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Teaching Reform and Practice Based on the Course of "Discrete Mathematics"

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Abstract

Based on the course of Discrete Mathematics, this paper studies the teaching improvement practice of cultivating computational thinking in the computer major. The specific implementation plan and methods are based on the construction of the "Theoretical Teaching System of Discrete Mathematics" and the "Experimental Teaching System of MAPLE Software". Through in - depth analysis of the teaching key points, difficulties, and characteristics of this course, while requiring students to master theoretical knowledge, practical teaching is also carried out, including computer - based practice, in - class tests, and after - class assignments. Innovative teaching concepts and heuristic teaching concepts are adopted to let the sense of innovation and active thinking germinate in the process of subtle influence, learning, and practice.

Keywords

Symbolic Computation, Computer Algebra, Discrete Mathematics.

1. Introduction

"Discrete Mathematics", as a classic achievement of the combination of computer science and mathematics, has been integrated into a basic professional course. It is a compulsory course for computer majors in various universities and plays a significant role in cultivating students' thinking and exercising their abilities. Since computer science is a highly practical course, if experimental teaching can be introduced into the "Discrete Mathematics" course, it will stimulate students' interest and inspire them to apply mathematical knowledge and computer tools to solve problems, which is in line with the training objectives of interdisciplinary talents. The "National Standards for the Teaching Quality of Undergraduate Majors Categories" recommends that the total class hours of the Discrete Mathematics course be increased to 72 Course hours. In some majors, it is even divided into several parts for separate courses, such as the graph theory part and combinatorial mathematics.

Mathematics and natural science education enables students to master theoretical and experimental methods, laying the foundation for students to describe engineering problems, select appropriate mathematical models, and conduct analysis and reasoning.

Computer algebra is often broadly understood as "symbolic computation" in many cases, and modern computer technology has made it possible for large-scale symbolic computation. The key issue lies in how to algorithmize the abstract algebraic theories so that they can efficiently handle various algebraic problems. Currently, the most well known software platforms are Wolfram Research's Mathematica and Maplesoft's Maple. They both provide rich mathematical resources. Compared with traditional high-level languages, these built-in mathematical functions can very conveniently realize the modeling of many engineering problems.

Currently, some foreign scholars have attempted to use computer algebra software to assist teaching and have published a number of academic papers and reference manuals. Among them, reference [1] provides many experimental examples and source codes in discrete mathematics,

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which is a very good learning tool. Students can reduce the learning difficulty and quickly complete some cases in the textbooks.

2. Teaching Goals

In traditional computer major teaching, mathematics courses are listed as basic courses. Students switch to the study of professional courses in the second year. After that, if students do not pursue postgraduate studies, they will basically discontinue their study of mathematics courses, creating an obvious gap. This arrangement has both advantages and disadvantages. Under the existing conditions, it is difficult to make major adjustments, and we can only adapt through the teaching of each course.

Under the existing teaching arrangement system, computer major students' perception of mathematics and computers is that mathematics is theoretical, profound, and difficult to understand, while computers are practical, hands-on, and interesting. However, when students actually participate in various subject competitions and enter the workplace, they will find that their reserves of mathematical knowledge are insufficient. But due to the long-term interruption of learning, they feel helpless when they want to change this situation.

In the current curriculum system of computer majors, the course "Discrete Mathematics" or the "Mathematics for Software Engineering" course offered by the software schools of some universities is a very good tool for exercising students' computational thinking. However, due to students' limited ability in manual mathematical calculations (for example, the relational algebra part involves matrix multiplication and inversion operations), they are unable to appreciate the applications of many wonderful classic algorithms in real life.

3. Teaching Strategies

In terms of teaching content, students' operational capabilities of existing computer technologies and software will be mainly cultivated through learning symbolic computation theory and the basic course of the mathematical software MAPLE. Based on this course, the focus will be on the applications of discrete mathematics in computers, including the applications of mathematical logic, relational algebra, graph theory, combinatorial mathematics, and number theory in computers.

Through the design of extended comprehensive experiments, students can not only master the logical operations in discrete mathematics but also perform common calculations such as elimination, calculus, linear algebra, and statistics. They can integrate well with the knowledge related to practical problems, independently complete the mathematical modeling of real life practice problems, understand the applications of symbolic computation technology in computers, master data analysis capabilities, form rigorous logical thinking and reasoning abilities, and enhance team - work awareness and collaboration capabilities.

The specific implementation plan and methods of this project are based on the construction of the "Theoretical Teaching System of Discrete Mathematics" and the "Experimental Teaching System of MAPLE Software". Through in depth analysis of the teaching key points, difficulties, and characteristics of this course, while requiring students to master theoretical knowledge, practical teaching is also carried out, including computer based practice, in - class tests, and after - class assignments. Innovative teaching concepts and heuristic teaching concepts are adopted to make the sense of innovation and active thinking germinate in the process of subtle influence, learning, and practice.

Therefore, this project mainly completes the following two tasks:

1.Compile teaching resource cases for "Discrete Mathematics" and complete the corresponding experimental instruction manuals to assist students in practical teaching.

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2.Propose a set of scientific assessment and evaluation systems, so as to improve students' computational thinking and their practical ability to solve problems.

4. Teaching Procedure Design

On the basis of teaching basic courses of discrete mathematics and mathematical software modeling, enabling students to master the conceptual algorithms of existing software engineering mathematics, the focus will be on the applications of discrete mathematics in computers. This includes the description, modeling, analysis, and operation of practical problems, as well as its applications in programming, so as to form a complete "Software Engineering Mathematics Curriculum System".

(1) Establish lecture notes, courseware, experimental designs, experimental lecture notes, and an online teaching platform for the "Discrete Mathematics Curriculum System" combined with the computer major.

Gather a team of experienced teachers and educational experts in the field of computer science and mathematics. They will collaborate to create high quality lecture notes that integrate theoretical knowledge with practical applications in the computer field.

Design visually appealing and information - rich courseware, using multimedia elements such as animations and real world examples to illustrate complex concepts.

Develop a series of experimental designs that cover a wide range of practical scenarios in computer science, from database management to algorithm design.

Compile detailed experimental lecture notes to guide students through the experimental process step by step.

Build an online teaching platform that provides a user - friendly interface for students to access teaching resources, submit assignments, and participate in discussions.

(2) Implement the case based teaching method in this project. The most prominent feature of the "case based teaching method" is to transform students from passive listeners in traditional teaching methods to active thinkers. Driven by clear demands, students actively explore knowledge in relevant unknown fields. For example, when teaching relational algebra in traditional courses, only the numerical calculations of relational matrices are taught in a dull way. In the "case based teaching method", an example of a database experiment can be introduced first, symbolize it, and then consider a series of teaching contents such as how to analyze it and which related knowledge points of discrete mathematics are needed. When explaining graph theory, a coding decoding process can be simulated. Under the guidance and inspiration of teachers, students gradually apply the learned computer knowledge points to explore and try to solve the problem. In this way, students not only feel a sense of novelty and not bored, but also achieve good teaching results and have a deep memory.

(3) The project enables an online Q&A and assignment process: Make full use of the network conditions of our university, establish an online discussion column, and teachers conduct discussions and exchanges with students on teaching difficulties. Students can submit their assignments and questions online during or after class, so that students' learning activities are based on a more scientific, open, standardized, and efficient teaching platform.

Set up a dedicated online discussion forum on the teaching platform, where teachers post weekly discussion topics related to the course content.

Teachers adopts a classroom + laboratory teaching mode, that is, theoretical courses are taught in the classroom, and practical activities are carried out in the laboratory, alternating with each other. Teach while practicing and answer questions in a timely manner, so that students can practice newly learned knowledge in class. It is expected to improve the teaching effectiveness

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of teachers and students. Of course, the actual effectiveness needs to be verified through the implementation of several sessions of courses.

Arrange the teaching schedule in a way that for every two weeks of classroom based theoretical teaching, there will be one week of laboratory based practical teaching.

In the laboratory, provide students with hands - on tasks that are directly related to the theoretical knowledge they have learned in class, such as writing code to implement discrete mathematics based algorithms, or using mathematical software to solve real world problems. Teachers are present in the laboratory during practical classes to provide on the spot guidance and support to students.

5. Conclusion

The mathematical software practical teaching system serves as a smooth bridge to subsequent professional courses. Since it is closely related to the actual application scenarios in the computer field, students can better transition to more advanced courses such as software engineering, data mining, and artificial intelligence. The skills and knowledge they acquire in the practical teaching of discrete mathematics using software can be directly applied in these professional courses, laying a solid foundation for their in - depth study.

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