Research on the teaching reform practice of "Data Structure and Algorithm" course integrating "Post-Course-Competition-Certificate"

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Abstract: "Data structure and algorithm" course is a theoretical and practical are very strong course, students need to master the theory to guide practice, in practice constantly improve the application of theoretical knowledge ability. Based on the characteristics of the course, integrating the concept of "Post-Course-Competition-Certificate", the teaching process of "three stages and six links" is designed, as well as the student practice process of "imitate-practice-evaluate-appraise" promoted at each level. The reform of curriculum teaching is explored from the aspects of teaching content reconstruction, teaching objective determination, teaching strategy optimization and evaluation system refinement. Through the effect evaluation and analysis, it is found that the reformed teaching program can effectively improve the teaching effect, gradually improve students' self-confidence, and stimulate students' creativity.

Key words: "Post-Course-Competition-Certificate"; Data structure; Curriculum reform

Introduction

"Data Structure and Algorithm" is a required course of computer application technology major, with a total of 64 class hours, mainly to train students to build data models, implement algorithms, write and debug programs. The traditional way of explaining knowledge points one by one according to the chapter structure neglects the cultivation of students' knowledge seeking and self-learning ability, and the lack of diversity of teaching methods leads to the low enthusiasm and participation of students in class. In addition, most of the experimental activities are single-person example exercises, which are monotonous in content and lack of innovation, and also lack the cultivation of students' teamwork ability. Aiming at the above problems in the course of data structure and algorithm, this paper integrated the concept of "Post-Course-Competition-Certificate" and explored the course teaching reform from the aspects of teaching content reconstruction, teaching objective determination, teaching strategy optimization and evaluation system refinement.

1. Teaching Design

1.1 Integrate the "Post-Course-Competition-Certificate" and reconstruct the teaching content

Integrating "Post-Course-Competition-Certificate" means that in the course teaching process, post teaching, industry competition and industry certificate are fully integrated to form a specific teaching system including post□competition and certificate. Based on the professional course standards and course characteristics, docking the basic tasks and professional ability requirements of "programming" posts, integrating into the test points related to the data structure and algorithm in the skills competition and soft test, taking the project case as the starting point, transforming the enterprise work content into a learning task, reconstructing the traditional textbook content, and building four teaching modules. For each teaching module, referring to the enterprise project development process, the project scenario process is analyzed first, and then the data storage structure model of each part is abstract constructed, and then the storage structure of each part is realized and tested. Finally, the process of realizing the remaining functions of the system is comprehensively developed. Each module is divided into multiple learning tasks, from simple to complex, from single to comprehensive. See Figure 1.

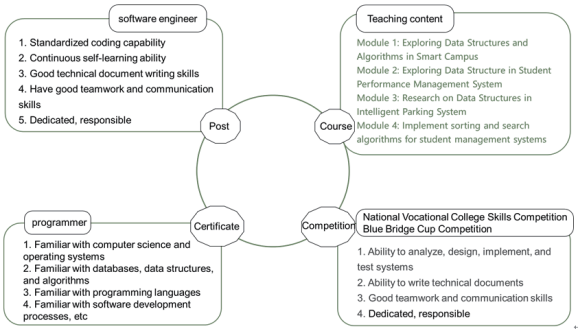

Chart1 Restructure Teaching

1.2 Investigate new and old students and accurately analyze the learning situation

Relying on the online big data system and using the form of investigation and interview, the previous graduates engaged in "programming" were investigated to understand the requirements of data structure knowledge, ability and quality in the work; For the students in the previous session, a questionnaire was used to add the description of course information in the questionnaire, including: mathematical foundation requirements, programming ability requirements, logical thinking ability requirements, theoretical depth, practical difficulty and other survey items, statistics, analysis and grasp the students' common evaluation of the course. For the teaching objects, through interviewing the teachers of prerequisite course, the examination scores of the pre-course papers were analyzed, and the students' mastery of the pre-course was qualitatively and quantitatively analyzed. Then, based on the general evaluation of previous students on the

courses, a questionnaire is generated, and data of students' various abilities and learning characteristics are collected. Finally, The survey data of three aspects and ten perspectives is generated, namely, knowledge and skills (discrete mathematics, program design, programming ability, logical thinking, innovation ability), quality state (confidence, fear of difficulty, resistance to frustration), learning characteristics (learning concentration time, learning ability, etc.).

Accurate analysis of the survey results, the statistical results are as follows:

1. Knowledge and skills: 98% of the students lack the basis of discrete mathematics, 79% of the students have medium knowledge of programming theory, 78% of the students have average logical thinking ability, 84% of the students have average coding ability, and 93% of the students have weak programming innovation ability.

2. Quality state: 66% of the students are not confident enough in practice, 57% of the students are afraid of difficulties, afraid of trouble, not strong sense of responsibility, 70% of the students have poor anti-frustration ability.

3. Learning characteristics: 81% of the students are too theoretical, more difficult content learning time is less than half an hour, 90% of the students prefer low difficulty, easy to achieve the practical operation.

Through comprehensive analysis, the basic learning situation of students is obtained: students' theoretical knowledge is not systematic, logical thinking ability is general, code writing ability is general, program design innovation ability is weak, like active practical activities with high participation, but the difficulty can not be too high. There are some level differences among students. Some students have a certain programming foundation, strong hands-on ability, but weak self-learning ability; Some have no foundation, but strong learning ability; Individual students in the secondary vocational major is liberal arts, mathematical foundation, logical thinking ability is weak, program writing there is a fear of difficult emotions.

Docking with the results of the above learning situation analysis, the standard professional post requirements, as well as the contest, soft examination points, determine the three-dimensional teaching objectives of knowledge, ability and quality of each module and each task, and predict the teaching difficulties of each task.

1.3 Adopt task-driven teaching and optimize teaching strategies

1. Teaching - learning - doing integrated teaching model

Following the principle of "learning by doing", the project-oriented task-driven method is adopted. The implementation process refers to the software project development process and takes the development process of specific projects as the main line. Students are asked to simulate the typical tasks of enterprise software development positions: from project demand analysis, to project design, to function realization, and finally to debugging and testing. With project implementation as the main body of the whole teaching process, the teaching is organized and implemented according to the operation process of a complete engineering project. Through project practice, students can effectively realize the transformation from theory to practical application, improve the ability to solve practical problems, and achieve the requirements of talent training goals. In the selection of the project, the project is divided into several tasks with familiar examples from students' daily life, and the project tasks are introduced into the teaching content, so that students can learn in the exploration with the task, complete a series of tasks step by step, acquire the knowledge of data structure in the process of completing the task, and cultivate the ability of analysis and problem solving.

2. "imitate-practice-evaluate-appraise" promoted the teaching organization layer by layer

From the survey results of previous students, it is found that most students think that this course is too theoretical, abstract and logical, and it is difficult to understand and apply practice. According to the characteristics of the course, the practical learning process of "imitate-practice-evaluate-appraise" is designed, which reduces the difficulty of students' starting practice and gradually improves their self-confidence. See Figure 2

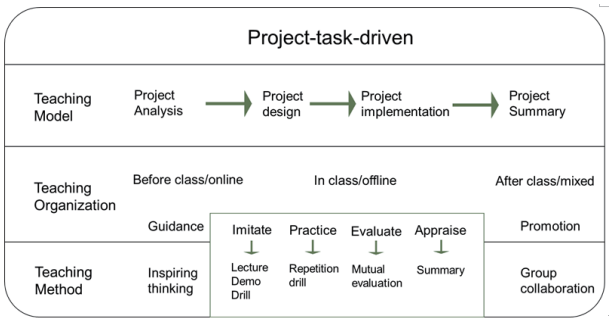

Chart2 Instructional Strategy

2 Follow the cognitive rules and implement teaching activities

Relying on the online learning platform, based on project orientation and task drive, with the analysis, design and realization of actual project tasks as the main line, integrating the teaching of relevant knowledge and theoretical knowledge points and related consolidation exercises and experiments, the teaching process of "three stages and six links" is designed. In terms of time dimension, it is divided into three stages: before class, during class and after class. In spatial dimension, it is divided into three stages: online, offline and mixed. In the dimension of knowledge learning, it is divided into three stages: transmission, internalization, expansion and promotion. Cooperate with a variety of teaching elements, establish a six-link teaching process of "guiding self-study, imparting imitation, counseling practice, driving mutual learning, induction and evaluation, expanding and improving". It is shown in Figure 3

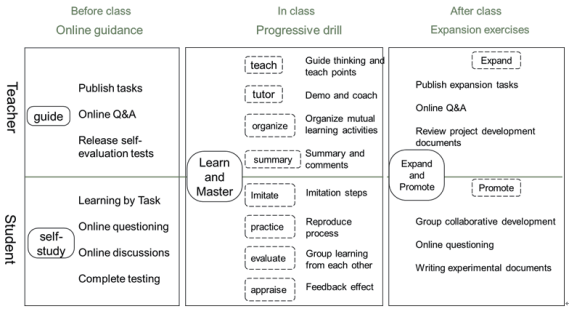

Chart3 The teaching process of "three stages and six links"

Session 1: Guided self-study. Before class, the teacher releases the learning task on the online learning platform, and the students learn teaching videos and PPT independently according to the task requirements, complete the self-test, and put forward difficult problems.

Session 2: Imparting imitation. In the class, the teacher explained the students' self-test results and difficult problems in detail. After that, they released related experimental tasks, guided students, analyzed task requirements, built data models, and demonstrated the implementation steps step by step while talking. The students followed the teacher's ideas and imitated them.

Session 3: Coaching exercises. After students complete the second step, the teacher provides the same function as the previous step, but the implementation steps only keep the notes of the document, students follow the notes prompts, repeat the implementation process, and consolidate the exercise again. During this period, the teacher offered help and guidance to the students with weak practical ability.

Session 4: Drive mutual learning. The teacher takes the group as the unit, adopts the initiative to take the stage, or randomly selects the group to share the results of the third step, and other groups learn from each other, sum up the experience, reflect on the shortcomings, so as to achieve the effect of mutual learning between students and common improvement.

Session 5: Induction and evaluation. Teachers summarize and comment, and students give feedback on the learning effect through the online platform. For students whose feedback is not satisfactory, they will find classmates to help them one-on-one; For those students who have the strength to study, they will be drawn into the preparation team.

Section 6: Expansion and improvement. Use the online learning platform for auxiliary learning and promotion. Students complete homework on the platform and submit the experiment report of the after-school enhancement project to consolidate theoretical knowledge and improve practical ability.

3. Students' learning effect

The results of the final evaluation and process evaluation show that 85% of the students scored above 80 points in the theory test, 91% of the students could distinguish the sequence table, stack and queue of these data storage structures, 70% of the students could design the basic stack and queue storage structure, and more than 80% of the groups could well complete the final comprehensive project design.

The value-added evaluation shows that 93% of the students' code writing speed and code quality have improved, and 85% of the students' independent learning ability has improved to a certain extent.

Through the analysis of the pre-class self-test results, it can be seen that the students' autonomous learning ability has been significantly improved, and the enthusiasm and participation of each group member has been significantly improved when sharing in the group. Through the analysis of the "experience" in the comprehensive experiment report and the contribution value of the members in the group, it can be seen that the students' teamwork and innovation consciousness have been significantly improved. The results of questionnaire survey after the course show that the students have a strong sense of gain after the course learning.

4 Summary

Integrating "Post-Course-Competition-Certificate", according to the teaching organization mode of "three stages and six links" and "imitate-practice-evaluate-appraise", students' professional knowledge, technical skills and quality have been significantly improved. In the future, the study will focus on strengthening the cooperation between schools and enterprises, allowing enterprises to participate in the reconstruction of the course content, making the project cases more close to the actual enterprise projects, better stimulating students' learning interest and improving students' practical ability. In addition, we will try to apply this teaching scheme to other courses to compare the differences and similarities of reform effects under different courses.

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