

Integration of Core Courses in Higher Engineering Mathematics

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Abstract: To truly integrate the two independent courses, allowing students to use both their brains and hands-on skills. Learning with different ways of thinking runs through the entire classroom, stimulating students' learning enthusiasm. The class hours are compact, and the combination of theory and practice is suitable for the current training mode of our college's majors. This teaching and research method that synchronizes theoretical courses with hands-on practice can optimize the curriculum and truly integrate mathematical theoretical knowledge with scientific computing.

Keywords: Optimize the Curriculum; True Integration; Knowledge Blocks.

1. Introduction

In the training system of engineering graduate students, mathematics courses are particularly important, as they play an important role in cultivating students' comprehensive mathematical abilities and subsequent course learning. Among them, "Matrix Theory" and "Numerical Computation" are core courses in many graduate schools^[1,2]. With the addition of new disciplines and directions, in order to expand students' research scope, courses such as "Stochastic Processes", "Operations Research", "Mathematical Modeling and Mathematical Experiments" have also been added one after another. Huazhong University of Science and Technology has also established courses such as "Applied Functional Analysis" for students with strong learning abilities. But in the training of many engineering graduate students, courses such as "Matrix Theory" and "Numerical Computation" are still core courses. Many universities in the province offer these courses for 48 hours, and some majors in some universities have compressed to 32 hours.

At present, the courses offered for engineering graduate students admitted to our university mainly consist of "Mathematical Modeling", 32 class hours, and "Advanced Engineering Mathematics", 56 class hours. The course "Advanced Engineering Mathematics" taught by myself is aimed at students from the control engineering major who have high requirements for matrix theory and numerical calculation. It is difficult for them to master these two major knowledge within 56 class hours. Therefore, in the face of short class hours, how to organize teaching content well and improve students' grades is the main task of teaching research for this course. Based on my previous teaching experience, I have identified the main research direction of this project: to fully integrate and interweave the two major knowledge blocks of "Matrix Theory" that emphasizes theoretical analysis and "Numerical Computation" that emphasizes computational ability^[3,4]. After the teacher explains the important theorems and conclusions in each section of the matrix, students will be guided to conduct programming experiments and numerical solutions for specific matrix models. This teaching method that synchronizes theoretical courses with practical applications can achieve the effect of

optimizing the course. It can enable students to use both their brains and hands, and the learning of different ways of thinking should be integrated throughout the entire classroom, stimulating students' learning enthusiasm and achieving true integration of teaching content.

2. The Role and Significance of this Research Project

Taking our graduate students as the research object, explore the teaching and education mode suitable for our graduate students, combine with professional background, and enhance their interest in learning. For example, for students majoring in image processing and data mining, singular value decomposition in matrix theory is a good example. It takes two class hours to teach how to decompose singular values, which can be very tiring for students. However, applying the results to satellite transmitted images will impress them and stimulate their learning enthusiasm.

The focus of this project is to fully integrate the two major knowledge blocks of "Matrix Theory" that emphasizes theoretical analysis and "Numerical Computation".

They emphasizes computational ability, achieving true integration of teaching content and enabling students to master important mathematical knowledge important mathematical knowledge in short class hours^[5].

The research of this topic will explore and establish a teaching system for the course of Advanced Engineering Mathematics, providing a good reference for the teaching reform of other mathematics courses. Significance of this research project in teaching quality

3. Project Implementation Plan

Understand their specific research direction and their basic level. Matrix theory is an extension of the undergraduate course "Linear Algebra". As graduate students, their foundation is good, but "Linear Algebra" does not require mastery of matrix partitioning, but it is the foundation of matrix decomposition. The vectors decomposed from a matrix form the units of a linear space. Students from different research directions have varying levels of proficiency in computer programming, and numerical calculations are based on this foundation. Among the students I taught in my

previous year, there were two who had no foundation in writing algorithms. Therefore, when writing the teaching plan, the initial teaching is mainly focused on reviewing and supplementing essential knowledge, and some students are required to strengthen their preliminary knowledge of algorithm language after class.

Develop a teaching syllabus suitable for the graduate training program of our school, write textbooks and create electronic lesson plans, and integrate the content of numerical calculations into the corresponding content of matrix theory. The Dolittle decomposition theory in matrix theory theoretically proves that a square matrix can be decomposed into the product of a unit lower triangular matrix and an upper triangular matrix under reversible conditions. The application of this result is the pursuit method in solving linear equation systems. After the main teacher explains the decomposition theory, they guide students to conduct numerical experiments, provide a specific equation system, and use the pursuit method principle to write programs and solve problems. This integrates the theoretical matrix theory content with numerical analysis characterized by numerical practice, which can improve the quality and efficiency of teaching without making the classroom too dull. Learning different ways of thinking runs through the entire classroom, stimulating students' learning enthusiasm and cultivating stronger mathematical application ability and mathematical literacy.

Develop new examination evaluation indicators. Currently, our school adopts an examination based mechanism with homework as a supplement. In order to enable students to better unleash their potential, the examination evaluation indicators have also been adjusted accordingly. The exam is still the main focus, but the difficulty of the exam can be reduced. In addition to regular homework, an innovative learning scoring index can be added to guide students to write more innovative articles based on their research direction and the knowledge points in this course. They can complete them alone or in groups of several people. By integrating various related disciplines, the teaching of engineering mathematics and professional courses can no longer be disconnected, and can be integrated with the professional background.

4. Intended Goals to Be Achieved

Develop corresponding teaching syllabus and content based on the characteristics of the major being taught, adopt flexible teaching methods, and train talents with high mathematical literacy and application-oriented skills[6].

Explore the role of our school's mathematics series courses for engineering graduate students in the process of talent cultivation.

Communicate with the graduate school to see if the redesign of textbooks and the implementation of new exam evaluation indicators can be successfully piloted. I hope to receive support from the school and school leaders. Before formal implementation, it is necessary to do corresponding work, prepare the learning outline in advance, write textbooks and create electronic lesson plans, and prepare convincing premises.

To address any issues that arise during the teaching process, adjust the teaching content in a timely manner, gradually improve the outline content and electronic lesson plans, more teacher teams are needed to conduct research and summarize in teaching practice.

Building a high-quality faculty team, with the annual

expansion of graduate enrollment, establishing a small team for teaching courses, dividing labor and cooperating, and hosting teaching and research activities in real time, jointly assuming the responsibility of cultivating mathematics courses throughout the school.

Exchange and learn, visit and study related courses at other universities for teaching and research activities, and develop talent cultivation methods and experiences suitable for our school.

Establish a teaching and research activity group to regularly host teaching and research activities, set up a small team for main courses, divide the work and cooperate to write teaching outlines, lecture notes, textbooks, courseware, and electronic lesson plans, and jointly undertake the responsibility of cultivating mathematics courses for graduate students in the whole school.

Forming a mathematical modeling team encourages students to participate in mathematical modeling competitions and establish learning workshops, grouping students with similar research directions to apply the knowledge learned in the competition without taking up their class time. At the same time, they can think about problems with a positive attitude. Although the mathematics series courses end in the first year, they can participate in competitions for three consecutive years, allowing them to continue their enthusiasm for learning.

This project is based on the mathematics course for engineering graduate students at our university, and through investigation and research of the students taught, explores the best mode of talent cultivation for this course. At the same time, the implementation of this project can cultivate a small team of high-quality main course instructors for our school, providing a reference for the teaching and research of other mathematics courses in our school.

5. Conclusion

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The main research subjects are graduate students majoring in engineering at our university. The main value lies in cultivating students' mathematical literacy and numerical calculation ability, exploring and innovating a feasible method, and providing a teaching mode for the entire mathematics series courses of graduate students at our university.

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