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Applying development evaluation in the teaching design of Food Biotechnology Curriculum

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Abstract: The idea of developmental evaluation was applied in the teaching design of Food Biotechnology Curriculum. During the process of designing classroom teaching, suitable measures included promoting students to master the knowledge gradually, training students to solve the problem through cooperative inquiry, creating practice opportunities to increase the ability of students, enriching the classroom knowledge via their homework, and jointly improving the professional level of teachers and students through communication and feedback. Regarding to teaching evaluation, to clearly reflect learning effect, pluralism such as subject, perspective and content was adopted. Applying developmental evaluation in Food Biotechnology Curriculum would be a beneficial and well-proven method.
Keywords: Developmental evaluation; Food Biotechnology Curriculum; Teaching design

INTRODUCTION

Food biotechnology is an important special course for the students majoring in food science and engineer, mainly containing two parts in general. One part is basic theory of biotechnology including gene, enzyme, cell, fermentation and protein engineering. The other part is the practical applications of biotechnology in food field, such as food process, brewage, preparation of functional components, food preservation, food analysis or treating by-products of foodstuff industry. With food industry expansion and biotechnology improvement, applying biotechnology in food field becomes more and more wide. Thus, the higher requirement of food biotechnology teaching was put forward[1].

Developmental evaluation is one of teaching assessment styles, continuously evaluating learning effect from a number of angles and differing from traditional summative assessment. Under developmental evaluation, students could acquire knowledge during the learning process and persistently enrich their knowledge through applying process, as well as finally enhance their ability[2]. In terms of strong applied property of food biotechnology, developmental evaluation was quite suitable for application in Food biotechnology teaching.

This work was to explore how to design the teaching process in food biotechnology applying developmental evaluation. It may further improve the teaching effect of food biotechnology or provide reference for other curricula teaching in food science and engineering specialty.

DESIGNING CLASSROOM TEACHING

Attaching importance to process assessment and prompting students to gradually master the knowledge.

Food biotechnology involved in much knowledge including biology, chemistry and physics. If the comprehensive knowledge was lectured in limited hours, it almost could not be fully understood by college students. Lecturing the knowledge according to circumstances at each level, the teacher guide the students to gradually master the new knowledge in relax atmosphere. During the learning process, students constantly assess themselves, continuously heighten their confidence. Now, we take the production of β-carotene with fermentation as an example [3]. B-carotene was expressed by specific gene, and the objective is to acquire the most β-carotene using the least material. Facing the cases, students usually easily think about the strategy of optimizing experiments that could reach to the best technical effect. The teacher may inspire students to extensively ponder. Whether are the maximum production acquired by excellent bacterial strain. Namely, the bacterial strain was induced with physical or chemistry method and the good strain were bred. Meanwhile, good strains may be obtained through transgenic method including protoplast fusion, transposition, conjugation and transduction[4]. Though many methods might be applied, the students should see

which method was the most reasonable by analysis. Furthermore, β-carotene as a secondary metabolic product was constantly biosynthesized and decomposed. The students should actively think about the measures to reduce degradation of β-carotene. For example, the activity of degrading β-carotene enzyme was partly restrained, the gene expression of degrading enzyme was reduced, or the gene of degrading β-carotene enzyme was silenced through antisense gene. The knowledge of gene engineer was lectured one by one. At the same time, the knowledge system of gene engineer was formed step by step in the brain of students accordingly. And the learning situation was continuously evaluated by the teacher and students. During the whole process, the students could continuously adjust their learning perception.

Deeply understanding knowledge through exploring solution as well as cultivating co-operation consciousness

Some knowledge may be taught through group discussion. During the teaching process, the students try to explore the possible solutions related to problems. Though the solution usually could be executed owing to the limitation of class hours, it could prompt students to further understand the knowledge as well as know how to reasonable assign their task in actual application. For example, a solution of clarifying fruit juice was designed. To effectively culture students, at least two kinds of fruits with different property were chosen. Hypothetically the apple juice and jujube juice were selected. Why are the juices clarified? Some ingredients in juice lead to precipitation of beverage and should be removed from the juice. Now the teacher guides the students to freely express their views on precipitation ingredients of fruit. In ever experienced case, some students thought that large impurity caused precipitation, part students consider ed macromolecules including pectin and starch caused precipitation, and other students deemed that other substances such as protein and cellulose could also caused precipitation. Thus, the precipitation reason of juice was clearly analyzed. Next, the juice should be clarified. The large impurities were removed by filtration or centrifuge. What else was the macromolecule removed? Use enzyme to decompose the macromolecule. Note! This method involved the knowledge of enzyme clarifying theory. The students would understand the clarifying theory and practical application in the following study. Which enzymes need to be applied? Were different enzymes added into the juice at the same time? How long time was suitable for enzyme reaction? To answer those questions, the students have to explore reaction conditions such as temperature, pH and time. Furthermore, they should know whether there were antagonistic effects among deferent enzymes. Additionally, the influence of enzyme on fruit juice qualities such as flavor and microorganism pollution should also be concerned. Thus, the students perceive why the reaction time was controlled. Enzyme reaction probably gives rise to microorganism pollution in production line with too much time. The simulative or actual production was arranged according to the cognition. If different enzymes could be peaceful, the enzyme clarifying may be carried out simultaneously, which could save production time and was beneficial to maintain the hygiene of production line. However, if there were antagonistic effects among deferent enzymes or the reaction conditions were different, the enzyme clarifying was proceeded by several sections. Thus, long time was needed and the hygiene has to be strictly controlled [5]. Meanwhile, the students should distinguish the difference between apple juice and jujube juice. Why the jujube juice was not be easily clarified? Through analysis, the students know the pectin in jujube is much more than apple and the method clarifying apple juice is not suitable for jujube juices[6]. With co-operation analysis, the students gradually mastered the biotechnology knowledge related to enzyme engineering.

Applying knowledge and improve skills by creating the practice opportunity

Practical teaching is a quite important step during the whole teaching process of food biotechnology, putting the learned theory into actual application. Take the manufacturing fruit wine as an example. Proper high temperature could accelerate the fermentation and much ethanol was produced per unit time. However, the flavor in higher temperature is unpleasant and forming good flavor during the fermentation needs a relatively low temperature. A temperature giving consideration to both flavor and ethanol production was investigated. Especially, the aroma ingredients should be effectively controlled. With a series of questions, the students explore and verify answer over again in practice. Usually the temperature may be ascertained by single factor orthogonal experiment. If the other qualities were also considered, the related parameters may be obtained through orthogonal experiment, response surface method or path coefficient analysis. Thus, the maximum efficacious components and the best flavor of fruit wine were preserved[7].

After the parameters were optimized based on batch fermentation, the experiment was further changed into continuous fermentation according to material concentration of input or the number of microorganism. The different fermentation experiments might be carried out and compared by students who finally determined the better fermentation effect and give the proper explaining [8]. Thus, the theory was fully verified during the process of practical teaching. The students deeply grasped the knowledge and the good skill was gradually cultured. If the experiment succeeds, the students may acquire a gratification and self-affirmation. Even if the experiment fails, the students may look for the possible causes which are also a

learning process. Once the questions were solved, the experiment could be done again. Here, we don't need to excessively concern with the experiment result. On the contrary, the students should pass through a valuable ordeal process with continuous self-affirmation or self-denial.

Widening vision and enriching knowledge of student through assigning moderate schoolwork

As for food biotechnology, assigning moderate schoolwork is quite suitable for students to master knowledge. Now take the cell engineer as an example. Cell engineer in food biology curricula introduces how to produce wholesome food, involving in selecting objective cell, manufacturing and separating functional nutrients. The teaching contents of textbook are quite limited owing to objective development level and subjective understanding. Teacher may select Nobel Prize of Chemistry, Physiology or Medicine in 2012 as schoolwork. The Chemistry prize is about how the cell subjects to smell through G-protein. And the Physiology or Medicine introduced that the induced cell had the function of stem cell differentiating and forming tissue [9-10]. Though the Nobel Prize in 2012 seemed to have little to do with the cell engineer of food biotechnology, the students could increase their knowledge level by means of external great achievements, deepening the recognition to cell engineer and knowing how to efficiently produce high-quality food through cell engineer.

Constantly adjusting and jointly improving by feedback and communication.

Before, on and after class, the teacher may communicate with students and answer some questions as for interesting subjects and learning situation of food biotechnology. During the interactive process, the teaching effect was enhanced. In terms of limited class hours, the communication was hardly executed, but the time is ample after class. In our class, we ever attempted to communicate for 3~5 minutes with students before class, gaining good effect. If the students were effectively mobilized with several minutes, they felt relaxed during the whole class. Students learned with interest, and the teacher actively lectured. Thus, a good atmosphere was created between the students and teachers with mutual respect and effort [11]. 3~5 minutes before class was similar to delicious juice that was joyfully shared at once with tension and activity. The ample time after class resembles mellow potent tea that needs to be lingered over. After class, the students may ask some questions met during the learning process or give some advices through E-mail, internet chatting, and short messaging of mobile telephone. The teacher may amply reply to students by consulting technical literature. In addition, the question and advices may be incorporated the coming prepared lesson. Namely, the question asked by individual was made a reply to all the students who were increased simultaneously. Accordingly, the teacher also improves oneself during the process of solving the asked question.

EVALUATION OF LEARNING EFFECT

Many related persons participate.

The persons such as teacher, learner and classmate, participate evaluation. The teacher was responsible for students' scholastic achievement and assesses students through questioning in class, experiment process and examination. Students assess themselves by learning attitude, skill level. Especially, new cognition is one of the best self-evaluation. Mutual discussion, help and answering questions among students are also positive assessments.

Multiple respects are contained.

Comprehension is one of basic objectives, but the practical application is also concerned because food biotechnology is an applying curricula. To some degree, the ability of practical application is much more important than the scores of classroom. Especially facing awkward difficulty, students could creatively apply the knowledge of food biotechnology and persistently solve the problem. The students were cultivated into talent to weather the snowstorm in the future, and not conformist knowledge carriers.

Forms are diversified.

The examination paper, team co-operation and experiment are all important evaluation forms. Furthermore, the various technological activities are also effective assessments. For example, learner oneself takes part in contest including kinds of challenge projects or serves for related local enterprises through applying the mastered knowledge [12].

PERSPECTIVE

Developmental evaluation was one of effective teaching evaluations. Applying developmental evaluation in food biotechnology would help the students deeply master the knowledge, increase their practical ability and enhance their metal qualities to solve the complicated problem. The teacher may also constantly raise teaching standards by adopting developmental evaluation. As for the learning evaluation, the participants, respects and forms are flexible, which might clearly reflect the learning effect. Applying developmental evaluation in food biotechnology would be a beneficial and well-proven method.

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