Exploration and practice of teaching methods of basic specialized courses for postgraduate majors based on the characteristics of "Three Teaching Processes"

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Abstract. The ability of engineering graduate students to use their knowledge and independently engage in scientific research is one of the important indicators to measure the quality of postgraduate training. This paper takes the comprehensive improvement of graduate students' ability to engage in scientific research independently as the starting point, and improves the teaching quality of basic courses of graduate majors in an all-round way by constructing teaching methods of basic knowledge intensive teaching, knowledge application and case process teaching, so that students can deeply grasp the course knowledge system and flexibly apply the knowledge learned in the course learning process. Finally, it lays a good foundation for students to engage in scientific research independently.

1 Introduction

The General Secretary pointed out that the world today is undergoing major changes unseen in a century, with a new round of scientific and technological revolution and industrial transformation developing rapidly. With the progress of scientific and technological revolution and industrial transformation, countries all over the world have put forward higher requirements for the quality of engineering education, and the demand for innovative talents is becoming more and more urgent. At this stage, the state regards the cultivation of all-round high-level specialized talents or high-level creative talents as the overall goal of postgraduate training. For engineering graduate students, the ability to apply the knowledge learned is related to the quality of engineering graduate training, and it is a direct manifestation of the ability and quality of graduate students to solve practical engineering problems after participating in the work, and it is also the source of innovation ability. Knowledge acquisition, knowledge application, and ability to solve practical engineering problems should become an organic whole process.

Under the new situation, the reform of postgraduate training methods cannot be delayed, we must actively meet the needs of social development and enterprise production, strengthen the scientific literacy and innovation ability of graduate students, train graduate students into talents urgently needed in a new round of scientific and technological revolution, and accelerate the transformation of China from a "big country of graduate talents" to a "strong country of graduate talents".

However, the traditional teaching mode leads to the ineffective interaction between learning and application, which separates the organic relationship between learning and application. With the continuous acceleration of knowledge update and iteration, the contradiction between the traditional teaching mode with teachers as the main body and the cultivation of postgraduate capabilities has become increasingly prominent. In view of this problem, this paper exploratorily puts forward the teaching methods of basic knowledge intensive teaching, knowledge application promotion and case process teaching, so as to enhance the ability of graduate students to solve practical problems, further develop their scientific literacy and innovation ability, and enhance the core competitiveness of graduate students. The diversification of training methods through reform will broaden the research horizons of graduate students and enhance their interdisciplinary capabilities.

2 Construction of teaching methods based on the characteristics of "three Teaching processes"

In the process of teaching engineering graduate students, the goal of teaching is to enable students to acquire knowledge, apply knowledge, and innovate knowledge. In the process of achieving this goal, there is a dialectical relationship between "learning" and "research": learning is a very complex psychological and physiological response process, is the process of assimilating new knowledge through the cognitive structure that students already have, throughout the acceptance process, students need to deeply decompose the knowledge to try to conform to their own cognitive structure.

The pragmatic educator Dewey emphasized that students need to "learn by doing", from the perspective of...
learning to integrate the relationship between "learning" and "research", that is, "Promoting research through learning".

In today's era, the knowledge update speed of various subject areas is very fast, how to teach students the basic knowledge of the profession in the process of postgraduate teaching, but also cultivate students' ability to apply knowledge to solve practical engineering problems, which requires teachers to set up relevant mathematical links in the process of teaching, and intersperse the knowledge learning process and application process of students.

### 2.1 Basic knowledge intensive teaching

The basic course of graduate professional is the theoretical basis of the main content of the subsequent dissertation, and the quality of the learning of the professional basic course is related to whether the students can make good use of the knowledge they have learned for scientific research project research and whether they can complete the dissertation with high quality, so that students can lay a good professional foundation.

So, when explaining the basic knowledge, the teacher investigates the professional direction and research interests of each student in advance, and consciously combines the teaching content with the subsequent knowledge application of students.

In the process of teaching, the relevant basic knowledge is "refined" for students in a targeted and focused manner, so that each student has targeted and targeted learning. Through "purpose" and "practical" education, students are stimulated to learn interest, so as to achieve a good target teaching effect.

### 2.2 Knowledge application teaching

The application of professional basic knowledge is an important prerequisite for cultivating students' innovation ability, and how to enable students to skillfully apply the knowledge they have learned is a very important part of the teaching process.

In the process of teaching, the teacher first "pushes" the application of the professional knowledge from the perspective of the discipline, introduces the application of course knowledge in various fields and the specific application methods in detail, so that students can know the application of the knowledge learned as a whole, and then according to the different research directions and research interests of each student, assign students a number of topics in the form of large assignments, so that students can carry out active research on the assigned problems through literature research, programming or software simulation analysis, and under the guidance of teachers.

High-quality completion of large assignments, through knowledge application and assignment of large assignments, can enable students to know the application of the knowledge learned, and gradually guide students to solve practical engineering problems.

### 2.3 Case process teaching

With the development of information technology, there are relatively mature analysis software and procedures in the basic courses of each major today, and how to better use the existing analytical tools to carry out research work is an important guarantee for engineering graduate students to produce early results and more results in the limited postgraduate stage. To this end, in the course of teaching, teachers take cases as the traction, "talk about" the functions and solution processes of relevant analysis software (programs) for students, and independently select analysis topics according to the different research directions and rise of each student, so that students can carry out academic paper writing exercises by using existing software (programs) and laying out relevant analysis methods.

Teachers should be involved in the process from start to finish. Through this teaching step, students can further expand the application scope of the knowledge they have learned and achieve effective connection with specific engineering practice.

### 3 The specific practice of the "three teaching processes"

Combined with the specific experience in the teaching practice of the course "Fundamentals of Engineering Fracture Mechanics", the teaching method of basic courses for postgraduate majors based on the characteristics of "three Teaching processes" is specifically elaborated. The teachers of the teaching group of "Fundamentals of Engineering Fracture Mechanics" all have doctoral degrees, have rich teaching experience in teaching positions, and are also engaged in scientific research related to fracture mechanics in scientific research positions, which provides a reliable guarantee for the implementation of the "three teaching processes" teaching method of this course.

"Fundamentals of Engineering Fracture Mechanics" is a basic and highly knowledgeable course. In order to enable students to be proficient in this course, in the initial teaching process, students will be able to explain the mathematical knowledge involved in fracture mechanics, so that students can know the "source" of fracture mechanics, and understand its basic solution process, ideas and connotations, so as to lay a good foundation for the explanation of subsequent knowledge points. In the follow-up teaching process, each lesson is explained through specific examples, so that the boring mathematical knowledge has a realistic and visible basis, which is conducive to improving students' interest in learning, and making the knowledge learned by students have a good foothold, thereby deepening students' impression of the knowledge learned.

In the course of teaching, according to the different research directions and research interests of students, the application and solution process of fracture mechanics are taught in series, so that students have an overall grasp of the application of fracture mechanics knowledge. At the same time, they are provided with research papers and reports on the analysis of practical engineering problems.
using the knowledge of fracture mechanics, and these recommended learning materials can increase students' motivation and interest in independent learning, expose students to practical engineering application dynamics, and enrich and expand their knowledge fields and application scope.

In the specific practice process, teachers assist students to extract theoretical problems in engineering practice, find ways to solve problems through scientific research, and then return to the actual engineering background, and discover new problems as much as possible to guide the cultivation of students' innovation ability.

4 The implementation effect of the "three teaching processes"

Since the implementation of the "three teaching processes" teaching method in the course "Fundamentals of Engineering Fracture Mechanics" for five years, a relatively complete and mature set of implementation materials and supporting materials has been formed, which has played a huge role in guiding students' learning and scientific research practice.

The specific implementation effects and research results include the following aspects:

(1) Through the highly targeted practical teaching links arranged in this course, each student proposes a research topic based on their own research direction and research interests, analyzes fracture mechanics and related knowledge for this research topic, and writes and publishes a number of academic papers.

(2) Through the collection and sorting of the research results and reference materials of each batch of students, a collection of materials covering multiple majors and research directions has been formed, and an excellent academic paper writing process file has been established, which can play a good exemplary role for subsequent students' learning and research work, promote the motivation and interest of subsequent students in independent learning, enrich their knowledge fields and broaden the scope of application of knowledge, and guide the cultivation of their innovative ability.

(3) In order to better mobilize students' learning initiative, stimulate students' innovation potential, and cultivate students' comprehensive ability, combined with the characteristics of the curriculum, the examination and assessment methods have been reformed. In the improved assessment method, not only the basic requirements of teaching but also the personality development of each student is considered, and a diversified assessment mode is adopted.

5 Summary

A set of basic knowledge intensive teaching, knowledge application and case process teaching system has been established, and through years of practice in the course "Fundamentals of Engineering Fracture Mechanics", good teaching implementation effects and a large number of construction results have been achieved.

Through the implementation of the "three teaching processes" teaching method, the teaching quality of basic courses for engineering graduate students can be further improved, and the enthusiasm of teachers and students in teaching and learning can be fully exerted, so as to lay a solid foundation for the cultivation of students' knowledge application ability and innovation ability.

References


