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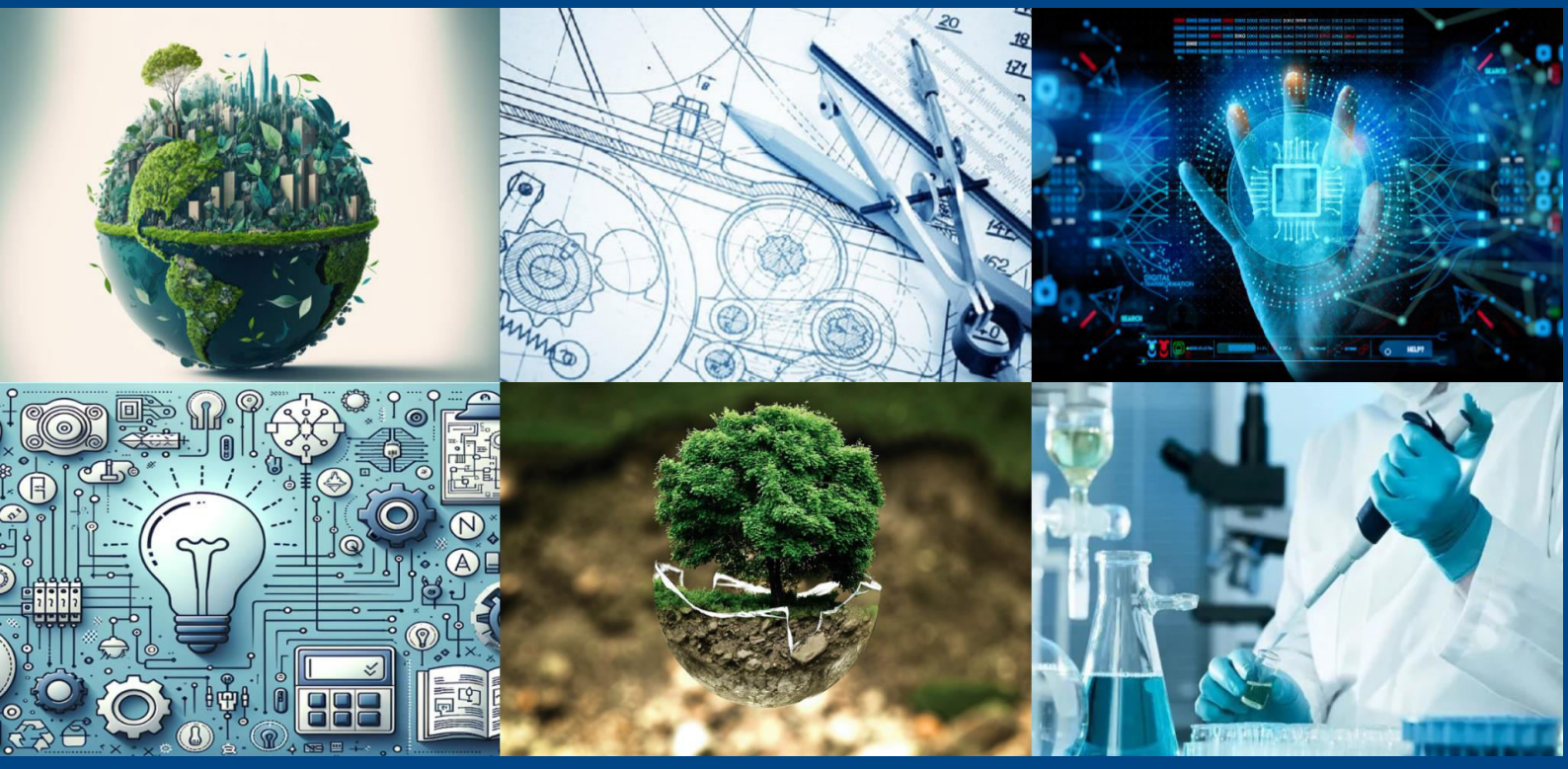

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Teaching Reform of the Underlying Programming Language Courses in Undergraduate Universities

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ABSTRACT: With the rapid development of computer technology, programming language has become a basic skill that students must master in computer-related majors, and undergraduate colleges and universities generally offer underlying programming language courses, such as C language, assembly language, Go language, etc. However, the traditional teaching model can no longer meet the needs of today's society for talent training. In view of the problems existing in the teaching of underlying programming language courses, this paper proposes a set of teaching reform schemes, aiming to improve the teaching quality and cultivate high-quality talents with practical programming ability.

KEYWORDS: Underlying programming language; Teaching reform; Student-centered

I. INTRODUCTION

The underlying programming languages mainly include C, C++, assembly language, Rust, Go, Ada, etc. These languages are widely used in operating systems, embedded systems, and system tool development due to their high performance close to hardware and the ability to directly control hardware [1-12]. Compared with high-level programming languages, low-level programming languages are more difficult to write and debug because they are hardware-oriented and have a large number of instructions. In the process of learning, students have difficulty in learning, the content is boring and obscure, and some students do not understand some of the content of the course, resulting in resistance and fear [6-12]. It can be seen that the teaching of the underlying programming language course needs to be repositioned, and new methods and new content need to be introduced. In view of the problems existing in the teaching of underlying programming language courses, this paper proposes a set of teaching reform schemes, aiming to improve the teaching quality and cultivate high-quality talents with practical programming ability.

II. IDEAS FOR CURRICULUM AND TEACHING REFORM

The underlying programming language course plays a role in connecting the previous and the next in the entire professional curriculum system. First of all, the underlying programming language is closely related to the machine, and with the deepening of the learning content of the underlying programming language, the relationship between the instructions of the underlying programming language and the machine becomes more and more close, and students can understand the working principle between computer software and hardware systems from a more global perspective after learning the underlying programming language. Second, the high-level language and the underlying programming language do not exist in isolation, and the machine, the underlying programming language, and the high-level programming language are closely related and inseparable. The high-level programming language is ultimately transformed into machine instructions, and the low-level programming language instructions and machine instructions are one-to-one correspondence, which is the bridge between the high-level programming language and the machine instructions. By understanding the working principles of computer systems and the underlying programming language, you can deeply understand the logical implementation of high-level programming languages in the underlying machine. Therefore, this paper proposes the idea of reforming the teaching of the underlying programming language course: the underlying programming language is the bridge, the computer software and hardware system is the foundation, and the goal is to improve the programming language design ability.

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III. TEACHING REFORM MEASURES

A. Improve the teaching objectives

Focusing on the requirements of the talent training program for ability training, and in accordance with the teaching ideas of the course, the teaching objectives of the course are improved: (1) Understand the basic principles of computer hardware, be familiar with the basic concepts of the underlying programming language, and initially master the programming ability for processors. (2) Be able to use the underlying programming language to design and implement algorithms to solve simple problems, and understand the relationship between high-level programming languages and underlying programming languages. (3) Understand the interrelationship between hardware, operating system, and application, and be able to analyze the factors affecting the time and space efficiency of program code based on the underlying programming language. (4) Cultivate students' quality of excellence and perseverance in learning, establish a good outlook on learning, and have the courage to explore and practice.

B. Reconstruct teaching content

The underlying programming language is closely integrated with the machine, with a variety of instructions, flexible programming, and straightforward explanations, which makes it more difficult for students to learn. Therefore, teachers can adopt a step-by-step teaching method, adjust the teaching content and teaching schedule accordingly, and establish a connection between the computer software and hardware system, the high-level programming language and the underlying programming language, so that students can enhance their understanding of the underlying programming language through comparison and connection, and at the same time deepen their understanding of the working principle of the computer system and the high-level programming language. In the initial stage of teaching, students are given the initial concept of the underlying programming language to avoid the hardware principle. Then, the concepts of the underlying programming language are introduced by contacting the computer system, such as: the composition and function of the five major hardware, registers, memory cells, addressing methods, etc. Then, the basic instructions and their functions are explained in detail, including data transmission instructions, arithmetic operation instructions, logic operation instructions, input and output instructions, etc. Finally, combined with the form of program cases, the program design methods such as branch structure, loop structure, and subroutines are introduced in depth. At the same time, the explanation of instructions in the previous stage deepened the understanding of the underlying programming language and strengthened the training of programming in the underlying programming language [11-16].

C. Innovative teaching mode

Based on the principle of "taking students as the main body and cultivating students' self-directed learning ability", we make full use of online learning platforms such as Wisdom Tree and Chaoxing to enrich teaching methods and resources, and build an online and offline blended teaching model [17-22]. Students can enter the course section by logging in to their accounts and passwords, and the teaching resources are teaching resources such as videos, courseware, practical exercises, and learning materials uploaded by teachers. Student learning resources are coursework, chapter tests, practical training reports, discussions among students, as well as teacher-led activities in the classroom, such as discussions, rush answers, selection, and theme discussions. This kind of online learning platform can stimulate students' interest in learning, mobilize students' enthusiasm and initiative in learning. Teachers need to fully upload relevant materials, arrange students' tasks before, during and after class, participate in the interactive content of students' learning platform in a timely manner, make full use of various functional software of the network platform in the classroom, organize students to participate in various activities and projects, create a strong classroom learning atmosphere, and build a learning chain for students in the whole process. At the same time, teachers should flexibly use tools such as mind maps to explain the key and difficult knowledge in detail. Questionnaires are regularly published to understand students' opinions on course teaching, so as to continuously improve teaching methods.

D. Integrating literacy education

Literacy education should be silently integrated into the curriculum, and knowledge transfer should be promoted in the guidance of values, and excellent quality should be bacon in the knowledge transfer [23-28]. This requires teachers to do two things: one is to find the right fit between curriculum content and literacy content. This requires teachers to extract the literacy elements from the perspective of various knowledge points, and integrate the literacy elements into the course teaching through vivid narration, so as to arouse students' interest in professional courses and maximize the integration of literacy education and teaching effectiveness. For example, when teaching students programming, we can incorporate the stories of scientists leading teams to develop instruction systems and high-performance computers, so

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as to guide students to establish a craftsman spirit and cultivate good study habits of dedication to study and research. The second is to cultivate students' ability and literacy through "implicit education", that is, through participation, perception, and infiltration education, to achieve value shaping, knowledge impartation, and ability training for students in a subtle way, for example, to create a classroom atmosphere that encourages innovation and creativity, to watch videos with value leadership, and to discuss hot issues of current affairs in a group form, etc., to convey the literacy education content related to the curriculum to students invisibly, so as to stimulate students' sense of responsibility and mission, and stimulate students' learning motivation.

E. Construct multiple teaching evaluations

The evaluation of course teaching should realize the transformation from "single evaluation" to "multiple evaluation", motivate teachers to innovate teaching methods, improve teaching quality, and motivate students to continuously explore themselves and achieve sustainable growth [29-33]. First of all, the teaching effect of teachers was examined through the supervision of the teaching group, questionnaire survey, student performance reference, etc., to understand whether the teachers have created a good environment conducive to promoting students' learning, whether the content of teaching is connected and systematic, whether the teaching method is conducive to the improvement of students' self-learning ability, and whether the teacher's words and deeds have a positive impact on the development of students. Through the follow-up evaluation of the whole semester, we can understand the comprehensive quality of teachers and motivate teachers to complete the teaching work of the course with a high sense of responsibility. Second, the comprehensive assessment and evaluation method combining process assessment and final examination is used to scientifically grasp the learning results of students. Among them, the process assessment accounts for 40%, mainly including students' classroom performance, homework completion, and chapter tests; The experimental score accounts for 10%, with the goal of improving students' programming design ability in the underlying programming language and solving practical application problems. The final examination accounts for 50%, and the content of the test paper should not only assess students' mastery of basic knowledge, but also pay more attention to assessing students' comprehensive ability to solve complex problems.

IV. REFORM OF EXPERIMENTAL TEACHING

A. Optimize the experimental environment

The underlying programming language program is cumbersome to write and cumbersome to debug, so it is necessary to choose an environment suitable for students to experiment at different stages of learning. For example:

(1) Use a specific software environment to carry out experiments by embedding underlying language instructions. In the early stage of learning the underlying programming language, students can use the method of embedding the underlying language instructions in the high-level programming language program, which can greatly reduce the difficulty of students writing and debugging programs, and improve students' self-confidence in learning courses.

(2) Use virtual machines to build the underlying programming language design and debugging environment to carry out experiments. At the stage where students initially have the programming ability of the underlying programming language, they can use the compiler, linker, and debugger of the underlying programming language to write and debug the complete underlying programming language source program. At the same time, virtual machines are used to set up a debugging environment, so that students will experience first-hand the differences and characteristics of the underlying programming language in terms of writing and debugging compared to high-level languages.

(3) Carry out low-level programming language experiments based on specific processors. Later in the course delivery phase, specific processors can be used for experiments in low-level programming language design and debugging. Students will learn to experiment with specific commands, editors, compilers, assemblers, linkers, debuggers, and more. In this way, it can deeply stimulate students' curiosity, fully mobilize students' enthusiasm for learning, and further improve students' practical ability.

B. Enrich the experimental content

The main purpose of traditional low-level programming language experiments is to consolidate the learned knowledge points, and the experimental content is to write some algorithm programs around the learned instructions. Some of these experiments seem boring, some lack practical meaning, and students are not motivated to experiment. To this end, some adjustments can be made to the experimental content, some experimental types can be added, and the

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experimental content can be designed to be closer to the actual situation, so as to cultivate students' transfer learning ability and expand students' comprehensive application practice.

C. Pay attention to the experimental process

In different stages of the experiment, specific task objectives are set and examined, so as to cultivate students' comprehensive practical ability to solve complex problems with knowledge in related fields. For example, the experiment is divided into four stages: experimental preparation, analysis and design, coding and testing, and summary corresponding to the steps in the software development process, such as feasibility study, requirements analysis, software design, coding, testing, and delivery and acceptance, and the task objectives of each stage are set as:

(1) Experimental preparation: read the experimental topic, fully understand the experimental requirements and be familiar with the experimental environment by learning experimental materials and consulting relevant literature;

(2) Analysis and design: According to the experimental content that needs to be programmed, the experimental topic is analyzed and the requirements analysis description is written. Then design the overall structure and procedural flow. Specify the entry and exit parameters of the subroutine.

(3) Coding and debugging: code writing in the underlying language; design test cases for testing; Optimize the code and correct code errors based on the test results.

(4) Summary: write an experimental report, record the problems encountered in the experiment and the corresponding solutions; Group communication, class presentation; Submit experimental reports and complete peer evaluations; Watch excellent works, learn from each other, and learn from each other's strengths.

V. EFFECT OF TEACHING REFORM

According to the above teaching measures, the college has carried out the teaching reform practice of assembly language courses. The practice shows that the teaching reform measures proposed in this paper have a significant effect on improving the teaching effect of assembly language courses. From the final comprehensive assessment data, it can be seen that the average score of students in the final examination increased from 78 to 82 points, the excellent rate (>= 80 points) increased from 62% to 71%, and the failure rate (<60 points) was reduced from 7% to 5%, and the average score of students' experiments increased from 79 to 85 points. It can be seen that the teaching effect has been greatly improved through the teaching reform measures proposed in this paper, including:

(1) It improves students' interest in learning. Through the problem-based classroom teaching method, students can feel the practical application of assembly language more intuitively, which increases their interest in learning.

(2) Enhance students' practical ability. Through the task-oriented experimental teaching method, students not only master the basic knowledge of assembly language in the process of solving practical problems, but also learn how to write assembly language code and programs, how to apply theory to practice, and the experimental and practical abilities are significantly improved.

(3) Cultivate students' innovative thinking. Through the online and offline blended teaching mode, students' independent thinking is trained, and students' innovative thinking and pioneering ability are cultivated by finding a variety of methods and means to solve problems.

(4) Promote the improvement of teachers' teaching methods. In the process of implementing curriculum teaching reform, teachers have continuously adjusted and optimized their teaching methods and improved their own teaching level.

Through this practice of teaching reform, the school has successfully transformed the teaching mode of assembly language course into a problem-solving core, effectively improved the teaching quality, laid the foundation for cultivating high-quality computer professionals with practical programming ability, and applied the teaching reform experience of this course to the teaching reform of more related courses.

VI. CONCLUSION

In view of the problems existing in the teaching of underlying programming language courses in undergraduate colleges and universities, this paper proposes a set of teaching reform schemes. Through the implementation of the reform of teaching content, teaching methods, practical links and assessment system, the teaching quality of the

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underlying programming language courses has been improved, and high-quality talents with practical programming ability have been cultivated. However, teaching reform is a long-term and systematic process, which requires the joint efforts of teachers and students, continuous exploration and practice, in order to achieve sustainable development and continuous improvement.

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