented by the online experimental project (virtual), and the combination of virtual and real to achieve the abstract image display and virtual make up for reality.



Figure 1. Virtual simulation experiment of zearalenone detection

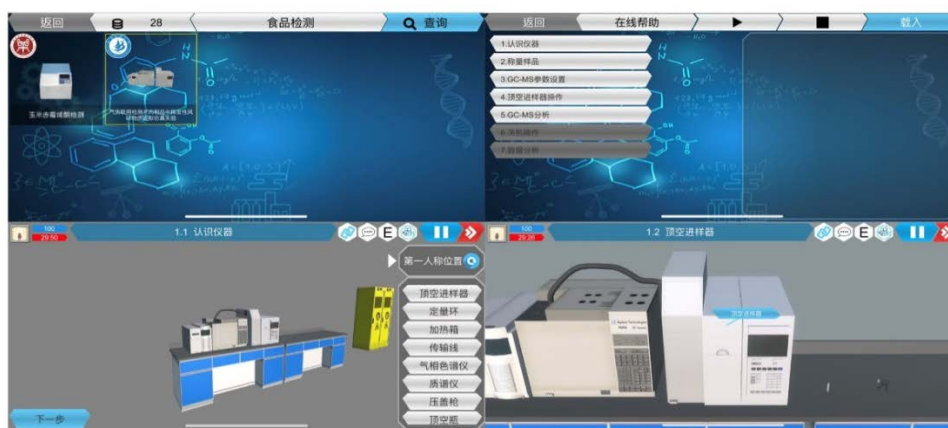


Figure 2. Virtual simulation experiment of GC-MS detection of volatile flavor compounds in lamb products

As shown in Figure 1 and Figure 2, the virtual simulation experiment software function of zearalenone detection and GC-MS detection of volatile flavor substances in lamb products are simulated dynamically through the two experiments. At the same time, whether it is an online or offline experimental project, students can watch courseware and videos through the existing online learning platform of the course, preview in advance, operate the entire process of the experiment through the mobile app, and can leave feedback on each step of the experiment, Teachers give timely feedback to achieve interaction. For offline experimental projects, students can achieve classroom interaction through the laboratory teaching process. For online experimental projects, students' feedback channels are increased. In addition to giving feedback on specific implementation steps in the app, you can also post messages on the course network teaching platform, or you can Through the timely communication software, the screenshots of the experimental steps are fed back to improve the learning efficiency, and the experimental site is not fixed in the laboratory, avoiding contact with the experimental drugs, eliminating the potential safety risks of the experiment. In addition to the two virtual experiment projects added in the course, students can also self-study other virtual experiment projects through mobile phone software to broaden their knowledge.

3.3 Establish a multidimensional teaching assessment system

Relying on the process of big data analysis and designing the teaching evaluation system that matches the course objectives, while emphasizing comprehensiveness, it also considers practicability and operability, diagnosis and guidance. Its evaluation dimension includes attitude, learning ability, experimental ability and so on. The evaluation method adopts a combination of student self-evaluation, peer evaluation, teacher evaluation and system software evaluation. The details are shown in Table 1:

Table 1. Mixed teaching evaluation system of food analysis experiment

Type	Project	Content	Method	Proportion
Formative Evaluation	Attitude	Class Performance (Attendance, Teamwork), Experiment Safety, Experiment Completion	Teacher Rating	15%
	Learning Ability	Related Courseware, Video Watching Time	System Scoring	15%
	Experimental Ability	Experiment Operation Offline	Teacher Rating	20%
Experiment Operation Online		Software App Rating	20%	
Summative Evaluation	Experimental Report	Experimental Report Standardization, Experimental Report Completion	Self-Evaluation, Mutual Evaluation	30%

It can be seen from Table 1 that although there are only two virtual simulation experiment items, the evaluation weight is the same as the offline experiment items, and the software scoring is more objective and true.

Conclusion

This article demonstrates the integration of online learning platforms and physical experiment courses. Through the introduction of embedded teaching and other teaching modes, the introduction of virtual simulation experiment content, various teaching modes are improved and complemented. Evaluation and other facets of the university's experimental course information teaching platform construction were analyzed. This research can provide new ideas for the development of information literacy education in colleges and universities, and realize the information literacy education model based on small-scale online virtual simulation experiment courses, and continue to improve in practice. I believe that with the continuous improvement of new technologies such as 5G network technology and VR technology, there will be more and more experimental courses that incorporate virtual simulation experiment content. While improving the teaching efficiency for college teachers, they can also stimulate students to a greater extent Enthusiasm for learning.

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