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Teaching Reform and Practice of Storage and Processing of Fruits and Vegetables Curriculum Based on OBE Concept

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Abstract: In order to improve the quality of curriculum teaching under the background of new engineering, it was necessary to explore OBE concept integrate into storage and processing of fruits and vegetables curriculum. Teaching reform of the curriculum was implemented from the aspects of optimizing teaching content, reforming teaching methods and means, and improving assessment methods. The practices showed that the blended online and offline teaching reform mode, which the online teaching platform of ChaoXing Learning Platform + Tencent Meeting + QQ group (or wechat group), can fully mobilize students' subjective initiative in learning, cultivate students' autonomous learning ability, and good teaching results have been achieved.

1. Introduction

Outcome-based education (OBE) was proposed by Spady et al., in the 1980s, and quickly became the mainstream teaching reform concept of engineering education in European and American universities, focusing on students' learning outcomes [1-4]. China introduced and implemented after becoming a full member of the Washington Agreement in June 2016, and is now actively promoting OBE. Its core concepts were student-centred, results-oriented and continuous improvement [5]. OBE was an educational concept oriented by students' learning outcomes and carried out talent training according to needs. The essence of OBE was that teachers should not only comprehensively consider the specific requirements of society and enterprises on graduates' professional knowledge, ability and quality when designing teaching, and also according to these requirements, the reverse design of teaching objectives and teaching content should be carried out, with the emphasis on teaching results as the starting point, and the teaching design should be carried out through reverse calculation. The teaching should be centred on students, and the whole process and all-round attention should be paid to students' learning results in order to achieve the improvement of teaching quality [6].

In teaching, the introduction of OBE concept and the teaching reform oriented by students' learning outcomes can greatly mobilize students' learning autonomy and enthusiasm, and improve students' learning effect of storage and processing of fruits & vegetables curriculum. It will play a pivotal role in the goal of cultivating talents capable of solving complex engineering problems in the food industry.

2. Optimizing Teaching Content

Based on the OBE concept, the content system of storage and processing of fruits and vegetables curriculum was integrated and divided into two modules, fruits & vegetables storage and fruits & vegetables processing, of which, fruits & vegetables storage module consisted of fruit & vegetable storage and preservation knowledge, technology, and major fruits & vegetables storage methods. fruits & vegetables processing module included the fruits & vegetables canning processing, dried fruits & vegetables processing, fruit wine and vinegar brewing, fruit & vegetable sugar products processing, vegetable pickling processing, fresh-cut fruits & vegetables processing, fruits & vegetables frozen products processing and fruits & vegetables by-products utilization, and so on. No less than 400 teaching resources and materials were reconstructed. The specific teaching content was divided into 3 stages: self-study before class, classroom teaching content and post-class extension content, and the classroom time was mainly used for the explanation some difficult points and key points, with the help of "Cloud Classroom" APP platform to deepen understanding, so as to obtain better teaching effect.

3. Reforming Teaching Methods and Means

3.1. Improving Teaching Methods and Enriching Means

Based on the OBE concept of blended teaching, we focused on heuristic teaching, case teaching and project teaching, with students as the centre and teachers as the leader. Relying on the online curriculum Storage and Processing of Fruits and Vegetables which built by our teaching team on Chaoxing Learning Pass (https://mooc1-1.chaoxing.com) and Xueyin Online Platform (https://www.xueyinonline.com). We used it as an online resource, and on the basis of offline teaching in the classroom, the blended online and offline teaching reform mode was adopted [7,8]. Through the online teaching platform of Chaoxing Learning Pass + Tencent Meeting + QQ group (or WeChat group), students were guided to conduct group discussions, literature review, class PPT production and inter-group evaluation of assignments to cultivate students' teamwork spirit. Meanwhile, the whole teaching process focused on combining theory and practice [9], forming a progressive teaching mode from basic theory to basic experiments, highlighting the characteristics of combining theory and practice in the curriculum.

3.2. Deepening integration of Science and Education, Building Practical Teaching Platform

We integrated scientific research into teaching from different levels, and it played the role of scientific research in promoting practical teaching results. The teaching process was transformed from the disconnection of science and education to the integration, so as to improve students' practical innovation ability, which had a very strong comprehensive education function.

3.2.1. Introducing Research Results into Classroom

Teachers of the research group pay close attention to the industrial problems and latest progress in the field of fruit and vegetable processing, and carry out scientific research on the bottleneck

problem of processing and preservation, then integrate the new scientific research results into teaching through short and concise cases. For example, during the production process of blueberry jiaosu, the scientific research example, how to maintain the stability of anthocyanins, was discussed in the form of a team, so as to fully stimulate students' interest in learning. Furthermore, in the storage and preservation of fruits and vegetables, the latest research results of irradiation preservation technology and low-temperature plasma technology were introduced to teaching contents.

3.2.2. Facing the Needs of Fruits and Vegetables Processing Industry and Solving Complex Scientific Problems

According to the fruits and vegetables industry needs, the teachers put forward the scientific problems, let students consult literature and propose a solution in teams. The teachers evaluated the plan proposed by the students and pointed out the existing problems. After students revising and improving the scheme, they will conduct research and group report. This method can improve the students' ability of autonomous learning and the ability to solve the complex scientific problems in the field.

3.2.3. Building Practical Teaching Platform

Students were encouraged to enter the scientific research laboratory and practical teaching platform of teachers, carry out innovative experimental research according to the content taught in class, and achieved the goal of cultivating high-quality innovative food professionals through the integration of science and education. Based on Heilongjiang Agricultural Product Processing Engineering Technology Research Centre and other provincial and ministerial scientific research platforms, the positive interaction between experimental teaching content and scientific research, engineering and social applications was realized. By making full use of the experimental centre and practice platform/base on campus, students’ ability to solve complex engineering problems can be significantly improved. In recent years, based on the principle of mutual benefit, we have established the practice and employment base with the fruits & vegetables enterprises in the reclamation region of Heilongjiang and the surrounding area of Daqing. According to different teaching contents, teachers led students to go out of the classroom, learned the production process of fruit and vegetable products in the factory, which can promote the continuous improvement of the curriculum [10]. For example, for the production process of fruits and vegetables juice, the course team established a stable cooperative relationship with Heilongjiang Baisen Beverage Co., Ltd, and led students to the factory to learn the relevant production process, sterilization and other key technologies.

3.3. Strengthening Process Assessment and Innovating Curriculum Evaluation Mechanism

In the traditional teaching process, the total score of storage and processing of fruits & vegetables curriculum was generally composed of the final examination score (80%) and the usual performance score (20%). Since the implementation of blended teaching in the spring of 2020, we have strengthened the process assessment, including classroom exercises, unit tests, unit assignments, online video learning, classroom discussion, etc., into the course evaluation indicators. The total score of the curriculum was adjusted to account for 60% of the final examination and 40% of the process assessment. Beginning in the spring of 2021, we have strengthened the teaching reform based on the OBE concept, the inquiry-based practical teaching link was added in the process assessment, and the exploratory questions with “non-standardized answers” were added in the final examination. Therefore, the scores of the process assessment and final examination

accounted for 50% respectively, which innovated the evaluation mechanism of the curriculum.

4. Reforming Teaching Methods and Means

4.1. Teaching Implementation

Taking the curriculum of storage and processing of fruits and vegetables as the object, the online and offline blended teaching mode based on OBE concept was designed. The teaching time of this study started from the second semester of the 2019-2020 academic year, and two classes of undergraduates majoring in food science and engineering were selected as objects. Teachers released 64 teaching videos related to this course through Chaoxing Learning Pass, with a total video duration of 592 minutes, and there were 401 course resources, 436 exercises and assignments, 39 PPTs, 15 experimental contents, and 305 learning materials and reference materials. The teacher distributed the group learning tasks, and checked the completion of each student's task points and self-test test situation. Students independently studied the learning resources provided by the teachers and complete the self-assessment questions. Students watched the task video carefully, made clear the task requirements, mastered the knowledge points and understood the realization ideas of practical training. In online and offline teaching, teachers explained the key and difficult points of teaching contents by theme discussions, in-class tests, and answer the questions. Teachers focused on refining knowledge points, explained them in a targeted manner, and talked about weak points. After class, they will use online communication to answer questions. During the training process, team building documents, training programs, and practical task decomposition were formulated in groups, and the division of labour and schedule of personnel were clarified to complete the training report. Teachers guided students in practical training and made summary evaluations, and students were divided into groups to evaluate each other.

4.2. Teaching Effect

Through the introduction of online and offline blended teaching based on OBE concept in the course of storage and processing of fruits and vegetables, the communication ability, cooperative consciousness, creative thinking and critical thinking of students were cultivated, and the initiative of autonomous learning was enhanced. Good teaching effects were achieved. The blended online and offline teaching has changed the teaching process from teaching before learning to learning before teaching. Teachers used the time of direct interaction between teachers and students to carry out a variety of activities to solve problems and help students improve their ability, which enhanced students' classroom interaction enthusiasm and reduced the failure rate significantly. The teaching concept focusing on learning outcomes improved students' innovative thinking ability, reflected the high-level, innovative and challenging content of the curriculum, and laid a foundation for the cultivation of high-quality and innovative food professionals [11,12]. Up to now, the total online learning times of this course have reached 2,337,330, and the cumulative interaction times have reached 9,216. Since 2019, relying on the storage and processing of fruits and vegetables curriculum, students have participated in innovation and entrepreneurship competitions at all levels. They have won 3 gold awards, 9 silver awards and 15 bronze awards in the provincial “Internet +” competition.

5. Conclusions

Since the food science and engineering major of the University passed the engineering certification, it has been strictly implemented the OBE teaching concept, emphasized the student

output as the guidance, and realized the overall optimization of the course teaching content and system through the course reform. The classroom teaching methods and means were reformed with students as the centre, teachers as the leader. The blended offline and online teaching has been realized by the construction and application of Chaoxing Learning platform. Teachers and students in the classroom interaction effect was better than before and also greatly stimulated students' enthusiasm and interest in learning.

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