

Research on online and offline blended classroom teaching of C++ programming course

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Abstract—In the teaching of C++ programming, according to the students' existing theoretical knowledge and practical experience, combined with case design, the combination of case and practice is adopted in the teaching of advanced class mixed teaching mode. Teaching strategies such as heuristic explanation and leading practice are used in classroom teaching to guide students to analyze the functional requirements of problems, find ways to describe core problems, and complete the design of experimental projects through teamwork. In the teaching process, students are encouraged to think independently, actively use their brains and hands, and combine theoretical knowledge with programming practice to cultivate students' ability to solve complex programming problems and improve their ability of high-level scientific thinking.

Index Terms—Online and offline mixed teaching; Problem-oriented; Practical exploration

I. INTRODUCTION

On-line and off-line hybrid teaching based on the wisdom tree and learning through the course platform. Using the Smart Tree website and learning Link to build a combination of online and offline course platform, Smart Tree online sharing course provides 65 video resources, supporting chapter test questions and question banks; The Smart Tree self-built online flipped course is used for publishing teaching resources and classroom quizzes and other activities; Learning Connect synchronizes course learning videos with learning resources to provide students with multiple options for student assignment submission and class activities. [1-2].

II. THE BASIS OF BLENDED TEACHING DESIGN, ONLINE AND OFFLINE TEACHING COURSE ARRANGEMENT

A. Optimize classroom teaching content

AC++ Programming is an important professional course for information and computing science majors, and its content permeates and applies to many fields of computer science (for example, computer software and theory, data structure, algorithm design and analysis, operating system, graphics and image processing, software engineering, Java language programming, design patterns, etc.). The study of this course will directly affect the further study and research of many subsequent courses of this major.

C++ is not only a process-oriented structured language, but also an object-oriented programming language. It integrates

object-oriented features such as abstractness, encapsulation, inheritance and polymorphism into one, which can help people develop large-scale software with a high degree of data abstraction and fully embody the characteristics of information concealment, software reuse, easy modification and easy expansion.

The main task of this course is to introduce procedural programming methods such as basic data types, basic operations and sentence structures in C++ language, and basic object-oriented programming methods such as classes and objects, operator overloading, inheritance and derivation, polymorphism and virtual functions in C++ language. In the process of learning, learners can master various object-oriented features of C++ through a large number of program examples and related exercises, so as to gradually master the basic knowledge and basic skills of object-oriented programming. Through the teaching of this course, students can understand the general situation of object-oriented programming and master the basic ideas and methods of C++ language programming. Master the basic theory and application of C++ language programming. Cultivate and improve students' ability of object-oriented programming design, implementation and debugging, laying a foundation for students to engage in large-scale software development and solve engineering problems, science and technology problems in the future, and also providing a guarantee for students' smooth learning of subsequent courses.

Course focus: understand the emergence and characteristics of object-oriented programming language, the origin of object-oriented method and its basic concepts, and initially understand the basic ideas of object-oriented programming. Students should have a deeper understanding of object-oriented methods and their basic concepts, and continue to understand the whole process of this course, on the basis of process-oriented, learn to use object-oriented concepts and ideas to analyze and deal with problems. It is necessary to fully understand the characteristics of class, deeply understand the characteristics and advantages of data encapsulation, inheritance and polymorphism, and grasp the essence of object-oriented programming. Support for object-oriented programming is one of the most important features of C++, C++ language classes, objects and object-oriented programming features throughout the course of the study, must be deeply understood, focus on mastering.

Course difficulty: master the role of constructors and destructors in the process of object creation and removal, master various initialization methods of objects, especially the construction and destruction of derived objects, nested objects, combined objects, static objects, constant objects and other objects. Inheritance can be said to be the most important part in object-oriented programming. To learn the characteristics of inheritance in object-oriented programming, we should not only learn its viewpoints and methods, but also learn how to apply it in actual programming. The application of polymorphism and virtual function in programming is also the difficulty of this course.

In order to meet the requirements of application-oriented personnel training, based on the curriculum and professional characteristics, docking the requirements of post ability and production process, docking the objectives of personnel training, restructuring the curriculum system and optimizing the course content; The cutting-edge achievements, realistic cases, curriculum thinking and politics, and teacher research advantages are organically integrated into classroom teaching. Through the mixed course design and reform of this course, students can master the C++ programming language in a more comprehensive way, understand the basic ideas of object-oriented programming language, and master the basic methods and ideas of solving problems with C++ programming language.

Since C++ programming language has many concepts, high abstractness and flexible application, in the process of learning, we should not only pay attention to learning the syntax of C++, but also understand the object-oriented characteristics of C++ language. In practical teaching, the combination of theoretical knowledge and cases guides students to think and solve problems with object-oriented programming thinking as much as possible.

"C++ Programming" is a very practical course, we must learn on the basis of theory through repeated computer practice, in order to deeply understand the basic ideas of object-oriented programming. Theoretical teaching integrates case analysis, and then through continuous experiment practice, deepen students' understanding of knowledge points, consolidate the theoretical content, and improve practical ability. In the teaching process, from the simple to the deep, from the simple to the complex, from the abstract to the concrete, and gradually guide the students to use the idea of object-oriented programming to analyze and solve problems, emphasizing the combination of classroom teaching, classroom testing, group sharing and computer practice.

C++ language content is varied, information and computing science major "C++ programming" course only 54 hours, in the limited class hours can not and do not need to cover everything, so to effectively organize teaching, focus on the key points, grasp the difficulties, not to study the details of grammar, but to grasp the C++ programming algorithm ideas, basic principles, from the whole to the specific. Cultivate students' interest in C++ language and

correct thinking mode. In determining the teaching content and method, the course focus is divided into three levels according to the students' computer foundation, professional background and learning goals.

The base layer focuses on data types, C++ operators, logical expressions, and commonly used internal functions.

The middle layer focuses on the knowledge and basic application of control structure, array, pointer and structure.

The core layer focuses on functions, classes and constructs, inheritance, polymorphism, and C++ streams.

The three-level key teaching system enables students to learn the basic knowledge of C++ effectively and master the basic skills of programming step by step in a more scientific way, and focuses on strengthening the training of students' programming ability.

Secondly, case teaching is adopted in the teaching method, teaching content is divided around teaching cases, and strive to teach each knowledge point content with vivid and effective examples, and teaching cases are divided into three levels:

Basic cases: Simple cases are used to verify basic knowledge. Such cases focus on the teaching efficiency and correspond to the knowledge points, so that students can master the format of basic sentences and understand relevant basic knowledge in a direct way.

Simple program case: A small program example that contains multiple knowledge points.

Unit comprehensive case: a comprehensive case of the main knowledge points of each chapter and the content that has been learned before. Its example content is a module or a functional part of the practical application design content, so that what students learn is closely combined with practical application.

B. Using information technology means to carry out online and offline mixed teaching

Based on the deep integration of information technology and classroom teaching, online and offline teaching mode is adopted. Online 1 class time mainly includes online video learning of 65 knowledge points, online problem discussion, online communication, and online quiz.

2 hours of offline teaching, in the classroom, the rain class teaching method is adopted, the class scan code and sign in. In the process of explaining theoretical knowledge points, questions are appropriately set according to the learned content, and the difficult knowledge points are tested along with learning, combined with communication and discussion, so as to timely grasp the learning situation of students, adjust the teaching design and teaching methods and methods, and use case problems as guidance in teaching. Integrate theoretical knowledge into cases, and make students truly participate in the class through group presentation and other ways in practice. [5-6]. [7] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties,



Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and DempsterSchafer in the expert information system of career guidance method has been studied. [8] discussed that according to the observations in this paper, an existing mathematical model of banking capital dynamics should be tweaked. First-order ordinary differential equations with a "predator-pray" structure make up the model, and the indicators are competitive. Numerical realisations of the model are required to account for three distinct sets of initial parameter values.

III. TEACHING METHODS

Teaching method is a key factor affecting the quality of teaching. Blended teaching and flipped classroom teaching methods are introduced, teaching methods are redesigned, and a variety of teaching methods such as "heuristic, case and project" are adopted to gradually form a student-centered learning mode, increase students' learning interest and improve their class participation. Finally realize the improvement of teaching quality.

Heuristic teaching pays attention to the guidance of students, emphasizes the interaction of teaching, encourages students to actively participate in the whole teaching process through questions, and transforms students from passive learning to active learning. For the inspiration of some small problems, the teacher can decide according to the performance of the students in the actual teaching, such as the determination of the data members, the determination of the function return type, the selection of parameters, the writing of the return statement, etc., can be inspired, so that students can explore the answer.

The case teaching method breaks the traditional teaching mode centered on theoretical knowledge points and integrates knowledge points into concrete examples, so that students can increase their perception and understanding of abstract concepts in imitation. For the modules of encapsulation, inheritance, polymorphism, template and exception in this course, at least one teaching case is designed for each module. Each teaching case should contain the main knowledge points of the module and the related programming methods.

The project-driven teaching method takes the project as the main line to carry out the teaching process. With the deepening of learning, in order to integrate relevant knowledge points into all aspects of the project, it follows the principle from simple to difficult and step-by-step progress, allowing students to use the after-class time to complete the project through group cooperation, experience the fun of knowledge accumulation and harvest the learning results.

The project-based teaching in this course is mainly embodied in the large assignments in the course design, such as arranging a small game or small system at the beginning of the course, requiring C++ programming, and with the

in-depth study to constantly improve the procedures. In actual teaching, although it is difficult for a project to contain all the main points of the whole course, it usually contains a lot of knowledge points, requiring students to consult materials after class to find solutions, this not only broadens the breadth and depth of knowledge, but also cultivate students' ability to analyze and solve problems independently.

IV. ASSESSMENT METHODS

According to the course outline, specify the assessment content, and measure the growth and progress of students and the achievement of the course objectives through the corresponding evaluation standards.

Multiple assessment methods and criteria are adopted. Process assessment includes classroom learning performance, online course learning, coursework, stage tests or chapter tests.

Through online independent learning, extracurricular development learning, in-class learning, theoretical assessment and practical assessment, the multi-dimensional assessment.

Based on the training needs of innovative talents, according to the professional characteristics of C++ Programming, students are encouraged to participate in college students' innovation and entrepreneurship training programs, college students' Mathematical Contest in Modeling, and "Challenge Cup" Chinese College Students' Entrepreneurship Competition, so that students can explore innovation and serve the society based on the course. In addition, the corresponding achievements, rewards and social repercussions of students based on curriculum innovation are included in the curriculum assessment.

V. CONCLUSION

Based on the deep integration of information technology and classroom teaching, a hybrid teaching mode combining online and offline is adopted. Online learning uses online platforms to share video materials of classes, including online video learning of 65 knowledge points and online chapter tests.

In addition to the shared course learning resources on the website, in order to provide students with more complete learning resources and better grasp the learning situation of students in class, the flipped classroom of C++ Programming Design was built on the platform for the release of relevant learning materials and classroom tests and other activities.

Courses, including course learning videos and learning materials, have been established in the app, which are mainly used for activities such as check-in, homework submission, pre-class discussion, etc. Offline classes make full use of modern information teaching methods to truly expand in-class learning to extra-class, so that students have clear learning goals before, during and after class. Through the breakdown of learning tasks, Let students know what to do

and how to do it, increase students' interest in learning, and cultivate students' self-learning ability.

Arrange online video preview and relevant questions for students before class, so that students can enter the class with thoughts and questions.

In class, we timely understand students' understanding and grasp of theoretical knowledge points by sending questions in class. In class teaching, we adopt the case teaching method of "raising questions -- introducing methods of knowledge analysis and solving problems -- summarizing general rules and concepts", so that students can have a complete, practical, concrete and tangible project as a knowledge association and application carrier when learning new knowledge points. Then truly understand the theory and method of C++ programming. The cases run through the whole theory teaching, so that students can experience the combination of theory and practice. In the whole process, students first try to solve their own problems, and constantly improve their ability to solve problems.

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