

Construction and Practice of Graduate Course of Advanced Data Structure

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Abstract. Advanced data structure course is the natural extension and specific application of the knowledge in the basic course of program design. In the course teaching, the course group uses MOOC classroom to realize the flipped classroom, so as to improve students' comprehensive ability. Through the OJ platform to strengthen the practice, the course group improves the programming ability of students. The course group improves students' research ability and innovation ability through subject competition. Through this kind of mixed teaching reform, the course group can guide students to change from "I want to learn" to "I want to learn", let students participate in all aspects of teaching, realize the real "I am the master of learning", and also stimulate students' innovation ability.

1. Introduction

With the rapid development of information technology, computer application technology has been permeated to all walks of life, and derived a lot of cross-disciplines related to information technology. Computer knowledge and skills have become one of the basic qualities of contemporary versatile talents with innovative ability. How to do a good job in the basic teaching of computer science and the training of computer science talents has become one of the hot issues concerned by the education department.

The advanced data structure course is a natural extension and specific application of the knowledge in the basic course of program design, which will have a profound impact on students' ability of data analysis, data organization, data processing and programming when solving specific practical problems. The curriculum system in the postgraduate training plan of the computer department of Qinghai University is designed by the experts of Tsinghua University. The content of the curriculum is closely related to the latest "information technology and application" training direction formulated by the Ministry of education, so as to meet the training needs of applied talents[1].

2. The Teaching Content

The advanced data structure is the core course of information technology courses, which has strong characteristics of comprehensiveness, timeliness and practicality. The main contents of this course include mastering the definition of various advanced data structures, the description of abstract data types, the description of related algorithms and the performance analysis and evaluation of algorithms, as well as the comprehensive application of advanced data structures to cultivate students' imagination. The purpose of teaching is not only to let students master the basic knowledge and train students' thinking of program development, but also to cultivate students' ability of independent learning, independent analysis and problem-solving.

In the process of teaching, scientific frontier content is introduced. Any subject is developing constantly, especially in computer science. The content of advanced data structure course in computer science is a summary of computer problem solving, and its change and development are very fast. The development of course content is mainly manifested in the following two aspects: first, new data structures are constantly generated; second, there are new problems that need to be

solved by applying data structure knowledge. In view of these developments, the teaching link of this course has given the corresponding design and transformation.

In addition, in the course content teaching, mainly combined with the actual, the introduction of teaching content. For example, for Google, Baidu, these search engine websites, when searching websites by keyword, guide students to think, should we use depth first search or breadth first search? What are the advantages and disadvantages of each? And introduce the new data structure in the appropriate chapter, and explain it. For example, when analyze the search performance of binary search tree, the course group can introduce the concept of the balanced binary tree, such as AVL tree, red black tree and so on, and explain them properly.

3. Teaching Methods

In the teaching process of this course, the course group is trying to change the traditional knowledge-based, principle based and display based teaching methods into incentive exploration based and ability training based teaching models. In the classroom and outside the classroom, students are encouraged to collect new data structures after class, analyze them theoretically and give demonstration algorithms, and then organize discussion.

In addition, the students who accept the course are all post-90s, their psychology and learning habits show a personalized and diversified trend. For example, they like to use intelligent terminals to learn, and they prefer fragmented learning methods. Therefore, teachers need to work hard in teaching methods and means, carry out in-depth teaching research, and design a good teaching model design. This course adopts a variety of teaching methods, as follows:

3.1. "Exploratory" teaching methods

In the teaching process of advanced data structure course, the course group is trying to change the traditional knowledge-based, principle based and display based teaching methods into incentive exploration based and ability training based teaching models. In the classroom and outside the classroom, students are introduced to discuss the cutting-edge issues of the subject. The course group encourages students to collect emerging data structures outside the classroom, analyze them theoretically and give demonstration algorithms, and then organize discussion.

When teaching the specific course content, the course group not only explains its basic principles, but also analyzes the design process to stimulate the students' exploration spirit. For example, when explaining Huffman tree, the historical process of Huffman's putting forward Huffman tree is reproduced to encourage students' interest in raising questions and the ability to solve problems.

3.2. "Ability type" teaching method

In the teaching process of this course, the course group pays attention to strengthen the training of the practical ability and operation ability of the data structure, supplemented by a large number of exercises, computer experiments, comprehensive design, etc. At the same time, the course group also attaches great importance to the supporting role of the advanced data structure for other software courses, that is, to cultivate the ability of students to apply advanced data structure knowledge to solve computer problems.

In addition, the course group trains students' ability to analyze problems through mathematical modeling, and trains students' ability to express through writing experimental reports and course design reports.

3.3. "Case formulation " teaching method

In teaching, teachers choose the real basic and essential knowledge as the case, through the research and learning of "case" content, to stimulate students' interest and enthusiasm in exploration. For example, when introducing the stack, the course group takes the game of "glass and table tennis" as an example, introduces the concept of stack, and analyzes the characteristics of the stack. You can think of the glass as a stack, and the table tennis as an element of the stack. You can put multiple table tennis balls into the empty glass continuously. But if you want to take out the table tennis, the first one is the top one, and the last one is the bottom one. So that students can understand that stack is a linear table with the limited operation, stack in and stack out operation, as well as the last in, first out feature of stack. This is to explain the algorithm, analyze the process and

draw conclusions through the knowledge points used in the case. The purpose is to make students draw inferences from one example and improve their creativity through "cases".

3.4. "Flipped classroom" teaching method

The online MOOC classroom is used to realize the flipped classroom discussion and help students to further think and understand the course content. Guide students' learning process from intuitive content understanding to logical thinking learning. This way of learning improves students' ability of autonomous learning and the ability of analyzing and solving problems independently. The learning progress of students on the MOOC platform is shown in Figure 1.

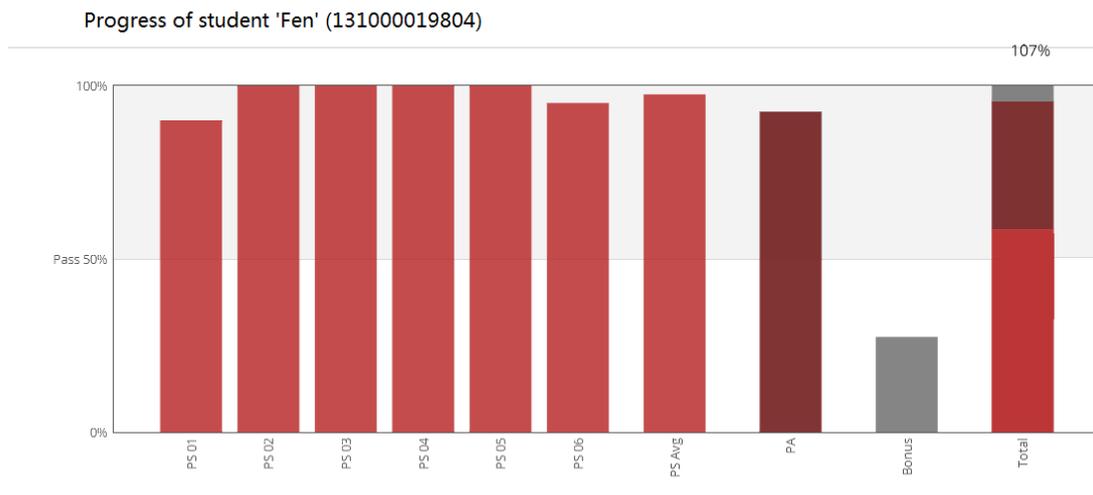


Figure 1. Learning progress of students on the MOOC platform



Figure 2. OJ platform

In addition, build your own online judge platform (OJ for short), as shown in Figure 2. Students can use OJ platform to submit a variety of programs online, which can improve students' programming ability. Through the certification examination of CCF CSP in Qinghai and the competition of computer system and program design, the comprehensive practical ability of students to solve practical problems by using information technology can be improved.

4. Subject Contests

With the rapid growth of the enrollment scale of higher education in China, it is an inevitable choice to promote the innovation and entrepreneurship education of graduate students. The

competition of graduate disciplines has set up a practical platform for graduate innovation and entrepreneurship education. The knowledge structure of graduate students is more comprehensive than that of undergraduate students. The ideas of finding, analyzing and solving problems are more logical, and they have more research ability and innovation and entrepreneurship ability. Through subject competition, the scientific research ability of Postgraduates can be effectively combined with practical problems. The competition can stimulate graduate students' interest in innovation and entrepreneurship. Through the program design competition, Graduate Students' programming ability has been improved, laying a solid foundation for better scientific research[2,3].

In recent years, graduate students have won the third prize of the state and the special prize of Qinghai Province in the national program design ladder competition. In addition, graduate students have won many awards in the electronic design competition.

5. Teaching Evaluation

In the aspect of assessment management, the assessment method has changed from the former assessment method of ordinary and final scores to the present one in various forms. The traditional assessment is mainly based on the closed book final exam. Now, the closed book final exam accounts for 30% of the total score, and 30% of the total score is divided into the algorithm training of students, highlighting the role of algorithm design in the whole score and the self-improvement of MOOC Learning, testing and online examination account for 30% of the total score, and curriculum design accounts for 30% of the total score. The change of evaluation mode makes the practical ability to become the yardstick of evaluating talents and embodies the idea of quality education.

6. Conclusion

After three years of curriculum construction and reform, the quality of personnel training has been significantly improved, and the innovation ability of graduate students has been greatly improved, and good teaching results have been achieved. Through the mixed teaching reform, the course group can guide students to change from "I want to learn" to "I want to learn", let students participate in all aspects of teaching, realize the real "I am the master of learning", and also stimulate students' innovation ability.

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