Developing New Quality Productive Forces and Cultivating High-Quality Applied Talents

— Exploration and Practice of "One Heart, Three Drives, Four Rings" Object-Oriented Programming Technology First-Class Course Construction

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Abstract. This study focuses on improving the teaching quality of the "Object-Oriented Programming Technology" course in applied universities. By assessing the deficiencies of the current curriculum, practical improvement measures are proposed. The research first analyzes the current situation of the construction of the object-oriented programming technology course in applied universities, then benchmarks the requirements for the construction of a first-class course, and constructs a plan for the construction of a first-class course. The plan covers reforms in teaching content, practical segments, teaching methods, and teaching evaluations. Through empirical teaching tests, the effectiveness of the plan has been confirmed.

Keywords: First-Class Course; Applied Universities; Object-Oriented Programming; Reform and Construction

1 Introduction

With the rapid development of China's economy, the demand for high-quality applied talents is increasingly strong. Applied universities, as an important base for cultivating high-quality applied talents, have particularly important curriculum construction. "Object-Oriented Programming Technology" as a core course in the computer science and technology major, is of great significance for cultivating students' programming abilities, software development capabilities, and innovative abilities. In order to improve the teaching quality of this course and better meet the social demand for talents in the computer science and technology major, it is of great practical significance to study how to build a first-class course of "Object-Oriented Programming Technology" and enhance teaching quality.

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2 Analysis of the Current Situation of Course Construction

In recent years, the curriculum design courses in applied universities in China have been continuously reformed, actively exploring talent training models that coordinate the development of knowledge, ability, and quality, in order to cultivate students' practical abilities and innovative abilities[1]. Taking the "Object-Oriented Programming Technology" course as an example, breakthrough changes have been made in the construction of teaching models. However, compared with the standards for first-class course construction, there are still many aspects that need in-depth exploration and strengthened construction. The current situation that needs reform in this course includes:

2.1 There is a Gap Between Course Teaching Content and Industry Needs

With the rapid development of information technology, the requirements for programming talents by enterprises are getting higher and higher[2]. Enterprises need talents with solid programming foundations and strong problem-solving abilities. However, the current teaching content often focuses too much on the explanation of theories and neglects the cultivation of practical programming skills, resulting in students' difficulty in quickly adapting to the work environment after graduation.

2.2 The Integration of Knowledge is Not Strong

Students show a lack of understanding and application of knowledge points during the learning process, and it is difficult for them to connect different disciplines or knowledge points within the same discipline to form a systematic knowledge system[3]. This phenomenon may lead to students being unable to flexibly use the knowledge they have learned to solve complex problems, thus affecting learning outcomes and the improvement of comprehensive quality.

2.3 The Combination of Theory and Practice is Not Close

The practical segment is an important part of the "Object-Oriented Programming Technology" course. Through practical operations, students can deepen their understanding of theoretical knowledge and improve their programming skills. However, there are problems in the current practical segment teaching, such as single teaching methods, single experimental cases, and a lack of innovation and practicality in practical content, all of which affect the cultivation of students' practical abilities.

2.4 The Weakening of Value Guidance

In the teaching process of programming courses, too much emphasis is often placed on the imparting of technical knowledge and skills training, resulting in relatively weak

guidance of student values. This phenomenon may stem from teachers not fully realizing the importance of value education during the teaching process, or it may be difficult to find effective integration methods in practice. In order to cultivate computer field talents with both moral character and talent, it is urgent to strengthen the guidance and shaping of values in programming courses, allowing students to deeply understand the core values of socialism while learning programming languages and algorithms, and internalize and externalize them.

3 General Requirements for the Construction of First-Class Courses

In October 2019, the Ministry of Education issued the 'Implementation Opinions on the Construction of First-Class Undergraduate Courses,' which clearly defined the overall requirements, construction content, and recognition methods for the construction of first-class undergraduate courses. It particularly proposed that courses are the core elements of talent cultivation, and the quality of courses directly determines the quality of talent cultivation. It emphasized that the construction of first-class undergraduate courses should adhere to moral education and reflect a student-centered approach, focusing on the comprehensive development of students' abilities, and striving to enhance the advanced nature, innovation, and challenge of courses [4].

4 Construction Goals and Strategies of "Object-Oriented Programming Technology" First-Class Course

4.1 Construction Goals

In accordance with the general requirements for the construction of first-class courses, adhering to the teaching philosophy of 'moral education as the priority, student-centered, and ability cultivation as the core,' the aim is to build first-class courses that are of high level, innovative, and challenging [5]. The specific construction goals are as follows:

(1) Closely integrate theory with practice, and integrate ideological and political content with course content to achieve an organic integration of knowledge, ability, and quality.

(2) The course content should keep up with the development trend of the industry, innovate teaching methods and means, adopt diversified assessment methods, and improve students' learning interest and teaching effectiveness.

(3) Build a new model for cultivating applied abilities in "introduction—learning—practice—research," guide students to conduct in-depth research and deep thinking by setting course difficulty.

4.2 Construction Strategies

4.2.1 Clarify the Course Positioning and Goals.

"Object-Oriented Programming Technology" as a core course in computer and related majors in applied universities, its course positioning aims to cultivate high-quality talents who meet the needs of social development, have good professional ethics, and can use the basic principles, methods, and practical skills of object-oriented programming technology to build software systems and solve practical problems. They should be aware of their social responsibilities as software developers and contribute to a harmonious society.

4.2.2 Optimize Course Content.

1.Course structure

(1) Hierarchical design: Divide the course content into three levels: basic, core, and advanced. The basic level introduces the basic concepts, principles, and methods of object-oriented; the core level delves into design patterns, refactoring skills, etc.; the advanced level focuses on advanced topics such as framework development and performance optimization.

(2) Modular organization: Divide the course content into several independent but interrelated modules, such as classes and objects, inheritance and polymorphism, encapsulation and hiding, etc. Each module contains clear learning objectives and practical tasks, which helps students systematically master the core knowledge of object-oriented programming.

2.Content selection

(1) Emphasize practical application: Integrate more practical project cases into the course content, allowing students to learn and apply the knowledge of object-oriented programming technology in practice. At the same time, pay attention to the development trends of the industry and new technology dynamics, and update the course content in a timely manner to ensure that the knowledge students learn is synchronized with market demands.

(2) Integrate software engineering concepts: Integrate the basic concepts and methods of software engineering into the course content, such as system analysis, system design, system implementation, system testing and maintenance, etc. Cultivate students' comprehensive quality and improve their ability to cope with actual projects.

4.2.3 Improve Teaching Methods and Means.

1.Use case teaching: Introduce actual project cases to let students master the knowledge of object-oriented programming technology through analysis, design, and implementation. The selection of cases should be representative and practical, which can stimulate students' learning interest and enthusiasm.

2.Strengthen the reform of practical segment teaching: Design a "introduction—learning—practice—research" closed loop of practical teaching, with students as the main body, providing more hands-on practice opportunities for students. Programming

competitions, project practices, and other activities can be organized to allow students to exercise skills and accumulate experience in practice.

3.Introduce online learning resources: Use online learning platforms to provide students with rich course resources and learning support. You can upload courseware, videos, exercise sets, etc., to facilitate students to study and review anytime and anywhere.

4.2.4 Improve the Course Evaluation System.

1.Diversified evaluation: Use a variety of evaluation methods, such as homework, projects, exams, etc., to comprehensively assess students' learning outcomes. At the same time, pay attention to process evaluation and focus on students' performance and progress during the learning process.

2.Timely feedback: Establish an effective feedback mechanism to provide students with learning suggestions and guidance in a timely manner. You can answer students' questions and confusions through online Q&A, classroom discussions, and other methods, helping them better master the course content.

5 Practice of "Object-Oriented Programming Technology" First-Class Course Construction

5.1 Optimization and Innovation of Course Content

Treat object-oriented programming technology as a complete course system, dividing the course content into theoretical modules and practical modules. The theoretical module is divided into 3 levels and 8 units. The practical module includes 4 projects, focusing on the course objectives. In terms of practical content setting, from the design of experiments, the determination of topics, to the introduction of topics, the combination of theory and practice is strengthened. At the same time, according to the arrangement of practical teaching content, verification, design, and comprehensive experimental projects are set up, focusing on the cultivation of students' practical abilities. At the same time, other resources such as teaching outlines, teaching plans, micro-course videos, PPT courseware, example codes, class exercises, unit tests, lesson plans, and textbooks among other supplementary materials. The theoretical and practical modules are fully integrated with ideological and political education, achieving an organic integration of knowledge, skills, and qualities. The teaching course system for object-oriented programming technology is shown in Table 1.

Table 1. Object-Oriented Programming Technology Course System

Teaching Level	Theoretical Module	Practical Module	Ideological and Political Elements
Basic Level	1. Introduction to Object-Oriented Programming	Project 1: Setting Up a Java Development Environment (Verification)	Career Vision
	2. Data Types, Arrays, and Strings 3. Control Structures and Control Statements	Project 2: Lucky Guess Game (Design)	Craftsman Spirit of Being Meticulous and Thorough

Core Level	4. Classes and Objects 5.Encapsulation, Inheritance, Polymorphism 6. Abstract Classes, Interfaces, Fina	Project 3: Student Management System (Comprehensive)	Professional Ethics, Establishing the Correct Skill View
Advanced Level	7. Collection Classes 8. Exception Handling	Project 4: Grade Management System (Comprehensive)	Professional Ethics, Reasonable Planning, and Thorough Consideration

5.2 Reform and Innovation in Teaching Methods

1. In the specific teaching process, different teaching methods are adopted for theoretical and practical parts. In theoretical teaching, a "three-drive" teaching method is used, while in practical teaching, a "guide-learn-practice-research" four-in-one practical teaching closed loop is adopted. The specific implementation is as follows:

1.Theoretical Teaching Part According to the requirements of the course objectives, the "three-drive" teaching method is carried out around the teaching content. ① Problem-driven: Introduce teaching content with engineering problems as the guide to stimulate students' interest and potential. ② Capability-driven: Focus on the algorithm design to solve engineering problems for analysis and discussion, training students to provide feasible solutions for actual engineering problems. ③ Practice-driven: Carry out group innovative experiments driven by projects, training students' ability to solve practical problems and possess the spirit of craftsmanship and innovation.

2. Practical Teaching Part Adopt the "guide-learn-practice-research" four-in-one practical teaching closed loop. First, the teacher explains the project requirements and overall design ideas, guiding students to think about problems using object-oriented thinking. After understanding the practical needs of the development project, students independently consult materials for learning and complete program design on their own. Teachers provide guidance based on the completion of the students and set the difficulty of the program further according to the students' situation, encouraging students to conduct in-depth research. Then, guide students to think deeply, learn independently, and use knowledge for independent design, to understand knowledge at a deeper level, forming a three-dimensional, open practical teaching closed loop built from points (knowledge points), lines (basic experiments), and surfaces (comprehensive experiments). This approach cultivates students' comprehensive ability to solve complex engineering application problems, advanced thinking, and innovative literacy [6], forming a rigorous and truth-seeking learning method and a scientific research attitude, and gaining successful experiences in learning activities. The practical teaching loop is shown in Figure 1.

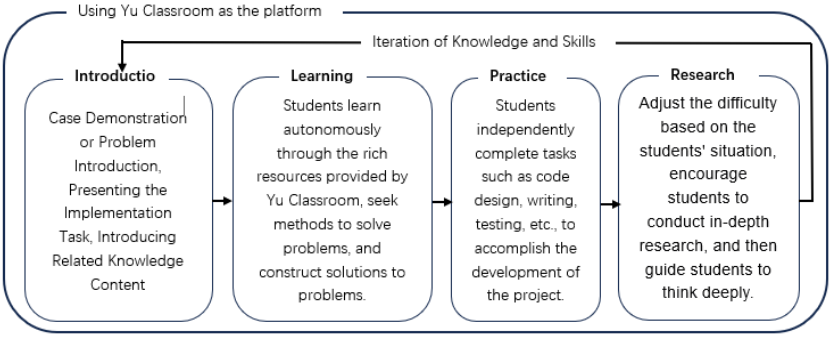

Fig. 1. 'Inquiry-Learning-Practice-Research' Practical Teaching Closed Loop

3. Use of the "Rain Classroom" Teaching Platform to Assist Teachers in Supervising Students' Practical Sessions To better grasp the specific situation of students' practical sessions, the course uses the "Rain Classroom" teaching platform to build practical sessions, releasing each experimental task through the platform in a timed and phased manner. Students complete and submit experimental results on the platform. Teachers monitor students' experimental situation through the platform's statistical data to understand the completion of students' experiments.

5.3 Construction and Optimization of the Course Evaluation System

To comprehensively assess students' learning outcomes, this evaluation is conducted from three aspects: attitude, knowledge, and skills. Attitudinal evaluation includes course ideological and political content, classroom discipline, and practical training attitude, etc.; Knowledge evaluation includes unit tests, midterm exams, and final exams; Skill evaluation includes practical operations of related modules. The weight distribution and evaluation methods of each part are shown in Table 2, the Course Evaluation System.

Table 2. Course Evaluation System

No.	Evaluation Component	Evaluation Content		Weight of Each Part	Total Weight
1	Attitudinal Evaluation	Classroom Discipline, Attendance, Practical Training Attitude		40%	20%
		Ideological and Political Content	Alumni Interview Industry News Sharing Project Participation Experience Summary	60%	
2	Knowledge Evaluation	Unit Tests		20%	50%
		Midterm Exam		20%	
		Final Exam		60%	
3	Skill Evaluation	Practical Operations of Related Modules (Experimental Reports)			30%

6 Effectiveness Evaluation and Analysis

The end-of-term total scores of students have been gradually increasing. The end-of-term total score includes 1 alumni interview or industry news summary, 5 unit tests, 1 mid-term exam, 1 final exam, and 4 programming assignments (laboratory reports), with the proportion as shown in Table 2 of the course evaluation system. Figure 1 shows the distribution of the end-of-term total scores and the percentage of students in each score range for the 2021 and 2022 cohorts. It can be seen intuitively from Figure 2 that the proportion of students with excellent and good grades (36.36%-59.01%), the pass rate (90.91%-98.36%), and the average score (73.5-78.2) have all increased.

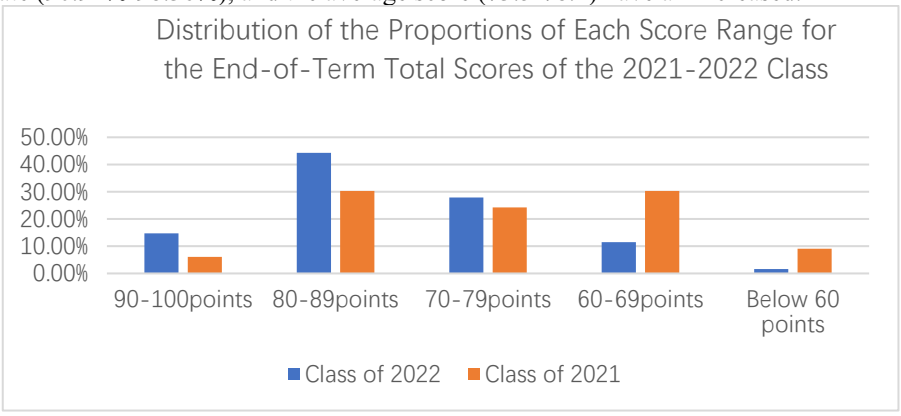

Fig. 2. Distribution of End-of-Term Total Scores and Percentage of Students

7 Conclusion

The research on the construction of this course has found that the construction of a first-class "Object-Oriented Programming Technology" course in applied universities first requires the optimization of course content and teaching methods. Secondly, establishing and improving course resources is key to enhancing course quality. Furthermore, constructing a diversified and comprehensive evaluation mechanism is equally important. In summary, the construction of a first-class "Object-Oriented Programming Technology" course in applied universities requires joint efforts in various aspects such as course content, teaching methods, teaching resources, and evaluation systems to cultivate high-quality programming technology talents needed by society.

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