Reform and Exploration of Teaching Mode in Numerical Calculation Course for Engineering Certification

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Abstract. For a student in engineering application-oriented undergraduate colleges, especially those who majored in mechanical manufacturing and automation, working at the first line of production after graduation is necessary. In order to better adapt to the "Internet Plus" era, it is especially important to cultivate the ability to solve engineering problems using numerical calculation methods. In this study, the teaching mode reform and exploration of numerical calculation courses is discussed. A new teaching curriculum system is developed, where the mechanism of flexible teaching is realized by "Internet Plus". And the numerical calculation course knowledge base for engineering certification is constructed to solve the problems existing in the current teaching mode. The new teaching curriculum system closely links the teaching with the scientific research, which can help students to combine the theoretical knowledge with actual application. Therefore, the new teaching mode lays the foundation for a higher level of "curriculum teaching material construction".

Introduction

Insufficient innovation capability is not only the main gap of science & technology between China and developed countries, but also the weakest link that restricts the development of China's higher education. In order to implement the "Implementation Opinions of the General Office of the State Council on Deepening the Reform of the Education of Innovation and Entrepreneurship in Institutions of Higher Education" [1], the education management departments at all levels have strengthened the comprehensive reform of higher education, stimulated the creativity of college students to use the "Internet Plus" thinking mode in innovation and entrepreneurship. The growth of wisdom and talents has brought unprecedented opportunities and challenges to the teaching and education of colleges and universities.

With the development of computer and information technology, the engineering numerical calculation technology is formed, which is also the basis of digitalization and informationization for modern manufacturing. Its development and application have had a tremendous impact and promotion for the manufacturing industry. The numerical calculation courses for engineering certification involve a wide range of subjects, and are related to numerical integration, matrix computing, computer graphics, design methodology, computer hardware and software, and finite element analysis [2-4]. For such courses, strong theoretical knowledge and high practical requirements are needed. The traditional teaching method is based on the content of the teaching materials, the teacher-student interaction is poor, and the innovation spirit and practical ability training are difficult to implement. However, the problems of modern engineering are more and more complex and changeable. The boundary of the teaching system of the traditional numerical computing curriculum is also needed to melt. How to improve the systemic and synergistic nature of engineering numerical computing courses under the premise of meeting the current teaching goals and satisfying the diversified needs of students' future job market, and cultivating students' comprehensive innovation ability has become an urgent problem to be solved.
"Internet Plus" is the action plan proposed by Premier Li Keqiang in the 2015 government work report [5]. It combines Internet technology with China's traditional industries through the Internet platform to innovate the industry development model. Introducing the "Internet Plus" thinking in the process of curriculum reform, can promote the organic integration of the Internet and education, and optimize the choice of college students for employment and entrepreneurship [6-7]. Therefore, conduct the curriculum reform for engineering computing courses by use of Internet technology, the quality of teaching can be improved.

Problems in Teaching Mode of Numerical Calculation Courses

Numerical calculation course covers all aspects of mathematics and is a combination of advanced mathematics and advanced algebra. It contains obscure principles, cumbersome abstract proofs and formula derivation, and integrates mathematical theories such as analysis, algebra and equations. It is a mathematics discipline that pays more attention to applied practice. As far as the current education and teaching mechanism is concerned, the following aspects have been raised in the teaching process:

The Design and Evaluation of the Teaching System of Engineering Computing

On one hand, the engineering computing class emphasizes the theoretical explanation. In this process, the theory and engineering case analysis and software tools need to be closely combined, and finally the professional skills should be improved. However, in this process, because of the limitations of teaching conditions and other reasons, it is difficult to achieve the combination of theory and the surrounding cases, and can only stay at the level of abstract cases. In addition, this course requires students not only to master software operations, but also to master in-depth knowledge of engineering calculations. However, for colleges and universities that mass-produce college students, the numerical computing curriculum can only be a course that satisfies the teaching tasks, and cannot be used to solve the actual application problem. The software and teaching required in this process is a complex system engineering. How to establish an operative and evaluable course system is a key issue to be solved urgently.

Knowledge Integration of Engineering Computing Courses for Collaborative Innovation

Modern mechanical engineering problems are often cross-disciplinary issues, and comprehensive knowledge and understanding of multiple disciplines is needed. In the process of learning and teaching, students have different mastery of knowledge. Teachers should control the students' ability to acquire knowledge during the lectures, and improve students' ability to innovate in the process of learning. Therefore, in the process of engineering computing courses, how to deal with the relationship between competence, knowledge and innovation, so that students integrate the necessary knowledge and ability to master is also a key issue to be solved.

Cultivating Creative Thinking as a Starting Point

Although the object of engineering computing class research has been expanded, current teach is still traditional and lack of innovation. However, actual application of engineering computation requires comprehensive support of various technologies, and various technologies are superimposed and inclusive [8]. How to train students to use creative thinking methodology to learn and practice is also a key issue in teaching.

Solution to the Problem of Teaching Model in Numerical Calculation Courses

In the open teaching environment, comprehensive consideration of factors such as learning objectives, teaching links, curriculum system, teaching content, evaluation system, etc. is needed in the actual teaching activities. With the introduction of "Internet Plus", the teaching tasks at various stages around the teaching objectives are disassembled. The teaching units are organized and implemented in a multi-layered manner to adapt to the learning needs of different levels of
acceptance, thus cultivating students' collaborative innovation and engineering practice capabilities is necessary.

In addition, under the requirements of the course syllabus, according to the students' cognitive rules, adopting a task-driven approach to cultivate students' collaborative innovation ability is the main line to study the fusion method in "Internet Plus" based numerical calculation curriculum system construction.

**Construct a Numerical Calculation Teaching Course System for Engineering Certification**

First, the traditional teaching mode of “center-centered, teacher-centered, and textbook-centered” is transformed into a curriculum system around the cultivation of students' creative ability. In the "Internet Plus" oriented teaching environment, "technology-application-practice" is the main line in teaching activities. Second, the various factors such as training objectives, curriculum system, computer experiments, teaching links, and evaluation systems are comprehensively considered to lay the foundation for engineering certification. Third, the Internet innovations around the needs of students are introduced to establish an innovative engineering computing curriculum system.

**Implement the "Internet Plus" Teaching Mechanism in Engineering Numerical Calculation Courses**

Breaking the traditional integrity of knowledge based subject curriculum, and then setting up a modular curriculum system under the guidance of "Internet Plus" thinking. The teaching unit is organized and implemented in a superimposed way to adapt to the learning needs of different students. WeChat, QQ and other "Internet Plus" tools will be powerful to train the self-learning ability and flexibility of students in numerical calculation courses learning.

**Develop a Knowledge Base of Numerical Computing Courses for Engineering Certification**

The project is used as the carrier to realize the combination of work and study. The teaching situation is constructed according to the project requirements, so that students can study relevant theoretical knowledge and cultivate synergy ability in the process of completing specific projects. The numerical calculation course is directly oriented to the scientific research or engineering. By conducting open, innovative and comprehensive projects, students are encouraged to use the database to search for multidisciplinary, comprehensive, academic frontier knowledge and online exercises. Project experience and achievements are incorporated into the “Engineering Computation Course Knowledge Platform”, so that the platform is updated in a timely manner.

**Prospects for the Teaching Model of Numerical Computational Courses**

With the development of the information technology, the establishment of the "Internet + engineering computing" knowledge system is an unstoppable trend. In the long run, strengthening the comprehensive ability, innovation ability and engineering practice ability of mechanical undergraduate students is an inevitable. In addition, through the "Internet Plus" based engineering calculation courses system, the curriculum content is planned to strengthen the students' innovative ability, and then reach the height of academic research. Using the Internet as a bridge, adopting the "Internet Plus" idea to improve the courseware and introduce engineering examples for numerical computing courses, the students’ learning ability can be greatly enhanced.

**Conclusion**

In this study, the teaching mode reform and exploration of numerical calculation courses is discussed. To better adapt to the "Internet Plus" era, the ability to solve engineering problems using numerical calculation methods is essential for students majored in mechanical manufacturing and automation. A new teaching curriculum system is developed, where the mechanism of flexible teaching is realized by "Internet Plus". And the numerical calculation course knowledge base for engineering certification is constructed to solve the problems existing in the current teaching mode.
The new teaching curriculum system closely links the teaching with the scientific research, which can help students to combine the theoretical knowledge with actual application. Therefore, the new teaching mode lays the foundation for a higher level of "curriculum teaching material construction".

References


