Design and Application of Participatory Teaching in Biology Teaching in Secondary Vocational Schools

-- Take “Beer Fermentation Engineering Experiment” as an Example

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Abstract

"Beer Fermentation Engineering Experiment" is a highly practical experiment in brewing technology, which is of great significance to improving students' practical ability. Participatory teaching can guide students to actively participate in experimental courses, and the participatory teaching model can guide students to actively participate in the teaching process, maximize the role of students as the main body, and improve the teaching effect of experimental courses [1]. The introduction of participatory teaching into the teaching of "Beer Fermentation Engineering Experiment" has changed the teaching mode and promoted the interaction between teaching and learning. Students have changed from "passive instillation" to "active learning", which effectively improved students' active exploration, independent analysis and The ability to deal with exercises is conducive to the cultivation of innovative spirit and enhance the quality of experimental teaching.

Keywords

Participatory teaching; Beer fermentation engineering experiment; Secondary vocational biology teaching.

1. Introduction

Participatory teaching means that teachers and students participate in learning activities on an equal footing, discuss problems in learning together, and implement teacher-student interaction and teaching each other in teaching activities. Participatory teaching is an educational activity that emphasizes that students participate in the activities of "learning" and "teaching" as the main body of teaching. Through the promotion of democratic and equal dialogue relationships, teacher-student interaction, student-student interaction, and students consciously participate in learning activities. Participatory teaching transforms the main participants of teaching from a single teacher to a model with students as the main body and teachers participating together. This change can enable students to intervene in the whole process of teaching, thereby maximizing the effect of teaching.

"Beer Fermentation Engineering Experiment" is an experiment included in brewing technology, and it is a practical experiment for agricultural secondary vocational students to focus on the cultivation of technical skills with employment as the orientation. Through the exploration of the experimental courses, students’ understanding of basic knowledge is deepened, and through experimental learning, students are trained to discover, analyze and solve problems and practical hands-on skills. However, nowadays, the experimental courses of secondary vocational schools mainly involve teachers preparing experimental materials before class. Teachers use PPT as the carrier to explain the experimental purpose, principle, content and experimental operation process one by one. This is not in line with the core mission of
secondary vocational schools to train professional and applied skills talents that meet the needs of social development and enterprises.

In order to enable secondary vocational students to master solid experimental operation techniques in teaching, and to be in line with future employment, the author uses "beer fermentation experiment" as the teaching content, infiltrating the participatory teaching mode, so that students' interest in learning biological experiments will be improved. To understand the original boring theoretical explanation and complicated operation process, increase the degree of student's learning input [2]. The experiment uses fermented malt as the raw material, and the experiment process is simple to operate and has strong operability, which is easy for students to master.

2. Experimental Teaching Content

This experiment is divided into three classes to complete the teaching. Before the start of the course, the teacher instructs the students to divide into groups, and the groups can be combined freely, with 5-6 people in each group. The group leader is selected from the group and the group leader responsibility system is implemented. One student was selected to prepare experimental materials through group discussion, and one student was to take photos and videos and record the experimental records. In the experiment, the team leader arranged specific work for the members. With the cooperation of the group leader, the management of the teachers is more convenient, and the enthusiasm of the students' experimental operation is more easily mobilized. The first lesson: the preparation of wort. The students learned the characteristics of beer fermentation through the previous theoretical study, and they had a certain understanding of the basic knowledge and characteristics of beer fermentation. The preparation process parameters of wort were discussed in small groups. Students in different groups adjusted the concentration of wort to conduct experiments on their own. Finally, they conducted group discussions and continued to sum up their experience. The second and third class hours: the fermentation of beer. During the fermentation stage, monitor the beer fermentation at different temperatures, such as the color, brightness, foam, aroma and taste of the beer, and evaluate the sensory quality. The main purpose is to allow students in each group to experience the quality difference of beer fermentation at different temperatures. Finally, each group discussed the optimum temperature for the main fermentation of beer, and learned to evaluate the quality of beer.

2.1. Preparation of Experimental Materials

From the purchase of raw and auxiliary materials to the pre-processing of raw and auxiliary materials, the students are all arranged by themselves, and the instructor will assist in contact, guidance and supervision. The teacher guides the students to look up the raw materials for beer making, and guides the students to go to the brewery to purchase raw materials (including malt, rice, hops, yeast, etc.) independently as a group. The students independently purchase raw materials to cultivate students' communication skills and coordination between groups The ability of cooperation and the ability to bear hardships and stand hard work lays a solid foundation for the employment of secondary vocational students [3].

2.2. Experimental Operation Process

This operation is mainly divided into two modules. The first part is the preparation of wort; the second part is the fermentation of beer.

2.2.1. Preparation of Wort

Preparation of wort This part of the operation requires students to be familiar with the preparation process of wort and prepare raw materials for beer fermentation. It includes several processes such as saccharification of materials, filtering wort and boiling wort. The
students in small groups conduct independent experiments. The teacher instructs the students to check the equipment and raw materials one by one. Each group carried out independent experimental operations. Weighed a certain amount of barley smashed by the EBC grinder, and added 46~47 ℃ brewing water according to the ratio of material to water ratio of 1:4. After maintaining for 40 minutes, the temperature was raised to 63 ℃ (1 ℃/min), keep for 30min; then increase the temperature to 70 ℃ (1 ℃/min) and maintain for 20min, then carry out iodine test; after the iodine test is normal, increase the temperature to 76~78 ℃ (1 ℃/min), keep it for 10min, and filter. The wort is filtered and then boiled. The boiling time is 80 minutes. The hops are added. The group discusses the amount of hops to add 0.1%, 0.2% or 0.3%. The hops are added in 3 times. When the boiling starts, add 1/2, and boil half Add 1/4 hours later, add 1/4 10 minutes before boiling is complete [4]. After the boiling is completed, the sediment is filtered, the wort is cooled to 6~8°C, and the wort concentration is adjusted to 11°P and 12°P for use. Finally, perform equipment flushing and experiment records.

2.2.2. Fermentation of Beer
The operation of the beer fermentation part is mainly to allow students to observe the characteristics of the beer fermentation process and have a grasp of the law of yeast fermentation. Students have learned the concept and related knowledge of beer fermentation in the previous theoretical class. Due to the limitations of laboratory conditions and the long fermentation cycle time, the observation teams of the fermentation process used the free time within one week after the experimental class to evaluate the yeast propagation period, foaming period, high foaming period, falling foaming period and foaming period of the whole fermentation process. Observe and record the cover formation period and other five time periods. The group carried out autonomous operations to inoculate a ring of slant yeast strains into a 10mL wort test tube, cultured at 28°C for 36h, first shake it evenly, add the removed 1mL bacterial solution to the 9mL wort test tube and place it in 25 °C constant temperature box 36h, take out for mixing, pour into 250mL Erlenmeyer flask containing 70mL cold wort, put it in 23 °C constant temperature incubator for 48h, take it out and put it into 4 °C constant temperature incubator for 12h to settle yeast mud, Discard the supernatant and transfer the yeast mud to 250mL wort culture medium (500mL Erlenmeyer flask), shake well, install the fermentation plug and seal with water [3], each group discusses 10 °C, 12 °C, 14 Fermented at °C and 16 °C for 7 days to observe the fermentation situation.

2.2.3. Discussion and Summary of Each Group
After the fermentation is completed, the finished work is obtained, filtered, and sterilized. The teacher collects the beer made by each group and puts them into the same beaker for evaluation. Each group selected a representative to form an evaluation group to evaluate the color, foam, aroma, and taste of the beer in the beaker, and select the best beer. The members of this group shared the video and operation points, and other groups made supplements in time. Finally, it was concluded that the fermentation temperature was 10°C, the added amount of hops was 0.1%-0.2%, and the wort concentration was 11. At P, the overall effect of beer fermentation is better. Finally, teachers should pay attention to the key points during the experiment. Each group cleaned the operating instruments, summarized the experimental materials obtained, and the group completed and submitted the experimental report as a unit.

2.3. Experimental Teaching Assessment and Evaluation
The evaluation of the completion of the "Beer Fermentation Engineering Experiment" with a single course sign-in and report cannot truly reflect the students’ understanding and operation level of the beer fermentation experiment. Therefore, in the "Beer Fermentation Engineering Experiment" integrated into participatory teaching, attendance accounted for 10% of the total score, team members' mutual evaluation accounted for 10%, random operation accounted for
40%, report collation accounted for 15%, and teacher evaluation accounted for 25%. Because the concentration and temperature of the wort selected in the experiment are different, the analysis of the experimental results is not the same, which can prevent each group from copying each other. This whole-process tracking assessment can directly and clearly reflect the problems of students in the operation process, and indirectly enhance the enthusiasm of students to integrate into the classroom.

3. Summary of Experimental Teaching

The teaching of "Beer Fermentation Engineering Experiment" has a strong subjectivity and practicality, and each link has more knowledge points to summarize. Therefore, in the experimental teaching, the use of participatory teaching methods can fully mobilize students' enthusiasm and improve students' knowledge points in order to realize the change from "students passively accept learning" to "students actively explore and learn" [5]. The students' communication skills and teamwork skills have been further strengthened, which will be of great help to work in the future [6]. In the beer fermentation engineering experiment class, group collaboration can design and choose experimental schemes. Different groups of students get different experimental results. Finally, the groups will discuss and communicate to improve their ability to analyze and solve problems and cultivate students' creativity Ability to enhance students' enthusiasm for brewing technology.

References


