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APPLICATION OF PBL METHOD IN BEVERAGE TECHNOLOGY TEACHING

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ABSTRACT

The characteristics of Beverage Technology were analyzed, and PBL method was applied in Beverage Technology teaching. Application procedure consisted of four processes: selecting cases and constructing situation, solving problem and promoting student to acquire knowledge, forming cognitive structure through learning transfer, and popularizing application and consolidating teaching effect. Implementation of PBL method could animate classroom, enhance experimental teaching, increase student technological innovation, and help students obtain employment. PBL method is quite effective in Beverage Technology teaching.

Keywords: Beverage technology, Food science, PBL method, Teaching research, Teaching model, Pedagogy.

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Contribution/ Originality

The paper's primary contribution is finding that implementation of PBL method in beverage technology teaching could animate classroom, enhance experimental teaching, increase student technological innovation, and help students obtain employment.

1. INTRODUCTION

Beverage is the name commonly given to a nonalcoholic drink. People are fond of beverage owing to its nutritious ingredients, tasty flavor, and convenience to consume. In recent year, the beverage industry of china develops fast, and the total beverage production had reach to 150 million tons in 2013, with an average annual growth rate of 20 percent in the last twelve years (Chyxx, 2014). Meanwhile, many new technologies are applied in beverage industry and new varieties constantly emerge in market. Accordingly, beverage industry needs much high-qualified personnel. Beverage technology is one of specialized curriculum of food science and engineering specialty. At present, most universities and colleges strengthen the teaching of beverage

technology in succession, especially emphasizing the students' ability to acquire and apply knowledge.

Problem-based learning (PBL) is a student-centered pedagogy in which students learn about a subject through the experience of problem solving. It was firstly applied by Howard Barrows, an American neurology professor, in the late 1960s at McMaster University in Canada. Nowadays, as an advanced pedagogy, it was widely accepted. Though PBL method was originated of medical teaching, other subjects such as computer, commerce, food science, and so on, were also adopt the pedagogy, acquiring some good effects in recent years (Ersoy and Başer, 2014). In brief, PBL method includes three main factors, namely problematical situation, student and teacher. Problematical situation is the core of PBL pedagogy. In terms of psychology, problem was divided into two kinds. One is structure-good field that the solving process and answer of the question is regular. The other is structure-bad field, namely the process and answer is flexible and the question needs to be solved according special circumstances. The PBL question belongs to structure-bad field and it could not be solved with traditional method. When student views the question from several angles, the question problematical situation designed was able to attract and maintain the interest of student, prompting that student actively looked for possible methods to solve the question. Students try to identify the question and explore answer. Furthermore, they need to understand the realistic significance of solved question and become Self-Directed Learning. The PBL group consist of 5~7 students, who can fully reveal their own intelligence and provide the best scheme to solve the designed question through collaboration (Ruiz-Gallardo *et al*., 2011). The teacher as a guider ensures that the learning process successfully proceeds. The teacher's duties include providing study materials, guiding the students to learning actively, and monitoring the whole learning process. One of the most important duties of teacher is to help the students by using the question when the students solve the designed question. Thus, the teacher should have the skillful technique to ask question. This work was to explore how the PBL pedagogy was applied in beverage technology teaching. It may further improve teaching effect of beverage technology or provide reference for other curricula teaching in food science and engineering specialty.

2. CURRENT CURRICULAR FEATURES OF BEVERAGE TECHNOLOGY

2.1. Tedious Enumeration

At present, the knowledge system of beverage technology usually is comprised of two parts. One part is input materials, such as water, raw material, subsidiary materials, and package materials. The other part is production technologies of various beverage including carbonated drink, fruit juice, protein drink, tea drink, solid drink, and so on. So the contents are tedious. In limited class time, the teacher only simply lectured every drink process and the students were inculcated with mechanical knowledge. Under these models, students' interesting often is low and the teachers also feel vapid. In order to inspire the students to think, the problems met in

beverage production process were introduced into textbook in recent years. Teachers want to increase the students' passion by means of analyzing realistic beverage question.

2.2. Dissociation between Learning and Application

Since production processes of various beverages are quite similar and much knowledge is general, beverage technological knowledge usually seems simple. However, as a matter of fact, beverage enterprises suffer many different problems in production, such as juice browning, protein drink precipitation, flavor deterioration of solid drink, and so on (Wu, 2014). Facing those questions, the scientific researchers of beverage enterprises or university work hard. Yet those questions still often trouble particular beverage enterprises actually. For example, thermo-acidophilic bacteria (TAB) of apple juice concentrate, a microorganism leading juice to awful smell, gives rise to great damage to fruit juice companies (Torlak, 2014). However, according to the current teaching models, the question met in beverage production was not adequately introduced in textbook. Though the question was occasionally referred to in textbook, some ambiguous measures to solving the questions were provided, which mean little to mastery of beverage knowledge in terms of students. Furthermore, almost all curriculums in university face a trend of reducing class hour at present, and each beverage impossibly occupies too much time.

2.3. Quickly Updated Knowledge

Beverage industry fast develops, and new technologies and varieties constantly follow. Some focuses of research in the early 2000s including enzymatic technique, ultra filtration, reverse osmosis and Ultra High Temperature have been successfully applied in beverage enterprises as ordinary techniques (Chen *et al.*, 2012). And some new varieties in previous years such as compound beverage, medicinal herbs drink, and flavor beverage have been sold everywhere at present. In order to suit the society demand to qualified personnel in beverage industry, the knowledge of beverage technology has to be updated according to beverage industry development.

2.4. Overall Viewpoint

To acquire the best benefit, some goals such as quality, cost and output were considered as a whole according to beverage production line features. Each goal reached to optimal effect through reasonably combining related working procedures. Only depending on one procedure or several simple procedures, the best benefit could not be effectively achieved. Now take the maximum output as an example. The parameters related to output in each working procedure were adjusted to the higher value and the on-line time of intermediate materials were also reduced as much as possible. Furthermore, the time of washing line was properly compressed under the quality guarantee. Thus, the output may reach to the highest in limited time. If the quality was effectively controlled, the machinery of production line should continuously run. And the material must be constantly supplied, even if the machinery runs at the quite low parameter. Persistently running

of machinery is beneficial to make the beverage avoid to be contaminated from microorganism during production process. Particular emphasis needs to be paid attention to in overall viewpoint. We should know which procedure is crucial to quality, which procedure is related to output, and which procedure may be developed to reduce the cost. One procedure influences the overall line in some sense and all procedures should harmoniously run.

3. PRACTICAL APPLICATION OF PBL IN BEVERAGE TECHNOLOGY TEACHING

3.1. Elaborately Selecting Cases and Constructing Problematical Situation

Typical cases such as fruit juice browning, microbial pollution, and precipitation should be usually selected when applying PBL pedagogy in beverage technology teaching. The cases are derived from textbook, enterprise practice, or teacher design. Critical characteristics of good cases could prompt successful running of the teaching plan. When students learned through the cases, they could found anywhere related information that help themselves understand the selected cases. We still take controlling TAB as an example. Microorganisms in apple juice usually could be killed at 98℃ with 60s, but TAB could be extinguished at least 130 ℃ which destroyed the nutrients and flavor of concentrate apple juice in such high temperature. Before teacher provided the cases of TAB in beverage class, the process of producing apple juice concentrate should be firstly completely introduced to students. Thus, the students are directed to a production scene in imagination.

3.2. Solving the Simulative Problem and Acquiring Knowledge and Ability

The students were divided into several groups of 5~7 students each. In group, each member was responsible for the success learning. When the learning need was identified during the process of learning cases, each member would receive a basic question and become the host of certain question. Facing a case or situation, members should firstly recognize the immanent facts (what they know) and study by talking about the facts. The students were encouraged to express their several opinions. Then related idea or hypotheses (how some facts interact) were provided by the students. Next, they identified learning wants that testified whether their hypnosis is right. The students may directly argue in class room, indirectly consult technical data by use of internet web and library, or ask for advice from professor (Turan *et al*., 2012). Even they verify their idea in laboratory through designed experiment in their spare time.

For example, TAB was controlled in apple juice process. What's the damage of TAB in apple juice? Where it come? Why and how it could be effectively controlled? Are the adopted measures effective? Facing a series of questions, each member necessarily deeply thinks. Teacher guide the students to analyze above questions by appropriately asking. TAB mainly comes from raw material contacting soil. In addition, if the beverage production lines are not washed completely, TAB could also appear. The reason that the TAB could hardly not be controlled as followed. On one hand, the nutrients and environment condition of apple juice is quite suitable for growth of

TAB. On the other hand, TAB spore was fairly heat resistant, so conventional heating method could not killed it. Once TAB appears, the flavor of apple juice would seriously deteriorate. Some measures may be adopted to control TAB. The raw materials and production lines were completely washed. Accordingly, the washing frequency and temperature, concentration and category of cleaning agent should be seriously selected. Especially the still corners of pipes and tanks have to be thoroughly cleaned. In addition, apple juice should be continuously produced and be packaged as early as possible, which could prevent TAB from growth in production line. Thus, the burden in sterilizing procedure was reduced, and the nutrients and flavor were preserved at the maximum degree. Now, the adopted measures need to be verified. The students may argue through microorganism knowledge or do some experiment in beverage laboratory to verify the related measures. If the conditions permit, they visit some local enterprise manufacturing apple juice and investigate the realistic measures. During the process of controlling TAB based on PBL teaching, students gradually master washing beverage production line and learn how to control microorganism pollution. Furthermore, they also know which procedures are apt to be polluted by microorganism.

Not every case has an ideal solving project that is not the last target in beverage technology teaching applying PBL. On the contrary, the selected cases serve as an intermedium and ensure the students to master knowledge. During the process of learning, students help their teammate understand the learning information, namely what and how to be learnt. To learn knowledge, the students have to continuously communicate with their teammate, gradually acknowledged with excellent communication and negotiation skill. Each member was responsible for the group in PBL mode. Thus, the students also become initiative learner, sharing the stress of teammate and encouraging their teammate.

3.3. Forming Good Cognitive Structure by Transfer of Learning

Solving the problem displayed in the selected cases is only learning means. The real purpose in beverage technology curricula is to integrate the beverage knowledge and construct the effective knowledge system. Every beverage definitely meets many questions during the practical production process. After exerting cases analysis, the students possess more and more module knowledge. On the basis, the teachers timely guide the students to unite the relative unattached knowledge into an entirety, which is helpful to students to form new cognition from the mastered knowledge. For example, after analyzing TAB, browning, flavor, precipitation, cost and output of apple juice, the students construct a clear frame of juice production in their minds. Namely they perceive how to optimize the related influencing factors based on target. Usually, personnel, machinery, material, technology and sanitation should be elaborately considered in every procedure. And then the interaction among the procedures was audited. At last, the complicated juice production turned into a laconic entity. Once any procedure changed, the other procedures were promptly adjusted accordingly. Thus, the whole production line was under the best condition throughout.

3.4. Further Popularizing PBL and Enhancing Teaching Effects

PBL could ensure that students effectively master the beverage knowledge. As we know, the learning goal is application. Theoretically, the contents in beverage textbook are the summary of realistic experiences with molding strategies to solving problems. However, the students will face many unknown questions in the future, which require particular solving methods. Therefore, the teacher should encourage students to attempt to solve the realistic questions faced by current beverage industry through utilizing convenient opportunity, such as network media, productive practice and amateur innovative experiment. After all, learning knowledge is past tense, while applying knowledge is the real purpose of learning. During the process of constantly popularizing PLB, the beverage knowledge mastered by the students will be further consolidated and perfected. Meanwhile, students' ability adapting them to the problem in beverage will be continuously enhanced in psychology. Thus, the teaching effect in beverage technology curricula with PLB pedagogy comes true.

4. THE ANALYSIS OF IMPLEMENTING EFFECTS

4.1. Livening Up the Class

After applying PBL in beverage technology teaching, depressed atmosphere in classroom was changed and the lesson livens up. Owing to flexible teaching method and innovative knowledge which is mechanical in the past, students' positivity increased. The whole class is in a heated discussion when the solving methods of designed question were argued. Under this active atmosphere, the teacher lectured with pleasant heart, enhancing the teaching quality.

4.2. Promoting Experimental Teaching

Experimental teaching is an important aspect in beverage technology teaching. After applying PBL, students actively think about question and verify the solving answers by demonstrative, comprehensive and designing experiment. PBL promotes the students to form the ability of deep thought and brave practice.

4.3. Enriching the Technological Innovation of Student

Many projects were related to beverage in innovative experiment of college student. Students could effectively develop new beverage production and solve the existent problem in beverage industry. At present, some patents related with beverage had been applied for by students in their spare time.

4.4. Enhancing the Ability of Graduates to Familiarize Job

Trained through PBL in beverage technology, graduates psychologically acclimatize themselves to the problem met in realistic production of enterprise and positively solve the question. Thus, the graduate could fast familiarize new job. Nowadays, quite a few graduates have grown into key personnel of famous beverage enterprises

5. CONCLUSION

PBL is quite suitable for application in beverage teaching in terms of the curricula features of beverage technology. It could liven up the class, promote experimental teaching, and enrich the technological innovations of student, as well as enhance the graduates to fast familiarize job. Applying PBL in beverage technology teaching is a well-proven method.

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