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EXPLORATION OF COMPUTER ORGANIZATION PRINCIPLES TEACHING REFORM IN MODERN EDUCATIONAL TECHNOLOGY ENVIRONMENT

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Abstract: In view of the abstract, difficult and boring characteristics of the course "Principles of Computer Composition", the teaching reform is carried out from the aspects of teaching objectives, teaching content, curriculum ideology. According to many years of teaching experience, the teaching mode and teaching method suitable for the course of "Computer composition Principle" are put forward. With the help of modern teaching methods, students can change from passive learning to active learning, which not only helps students to master the composition and working principle of computer hardware system, but also improves their ability to analyze, apply and develop computer hardware structure.
Keywords: Computer organization principles; Modern educational technology; Teaching objectives; Teaching content; Teaching methods

1 INTRODUCTION

Educators from around the world have been continuously exploring the application of advanced technologies and equipment in education and teaching. With the continuous advancement of information technology, its application in the field of education has mainly gone through the following three stages[1-3]:
(1) Computer assisted instruction
At this stage, the main focus is on utilizing computer-aided calculation, animation simulation, and other functions to assist in addressing key points and difficulties in teaching[4].
(2) Computer assisted learning
At this stage, computers are mainly used to assist students in their learning[5].
(3) Integrating IT into the curriculum
At this stage, we not only use computer-aided teaching and learning, but also emphasize the use of modern information technology with multimedia and network communication as the core to create a learning environment and build a new teaching and learning way[6].
Introducing modern educational technology into the educational and teaching process can significantly improve the efficiency of teaching and learning[7-8]. "Principles of Computer Organization" is a required course for computer science majors at Xuzhou University of Technology, focusing on the composition, working principles, and design methods of computer hardware systems. It emphasizes cultivating learners' ability to analyze and design computer hardware systems. However, in the current teaching process of the "Principles of Computer Organization" course, there is a general situation that teachers are difficult to teach and students are difficult to learn. This is mainly because of the following two outstanding problems: the teacher's grasp of the learning situation is not ideal, and the teacher's monitoring and assessment of the student's learning process is not enough. Therefore, exploring the integration of modern information technology with the "Principles of Computer Organization" course and fully leveraging the advantages of modern information technology are of great significance for improving the teaching quality of the "Principles of Computer Organization" course.

2 CLARIFY TEACHING OBJECTIVES AND OPTIMIZE TEACHING CONTENT

2.1 Clarify Teaching Objectives

Teaching objectives guide and govern the entire teaching process, and establishing accurate and reasonable teaching objectives is considered the first step in instructional design. Modern educational technology emphasizes the cultivation of composite talents. In determining educational objectives, it is necessary to not only meet societal needs but also prioritize students' individual needs, encouraging them to develop in the direction of becoming composite talents. During the teaching process, in order to fully leverage the motivating role of teaching objectives, teachers should focus on studying students' interests, willpower, knowledge and ability levels, as well as their individual differences. The course "Principles of Computer Organization" mainly introduces the composition and working principles of a complete computer system, and trains students to understand the composition and working principle of computer hardware

system systematically and completely, as well as their ability to analyze, apply, design, and develop computer hardware structures.
Teaching objective 1: Students can understand the basic concepts and functional characteristics of the five components of the computer system, master the working principles and mainstream technical standards of each component, and can use software tools to analyze the execution process of instructions and the working state of the model machine.
Teaching objective 2: Students can effectively decompose the architecture of the model machine, master its hardware composition, analyze and identify different methods of realization of the computer, memory expansion methods and controller design methods combined with the method of measuring the performance of the computer system, and judge their effectiveness.
Teaching objective 3: Students can master the design principle of various hardware modules and the design method of data path to build basic digital circuit modules, and understand the influence of different architecture and design parameters on improving processor performance.
The correspondence between course goals and graduation requirements is shown in Table 1.

Table 1 The Correspondence between Teaching Objectives and Graduation Requirements

Teaching objective	Graduation requirement	Graduation requirements target points
Teaching objective 1	1. Problem analysis	Be able to use basic knowledge and professional knowledge of computer engineering to understand complex computer engineering problems and build solution models
Teaching objective 2	2. Problem analysis	Abstract analysis and identification can be carried out for a problem or a process or module in the computer field, and a model abstract expression can be selected or established.
Teaching objective 3	3. Design/develop solutions	Master the design principles and methods related to computer systems, and be able to design functional modules or components of system hardware and software to meet specific needs.

2.2 Optimize Teaching Content

Currently, the teaching of the "Principles of Computer Organization" course faces several issues: the textbook content lags behind the development of computer hardware; the teaching content is abstract and difficult to understand; and there is a disconnect between experimental teaching and classroom instruction, and so on. Therefore, the organization of teaching and learning should be based on the mold machine and separated from the body machine. Taking the digital representation of information, transmission of information and control methods as the main line, the principle of computer composition is expounded according to the three levels of foundation, composition and system, and the working mode of computer and the processing and control process of internal data of computer are mastered. When students learn each part of knowledge, they know the use of what they learn in the whole computer work, and constantly induce students to have a desire to recognize the parts that have not yet been learned.

2.3 Explore Curriculum Ideology in Courses

By leveraging modern information technology to deeply explore curriculum ideology in courses, we can truly achieve an organic integration of ideological with professional education. This will stimulate students' patriotism and sense of mission to serve the country through science and technology, strengthen engineering ethics education, and address the problems and puzzles that students may encounter in their current and future studies and work.
Moral education goal 1: Students can investigate the current situation of central processing unit at home and abroad, realize the importance of independent research and development, cultivate national feelings and innovation consciousness, and understand the importance of teamwork in hardware development.
Moral education goal 2: In action-oriented teaching, students should be trained in engineering awareness, craftsman spirit, and be able to correctly understand and evaluate the impact of hardware engineering projects on society, humanity, environment and sustainable development.

2.4 Rational Arrangement of Experiment

According to the course content, the experiment content is divided into three levels. The first is the basic verification experiment, which mainly involves the relevant knowledge points of the course. The purpose of the experiment is to enable students to verify, understand, consolidate and grasp the basic contents required in the course, such as the operator test, the composition experiment of the sequential circuit and the memory experiment. The second is to design applied experiments, which put forward experimental requirements and specific experimental results in the form of "tasks", requiring students to master the knowledge involved in experiments through relevant courses or self-study, and design, develop and finally complete experimental projects through comprehensive use of these knowledge. The third is comprehensive innovative experiment, which mainly cultivates students' ability to comprehensively apply computer knowledge and technology, and cultivates students' ability to learn independently with problems, such as the design and implementation experiment of complex model machine. The design of the course experiment content is shown in Table 2.

Table 2 Course Experiment Content

Experiment name	Experimental content	Experiment hour	Experiment type
Chinese character coding	Understanding the internal code and location code of Chinese character machine, using a simple circuit to realize the conversion of GB2312 code and location code, can realize the dot matrix display of Chinese character GB2312 code in the experimental environment.	4	Design
Source code one multiplier design	Understand the concept of group carry transfer functions, build fast addition designers, analyze circuit delays, and understand circuit parallelism concepts.	4	Design
Memory expansion	Understand the principle of character bit expansion in the storage system, solve the problem of Chinese character database storage expansion, and be able to use the correct character database data filling.	4	Design
Microinstruction design	Master the basic principle of controller design, and can use the principle of microprogramming to design and implement microinstruction coding.	4	Design

2.5 Evaluation of Achievement of Curriculum Objectives

Regular course quality evaluations are conducted to comprehensively assess the achievement of students' course objectives and identify areas of instructional deficiencies, with measures taken to continuously improve course quality. In order to ensure that the graduation requirements indicators are fully and effectively implemented in the course teaching process and promote teachers' ability to center on students and continuously improve teaching quality, according to the "Implementation Methods for Course Achievement Evaluation," a course quality evaluation mechanism based on course achievement evaluation is implemented. The evaluation process of the achievement of curriculum objectives is shown in Figure 1.

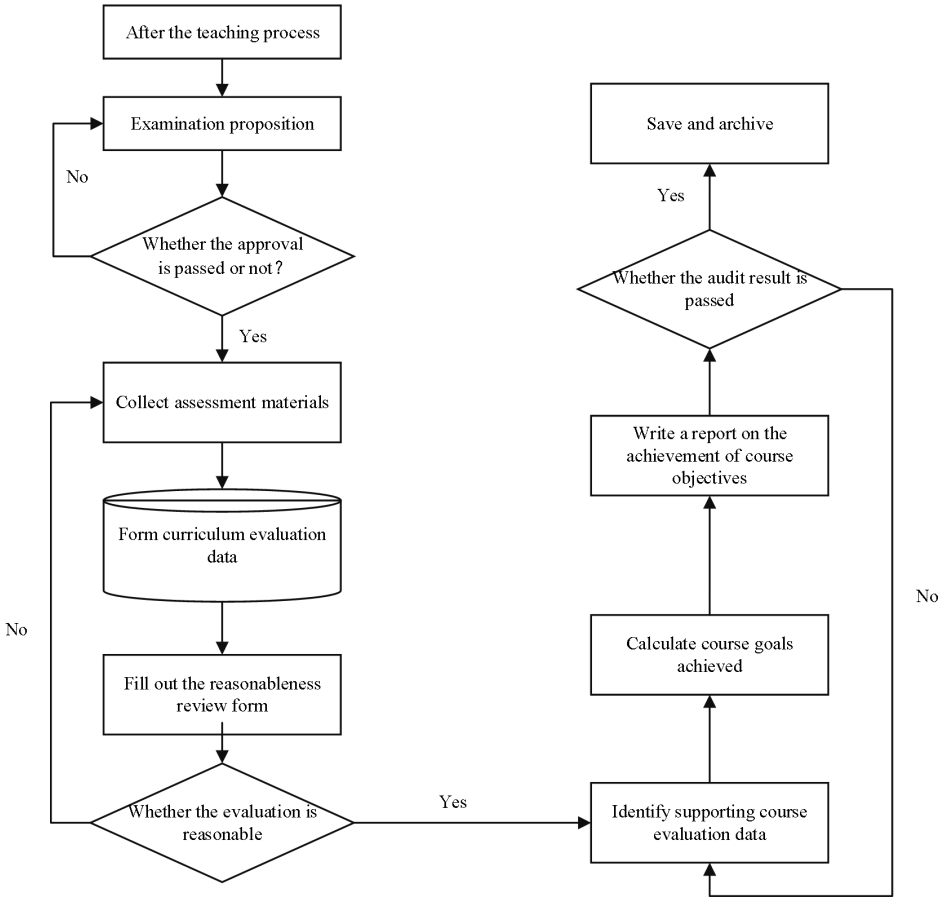

Figure 1 Evaluation Process of Achievement of Curriculum Objectives

2.6 Continuous Improvement of Teaching

The teaching staff determine the supporting evaluation data based on the course objectives, and calculate the degree of achievement of the course objectives according to the evaluation method. A comprehensive analysis is conducted on the suitability of the course objectives to the teaching content, the matching of teaching methods, the effectiveness of teaching content and assessment methods, and the achievement of students' comprehensive abilities. A report on the achievement of the course objectives is prepared, which includes a comprehensive analysis of the problems and continuous improvement suggestions. The achievement evaluation work group reviews the report on the achievement of the course objectives and notifies the relevant teachers of the evaluation results and suggestions for continuous improvement. The teachers will use this information to improve their teaching in the future.

3 REFORM TEACHING METHOD

Teaching method is the embodiment of educational thoughts and concepts in the teaching process, and it is a kind of accumulation of experience. Different teaching methods should be implemented for different levels of students and different abilities. In the course of "Principles of Computer Composition", we have tried the following different teaching methods:

3.1 Heuristic Teaching

Heuristic teaching method is a kind of teaching method that teachers inspire students to think positively and make them master knowledge actively. Teachers should pay attention to the logical organization of knowledge and combine the dry theoretical knowledge with flexible practical application in various forms, so as to form a smooth flow of information between teachers and students, so as to maximize the initiative of students and create a positive and harmonious classroom teaching atmosphere. In this process, teachers can randomly set some problem situations, guide students to think positively, and then realize the impact of ideas.
For example, when explaining the adder, the teacher can guide the students to think about the additive inside the ALU, why there is no subtractor. The teacher can further guide what is the meaning of the complement, and how the complement can be reduced and increased. After inspiration and guidance, students organically link the two seemingly isolated knowledge points together to form a complete knowledge system.

3.2 Task-driven Approach

The principles of computer organization can be relatively dull and dry for students. To transform this stale content into something lively and engaging, the adoption of the task-driven approach yields more noticeable results. When discussing the hardware structure of computers, a computer is specifically dismantled to allow students to visually observe the components of computer hardware and even engage in hands-on activities to assemble and disassemble the computer themselves. Task-based learning starts with practical problems, adopting a methodology of proposing tasks, analyzing tasks, designing tasks, solving tasks, and summarizing patterns, enabling students to acquire knowledge in the process of completing tasks.

3.3 Discussion Teaching

In discussion-based teaching, students are encouraged to speak up, ask questions, and present their own ideas. Through this teaching method, students can motivate and engage with each other in exploring issues, increasing their participation and encouraging them to fully immerse themselves in learning. This approach fully mobilizes students' enthusiasm for learning, taps into their potential, and thus enhances teaching efficiency.

3.4 Inquiry-based Learning

Inquiry-based learning is a learning activity in which students choose and determine topics from nature, society and life through the guidance of teachers, and actively acquire and apply knowledge in the research process to solve problems. For example, students use various forms of media to collect information resources, and compare various parameters between the previously used SDRAM memory and the current main stream memory, so as to master the development trend of memory. By generalizing from one instance to another, students can gain a certain understanding of the development of other related hardware in computer systems. Furthermore, by comparing various parameters, students can also be guided to predict the future trends and directions in the material, capacity, internal structure, wiring, and other aspects of memory. The setting of these questions can greatly promote students' learning enthusiasm and exercise their learning thinking ability and creativity.

4 CONCLUSION

The "Principles of Computer Organization" course is a well-recognized boring and difficult-to-learn core professional course, but there is always a certain pattern to be followed in the knowledge of any discipline. Utilizing modern information technology to integrate the latest research findings, research challenges, and hot topics in the field of computer science, as well as other related course content, with the content of "Principles of Computer Organization" course can help make the course content more profound and extensive, reflecting its cutting-edge nature and timeliness, thereby enhancing students' learning interest.

COMPETING INTERESTS

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