

Research on Improving Innovative Practical Ability of Graduate Students by “Integrating Science and Education” with BOPPPS Teaching Mode- A Case Study of “Experimental Design and Data Processing”

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Abstract:

Based on the teaching of “Experimental design and data processing”, the “science-education integration” and the BOPPPS teaching mode are deeply integrated. The latest and most important research trends and innovative achievements are integrated into the six modules of BOPPPS teaching. The new classroom teaching mode is used to help the science-education integration, and it is realized by participatory teaching. To improve the quality of teaching materials and strengthen the science-education integration, characteristic courses are constructed that deeply implement the concept of “science-education integration”, and feedback the teaching effect of “science-education integration” and BOPPPS mode to improve the innovation ability of graduate students, providing new ideas for the reform of graduate education and teaching.

Keywords:

Graduate Students, Course Reform, BOPPPS, Innovative Practical Ability

1. Introduction

Today, the deep integration of sci-tech innovation and talent cultivation is the recognized cultivation mode of university education and teaching. “Science-education integration” is the key point of higher education reform of China. The key factor of “science-education integration” is to carry out knowledge innovation, imparting,

dissemination and inheritance from research to learning, and strengthen the combination of scientific research and teaching with student development as the center. In-depth cooperation between universities and scientific research institutes is a good method to closely combine the research and teaching [1]. As the main force of scientific and technological innovation, cultivating the innovative spirit and practical ability of graduate students is the top priority of graduate education. The strategy of science-education integration is not a castle in the air, but should be deeply implemented into the daily postgraduate education and teaching. However, in the current teaching of postgraduate courses, the concept of science and education integration is not deep enough, and the integration with specific postgraduate courses is not high. The reason of lack of in-depth implementation of “science and education integration” of the characteristic courses is that the new teaching methods and new teaching models are difficult to reasonably integrate into the process of postgraduate teaching.

BOPPPS teaching model is a student-centered teaching model that emphasizes teaching effect, efficiency and benefit, so as to increase students' learning enthusiasm, classroom participation rate and teaching effect and benefit [2]. The concept of “science-education integration” is integrated into the six modules of BOPPPS teaching mode. The latest scientific research progress and technological trends are integrated into the course modules. Students can feel and learn the charm of scientific research and technological progress in each learning module, which ensures that students can master the theoretical and practical basis of the course skillfully. Moreover, it can stimulate students' scientific research interest and innovative thinking, and effectively promote the classroom teaching reform under the concept of “science-education integration”, which is of great significance to promote the construction of graduate education and cultivate the innovative practical ability of graduate students.

2. Concept of Science-education Integration

“Science-education integration” is an important strategy of higher education pattern in China. Some researchers have pointed out that “modern universities are knowledge places where teaching and research are combined, and teachers have both the responsibilities of scientific research and teaching, which is the key to integrating scientific research and teaching” [3]. And “scientific research has unique advantages in cultivating students' critical thinking ability and rational temperament” [4]. Therefore, the function of science and education integration in college talent cultivation is increasingly clear and important. Teaching and research are often combined in the process of science-education integration. We should learn from the experiences and improve them in the process of joint exploration, integration, application and dissemination of knowledge. The aim is to truly realize the above aims. At the 11th “China University Teaching Forum”, Wu Yan (director of the Department of Higher Education of the Ministry of Education) said: “Curriculum is the core element of talent cultivation and a micro problem of education, and it solves the strategic problem and the embodiment, operation and goal of the fundamental standard of talent training” [5]. Only with the aid and support of scientific research, we can teach and realize the true value of college education, especially graduate education, which is an education with views and soul. However, in the current teaching of postgraduate courses, the concept of science and education integration is not deep enough, and the integration with specific postgraduate courses is not high,

the lack of in-depth implementation of the concept of “science and education integration” of the characteristic courses, the reason is that the new teaching methods and new teaching models are difficult to reasonably integrate into the process of postgraduate teaching.

3. BOPPPS Teaching Method

The BOPPPS teaching model began with the Canadian teacher skills training workshop, which followed the natural law of human attention maintenance and divided the classroom into six units and modules: Introduction (Bridge-in, B), Learning Objectives (O), Pre-assessment (P), Participatory Learning (P), Post-assessment (post-assessment, P) and Summary (S) [6]. The six units are connected to form an effective and complete curriculum process. The purpose of BOPPPS teaching model is to cultivate students' subjective initiative, strengthen students' independent innovation ability and practical ability, change the past “cramming” and “exam-oriented” teaching methods, and establish the student-centered classroom teaching concept. From the purpose, method and implementation process of in-depth analysis, it is found that “science and education integration” and BOPPPS teaching mode coincide: science and education integration provides rich and highly teaching content for BOPPPS teaching, BOPPPS provides specific implementation mode and method for science and education integration, and their combination can jointly improve the innovative practical ability of graduate students.

“Experimental design and data processing”, combining theory and practice, is a comprehensive, application-oriented course based on mathematical statistics, probability theory and professional knowledge. The course covers a wide range of fields and has huge, complex content and distinct professional characteristics [7]. In the Faculty of Food Science and Engineering (Qilu University of Technology), “Experimental Design and Data Processing” is an important course in the graduate courses of various majors in food science, which is the application of statistical principles and methods in the field of food science research and food industry, and is also a comprehensive and engineering course that closely combines theory and practice. In recent years, some papers are not scientific enough in terms of experimental design, or the design method is single, which leads to unclear experimental data and statistical analysis. These problems will not only reduce the efficiency of scientific research, but also affect the credibility of research results and the quality of papers. The reason is that graduate students are weak in experimental design and data statistical analysis, and some colleges and universities do not offer relevant courses in food undergraduate education, resulting in lack of relevant theoretical and practical basis of the considerable number of graduate students. In the process of teaching, teachers pay attention to the explanation and imparting of knowledge, and lack the practice of new ideas and new methods. In order to solve this problem, in addition to relying on the patient guidance and careful education of graduate tutors, we should strengthen the course teaching of “Experimental design and data processing”, improve the course position, and deeply reform the teaching mode and method.

4. Reform Content and Target

4.1. Reform of the teaching method

The traditional teacher-centered teacher-listening teaching method neglects the learning initiative of students and has poor teaching effect. Based on the teaching mode of BOPPPS, the reform of the teaching method of “Experimental design and data processing” course has been carried out, integrating diversified teaching methods into six teaching sections and integrates the concept of “science-education integration” into various teaching methods.

4.2 Reform of teaching practice

The course “Experimental design and data processing” has the characteristics of wide application and strong practicability, high theoretical knowledge requirements, many difficulties, and multiple interdisciplinary contents, etc. BOPPPS teaching mode divides the complicated teaching content into small units, and each unit is divided into six modules. The advantages of each module have been made full use of. We should reform the course teaching practice and carry out the scientific thought of “science-education integration”.

4.3. Reform of the teaching objectives

Teaching goal is the final effect of a course. The establishment and reform of teaching goal have inevitably affected the design of teaching content and the implementation of teaching process. The “science-education integration” is the rational introduction of scientific research results into teaching to improve teaching effect. BOPPPS teaching model is goal-oriented and student-centered in order to effectively improve the teaching effect. The two teaching objectives coincide with each other. Therefore, we intend to reform and formulate teaching objectives that conform to the development of students.

4.4. Reform target

Based on the course teaching of “Experimental design and data processing”, the “science-education integration” and the BOPPPS teaching mode are deeply combined, and important research trends and innovative results are integrated into the six modules of BOPPPS teaching, so as to realize the innovative reform of this course in the teaching of food graduate students. Characteristic courses have been constructed thoroughly by implementing the concept of “science-education integration”. The science-education integration with new classroom teaching mode is promoted to realize the science-education integration with participatory teaching, improve and strengthen the science-education integration with curriculum teaching materials. The teaching effect of “science and education integration” and BOPPPS mode are used to improve the innovation ability of graduate students, providing new ideas for the reform of graduate education and teaching.

5. Implementation Plan and Measures

5.1. Construction of the curriculum system

The specific implementation scheme is shown in Figure 1. Postgraduates of food majors should have high comprehensive quality and strong practical ability. In the course of postgraduate education of food majors, the teaching of “Experimental design and data processing” is very important to cultivate the innovative consciousness and innovative ability of postgraduates, but there is no complete and effective curriculum system at present. Some courses such as “Subject Frontier

Thematic Course” and “Advanced Food Chemistry” can be selected to build a curriculum group. And undergraduate practical courses such as “Modern Food Testing Technology” and “Food Analysis and Experiment” can be used as auxiliary teaching courses to fully combine theoretical basis with practical operation, so that a complete knowledge system can be formed for students.

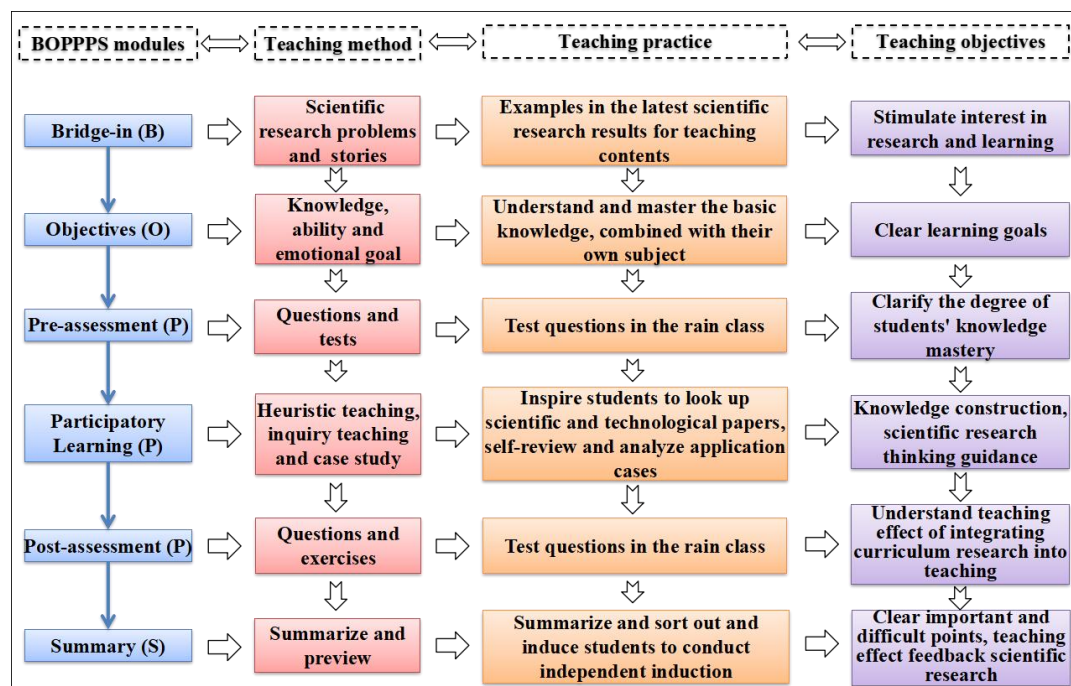


Figure 1. The specific implementation scheme.

5.2. Optimize and update the teaching content based on the concept of “science-education integration”

With the rapid development of modern experimental design and data processing technology, this course should keep up with times and the new teaching content should be constantly updated and improved. Keeping up with the cutting-edge technology and concept is to adapt to the development trend of food science. According to their own research direction, the teaching team members should integrate cutting-edge research and experimental design scheme methods into classroom teaching and introduce the latest research results into the curriculum system, and constantly optimize and update the teaching content.

5.3. The flexible combination and mutual promotion of “science-education integration” and BOPPPS teaching mode

In the six modules of BOPPPS teaching model, the concept of “science-education integration” is integrated. The courses are introduced with scientific research news, interesting scientific research with the goal of cultivating students’ innovative practical ability. Theoretical knowledge and practical scientific research problems are combined for pre-test. In the teaching process, students are asked to engage in participatory learning to deeply understand the theory and method of experimental design and data processing in scientific research, and then conduct post-test with practical scientific research problems. And they finally summarize the effect of students’ theory and ability improvement.

6. Conclusions and Prospects

“Science-education integration” develops rapidly in our university. Many scientific research results are constantly produced. The organic integration of scientific research results and classroom teaching is an important measure to promote the innovation ability of postgraduates. The six stages of BOPPPS teaching model are in line with the learning habits and characteristics of students, and can reflect the participation of students in the whole teaching process. Integrating the concept of science and education into BOPPPS teaching mode is an innovative teaching method, which not only allows students to have access to the latest and high-level scientific research results, but also makes it easy for students to accept and actively interact with each other. This conforms to the concepts of “new engineering”, “student-centered”, “continuous improvement”, “output-oriented OBE”, “three-whole education” and “moral cultivation”. Therefore, their combination has improved the teaching effect of postgraduates.

In addition, the application of AI technology in the teaching process has drawn more and more attention. In the near future, the integration of AI technology into the teaching process of research will be a long-term promotion of the integration of the latest scientific achievements and teaching. This is also the effort direction of the author in the future.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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