Research of Information Experimental Course Group and Design of Comprehensive Experimental Platform Based on Cloud Computing

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Abstract. Under the new situation, the information experimental course group has become an important professional course group in the information specialty of universities, but the traditional experimental teaching mode and system cannot meet the needs of the construction of the experimental course group in the new environment. Based on the analysis of teaching content and characteristics of information experimental course group, aiming at the shortcomings of current experimental teaching, this paper studies and puts forward a hierarchical structure of information experimental course group system under cloud platform environment, and constructs a new comprehensive experimental cloud platform which meets the needs of personnel training. It can provide a high level and high efficiency teaching and research platform for teachers and students.

Introduction

At present, the construction of information course group still lays emphasis on the theoretical part [1]. The system construction of information course group in the practical part has not been paid enough attention. The traditional experimental teaching method and management mode are still used, which leads to some problems: the experimental courses are independent of each other, and the system of course group has not been formed. There is no advance planning in the setting of experimental content. The teachers in charge of each course are only responsible for the experimental teaching syllabus of this course. There is little communication with the teachers of other related courses, which leads to the phenomenon of overlapping experimental contents among closely related courses. The experimental contents between the relevant courses are neither coordinated nor coherent. Lab construction planning is scattered and lacks of overall construction. There is no unified and perfect experimental teaching platform for all disciplines.

Beijing University of Posts and Telecommunications [2] has studied and practiced the reform of teaching content, methods and means only from the perspective of course group construction for the basic courses of electronic information specialty. Fudan University College of Computer [3] has only redesigned the hardware course group of computer specialty. Literature [4] only analyzed the effect of open experiment. Literature [5] introduces the analogy teaching method with simulator using the platform of field programmable gate array (FPGA).


In view of the above problems in the traditional experimental teaching and laboratory construction, this paper makes a thorough study, combing and integration of the professional training objectives, curriculum characteristics and the internal links between the curriculum groups under the cloud platform environment, and carries out the overall planning and integration of the experimental environment of the curriculum groups in order to achieve the following objectives:
• With “curriculum collaboration” as the driving force, a hierarchical experimental architecture of curriculum group is built under the cloud platform environment. We introduce the concept of course group construction in experimental teaching, fully consider the relationship between the structure and content of each course within the course group, comb and integrate the experimental content of each course, and consider the arrangement and planning of the experimental content from the overall perspective, so as to reduce the repetition of the experimental curriculum content and ensure the coherence and integrity of the content.

• With “innovation first, ability leading” as the training objective, a unified information experimental teaching cloud platform is established and perfected. The experimental environment of scattered courses is planned and deployed, and the information courses cluster is concentrated in an experimental environment under the cloud platform. The sharing of equipment is increased, which is conducive to the realization of the needs of various experimental scenarios. At the same time, the platform can also be used as a platform for teachers and students' independent innovation and scientific research, while serving teaching and scientific research.

Construction of Cloud Platform Comprehensive Laboratory

Cloud platform provides virtual experiment projects 24 hours a day for teachers and students. According to the teaching plan, administrators arrange teachers and students to use cloud platform for the experiment. Teachers can log on to the cloud platform after class to do experiments. They can open the login authority through administrators. Students need extra-curricular time to log on to the cloud platform for experiments, and teachers can apply for the login rights. According to the timetable intelligent controlling laboratory, cloud platform intelligent management laboratory allows teachers and students on the timetable to enter the laboratory, after-school time students use the laboratory according to standard fees. Intelligent management greatly reduces the workload of experimental management personnel.

Cloud platform provides high-performance computing platform: through high-performance cloud platform computing management system the hardware system builds a high-performance computing platform. Users only need to install the corresponding computing software or directly invoke the existing computing software of the platform to obtain the experimental projects provided by the cloud platform.

We achieve the goal of integrating multiple independent experimental platforms into one laboratory platform, hardware resources and software resources can be shared to the greatest extent, and can be switched conveniently according to courses and experimental projects. It can not only support the vast majority of experimental contents in the information curriculum group, but also realize the comprehensive construction and management of laboratory in the experimental center.

The comprehensive experimental platform is divided into two experimental management platforms: computer and information specialty. Under these two experimental management platforms, there are several sub-experimental platforms according to the construction of the course group. The courses in each sub-experimental platform are related, and each sub-experimental platforms are relatively independent and have no cross-cutting content. The courses in each sub-experimental platform are arranged by the course group on the cloud platform to do experiments, which can avoid duplication of content.

The design of hardware platform refers to literature [8]. The server cluster builds up hardware cloud, the server cluster loads the experimental data of the cloud platform, the virtual software of the data in experiment class builds up resource cloud, the data of the cloud platform stores the commonly used experimental software of teachers and students and the website of the experimental course which build up software cloud, and the managers control the experimental data and management of the server cluster through the managers’ computers, and manage Experimental Cloud Platform [9]. Personnel who need to access cloud platform data can connect to the experimental cloud platform through LAN or WAN. The equipment and facilities of the laboratory can be unified managed through LAN. Teachers, students and laboratory managers can access the cloud platform through PC.
or mobile phones. Teachers and students can also attend classes in cloud classrooms. Teachers concentrate on teaching and complete teaching activities.

The design of software platform: the experimental items of each course are input into the corresponding experimental platform. The overlapping knowledge points appear repeatedly in the experimental items of each course. However, according to the teaching arrangement of the subject group, teachers require students to study independently or focus on learning. The development of cloud platform experiment course is referred to literature [8].

**Course Experiment System of Information Course Cluster**

The course experiment system of information course group includes two systems: computer specialty and information specialty.

The experimental course group of information specialty consists of three sub-courses in turn: communication electronic system, information processing and transmission, and mobile communication direction. Students need to complete the experimental projects of each sub-curriculum group in turn. For example, the sub-curriculum group of communication electronic system includes circuit experiment, analog electronic technology experiment, digital electronic technology experiment, signal and system experiment, low frequency electronic circuit experiment, pulse and digital circuit experiment, course design of FPGA and digital logic, course design of AVR MCU application, electronic measurement and communication electronic circuit experiment, integrated design of electronic system, FPGA and communication system design, embedded system design. After completing the circuit experiment, students can carry out the experiment of analog electronic technology, and then complete the experiment course in the sub-course group of communication electronic system step by step. Among them, “Circuit”, “Analog Electronics”, “Digital Electronics” and “Signal and System” are closely related, and the contents are mostly overlapping. In the content of these four experimental courses, we have made the following adjustments. Firstly, according to the order and relationship of the courses, electronic components such as diodes and triodes is introduced in the course of “Circuits”. “Circuit” course no longer teaches the experimental contents of “impulse response of first-order circuit” and “Laplace transform” in “Signal and System” course, but strengthens the experimental contents of “time-domain, frequency-domain characteristics, steady-state and transient characteristics of first-order circuit”. Secondly, “analog electronic technology” course no longer teaches the experimental content of “gate circuit” and “A/D, D/A conversion” in “digital electronic technology”, but moves the experimental content of “pulse signal” in “digital electronic technology” to “analog electronic technology” course. The curriculum in the sub-curriculum group has been adjusted in a unified way, which is more conducive to students' learning.

The curriculum group of computer specialty emphasizes the integration construction, the reorganization of curriculum knowledge and the integration of knowledge. In order to eliminate duplication, the treatment of duplicate knowledge points between courses should be clearly divided. The experimental course group of computer specialty consists of four sub-courses: computer programming and algorithm design, hardware system analysis and design, software system analysis and development, and mobile interconnection application system development. Students need to complete the experimental projects of each sub-curriculum group in turn. For example, the sub-curriculum group of computer programming and algorithm design consists of C language programming, object-oriented programming (C++), Java programming, algorithm analysis and design, data structure curriculum design and discrete mathematics. After completing C language programming, students can carry out object-oriented programming (C++), and then complete the experimental courses in the sub-curriculum group of computer programming and algorithm design step by step. In the teaching of C language programming and object-oriented programming (C++), we all choose the same student information management system. In the learning process of C language programming, students are required to develop experiments with process-oriented programming method. In the learning process of object-oriented programming (C++), students are required to use
object-oriented programming method. Through the comparative study of different programming methods in the same system, students have realized the fundamental difference between process-oriented and object-oriented programming ideas and their advantages and disadvantages in personal practice. For the experimental teaching of many courses in successive or advanced stages, the system can be continued to be selected. For example, in the experiment teaching of software engineering, we should continue to use this system to let students complete the information of each stage according to the normative development process in the non-normative parts of the previous development process.

Object-Oriented Programming (C++) and Java Programming are both object-oriented programming languages. The repetitive knowledge points of these two courses are the key technologies of object-oriented programming (abstraction, class, inheritance and polymorphism). Our approach is to put the experimental content in C++ to focus on learning, and weaken it in Java experimental teaching. Leave it for students to study by themselves and let students digest and absorb in project practice. The experimental teaching of Java programming focuses on the visual programming, multi-threading programming, database access and design patterns of Java. For example, there are also overlapping experimental teaching contents in the two courses of software engineering and software testing. Generally speaking, the experimental teaching of software engineering covers software testing technology. Our approach is to focus the experimental teaching of software engineering on the theory and practice of process-oriented software development, and to put software testing in the course of software testing technology.

The hardware system analysis and design sub-curriculum group is composed of micro-computer technology, computer composition and structure, digital logic design and network engineering curriculum design. Only after the completion of micro-computer technology can students complete the computer composition and structure, and step by step complete the experimental courses in the hardware system analysis and design sub-curriculum group. Among them, the storage system in “Computer Composition and Structure” and “SRAM/DRAM/E-PROM Basic Memory Cell Circuit, Chip Example, Reading/Writing Sequence”, “Main Memory Connecting with CPU” overlaps with “Digital Electronic Technology” and “Microcomputer Technology”, which can be put into “Digital Electronic Technology” course for further study. For “Computer Composition and Structure”, on the basis of a brief review of the above-mentioned teaching contents, we can consider that experimental teaching should focus on learning “cache memory”, “virtual memory” and “high-speed memory” (dual-port memory, multi-body cross memory, interconnected memory, etc.). We can consider putting the overlapping teaching content of the “Storage System” part of “Microcomputer Technology” course and “Computer Composition and Structure” into “Computer Composition and Structure”, and focusing on the experimental teaching of this course which we analyze the closed memory knowledge of “Allocation and Use of Memory Space” and the assembly language program design, taking IBM PC/AT as an example.

In the part of machine representation and machine operation of numeric value, the experimental contents of “operation and conversion of different carry counting systems”, “definition and conversion of signed numbers” (original code, complement code, inverse code, shift code), “representation and comparison of fixed and floating point numbers”, “logical algebra and basic logical operation” overlap with the course of “digital electronic technology”. In “Basic Hardware Configuration of Fixed-Point/Floating-Point Operating Method”, latches, adders, data selectors, shift registers, counters and other devices will be mentioned, which are the key points of experimental teaching of “Combination Logic Circuit” and “Sequential Logic Circuit” in the course of “Digital Electronic Technology”. We should study their working principles and usage methods in this course, and explain their further application in the follow-up courses. In addition, in the two courses of “Digital Electronic Technology” and “Microcomputer Technology”, the contents of “Principles and Main Performance Indicators of Digital/Analog and Analog/Digital Converters” overlap, which can be put into the course of “Digital Electronic Technology”. In the course of Microcomputer Technology, we focus on learning about the structure of typical analog-to-digital converter, the working process of data acquisition and the connection with system bus. The curriculum in the
sub-curriculum group has been adjusted in a unified way, which is more conducive to students' learning.

Conclusion
In the environment of cloud platform, information experiment course group plays a special role in information specialty. Because the information curriculum group has the characteristics of wide coverage and abstract theoretical concepts, experimental teaching is the key link for students to understand professional knowledge. We propose for the hierarchical information experimental curriculum group system structure under the cloud platform environment and plan and deploy a comprehensive experimental platform, which realizes the conversion from the experimental teaching concept to the specific experimental teaching implementation process. Based on this comprehensive experimental platform to carry out experimental teaching work, teachers and students can login to the cloud platform to do experiments without entering the laboratory; each course group is arranged on the cloud platform to do experiments, so as to avoid duplication of teaching content. Teachers reduce teaching workload by managing the cloud platform of courses; cloud platform realizes intelligent management. The workload of personnel has been greatly reduced.

References
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