Research on the Related Teaching Method of Computer Operating System Course

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Abstract. Computer operating system (OS) is one of the most important course of computer science. According to the difficult situation in the teaching of computer operating system course, the article analyses the reasons of main problems in the teaching process, and puts forward a new related teaching method based on association. Firstly, the method regards the computer system as a complete social system, and strengthen the crossing and connection with other courses. Secondly, strengthen the specific association and correspondence between experiments and theoretic. Finally, specific examples are given and explained.

Keywords: Operating system (OS) · Related teaching method
Cross learning · Educational reform

1 Background

Computer OS is an important and indispensable part of the computer system. It is the first extension of the computer hardware function, and the computer system is no use without it. The Operating System Principle (OS) course is a foundation course and a core course of computer and related subjects. It is an important software course which related to much hardware knowledge in computer system courses. In curriculum settings of the computer software and hardware courses, it plays a connecting role. The OS implements the overall management of computer system resources, which is the only interface between all other software and computer hardware. Therefore, all users need to use the computer on the OS, and the services provided by the OS are required. The mastery of OS course affects the professional level and development direction of computer learners. By the studying of this course, student can learn the basic concepts and main functions of the OS. In addition, student can master the use and general management methods of common OS (such as windows, UNIX, Linux), understand how it is organized and operated. And then, the knowledge of OS lay a solid foundation for students' future study and work.

Constantly, the usage, analysis, design and development of the OS is always the important subjects and tasks of computer science. In order to learn the course well, it

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not only requires students to have a certain knowledge of computer hardware, but also requires students to have the knowledge of software technology. Thus, the purpose of this course is to make students to understand and master the basic working principle design techniques and design methods of computer OS. The content of OS course is the composition structure, design idea, design method and theory synthesis of all kinds of OS. Because of the multiple knowledge points, with conceptual and abstract strong, it is different for many learners to understand and master.

2 Main Problems in the Teaching Process of OS Course

Many students raises the question after class as if by prior agreement: What is the principle of computer operating system? What is the relationship with other courses? How does the knowledge links up between chapters? Why is the experiment difficult to correspond with the theoretic? Many teachers are also studying how to improve the teaching methods of this course [1–5], or try to improve the experimental content and facilities [6–8]. These articles analyze the shortcomings of the traditional teaching model from various aspects.

After getting rid of the extrinsic factors such as the less change of teachers' teaching methods and obsolete computers, the course itself should be analyzed on its characteristics and difficulties.

2.1 Curriculum and Experiment Are More Difficult

There are many concepts, strong principles, high degree of abstraction in the OS course, so it is difficult to understand for learners. The theoretical knowledge accounts for a large proportion, in especial, the key knowledge points are dispersed, and the intrinsic logic relationship between concepts is hard to find. Moreover, operating system itself is a complex programming set, for that reasons both experimental comprehension and design are difficult.

2.2 The Teaching Content and Experiments Cannot Be Effectively Related

The choices and arrangements of experimental contents are of great concern. There are many experimental settings unreasonable, special details as follows:

(1) Few experiments is set about memory management and device management.
(2) Most of the experiments are of replication experiments and the number of designed experiments is few and difficult.
(3) Curriculum content is generality OS theory, while the OS experiments must be corresponding to a specific OS(such as windows), so, experiments cannot be one-to-one correspondence to OS theory.
(4) The operating system is closely related to hardware, but the experiment is often not associated with hardware or difficult to achieve.

2.3 The Student's Knowledge Reserve Is not Enough

The setting of previous courses is unreasonable, so that the development experience and hardware related knowledge of the student is weak. In addition, some courses are closely related to the content of the OS course, the same content will be appear in different ways or different angles. However, students do not associate and utilize other courses in their study.

2.4 The Examination and Application Are Relatively Divorced

Examinations focus on concepts and principles, and often divorces from the actual application. It was this issue which led to the deviation of students' learning focus. Many students think that the mastery of knowledge is nothing but rote learning.

To sum up, the difficulty of operating system course cannot be overcome. Not only good teaching materials can play a role in teaching process, but also continuous accumulation of teachers teaching experience is needed. Therefore, it is particularly important to adopt reasonable teaching methods. In this paper, the related teaching method is put forward to the teaching of operating system. This method can mobilize the enthusiasm of the students to the greatest extent, guide students to learn independently, and then improve their learning ability.

3 The Related Teaching Method of the OS Teaching

A good teaching method will not only allow students to understand the principles and internal mechanisms of the operating system, but also enable them to master the key-skills of software engineering. In the related teaching method, teachers will impart knowledge by association and analogy. Students are required to learn the operating system in the developer's mind, and to think of all the parts of the OS as a whole. In the traditional way of teaching, we often divided the course content based on OS function into several modules which is further divided into smaller modules.

Because of the dispersive characteristic of OS, we should pay more attention on how to strengthen the contact of knowledge points rather than split them. Therefore, the aim of related teaching method is to change the relationship of knowledge modules from high cohesion and low coupling into high cohesion and high coupling.

According to the differences of knowledge points, different correlation and correlation range, the basic association of knowledge can be divided into tree structure, cluster structure, ring structure, and mesh structure.

The key points of related teaching method is shown in Fig. 1. New methods and concepts in each chapter will be studied associating with other related subjects and things in life. By this means, learners can get the knowledge more easily and concretely. Knowledge is especially associated with experiments, and then main knowledge is deepen understanding by programming. We also link up the knowledge and experiments between chapters.

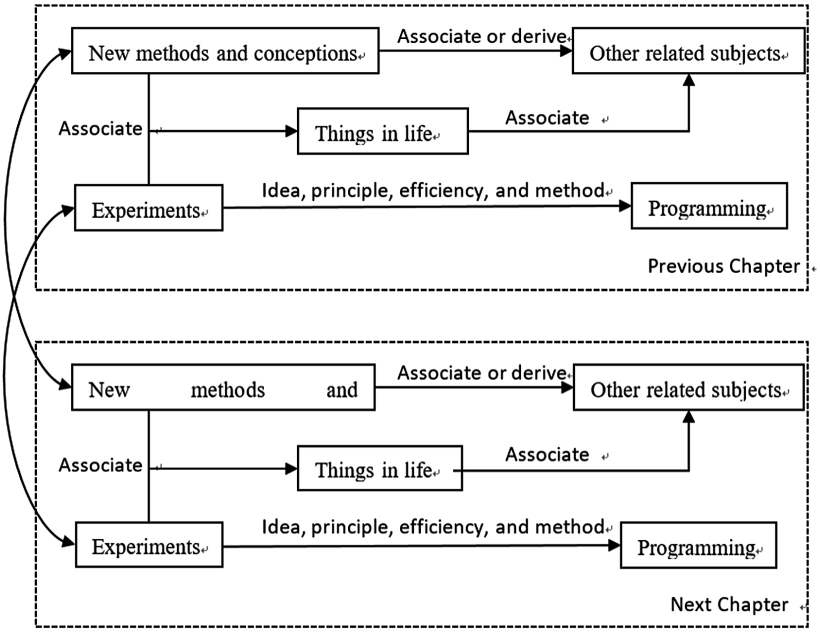

Fig. 1. Key points of the related teaching method. New methods and concepts in each chapter will be studied associating with other related subjects and things in life, especially associated with experiments.

Based on years of teaching, 8 methods of OS teaching need to be done.

(1) Pay attention to the training of students' associated mode of thinking.
(2) As an OS learner, transposition should be thinking more different stand point of view the problem, such as developers, users, and managers.
(3) Provide Linux, windows, Android, or simplified experimental platform of operating system, in order to corresponding the general functions and the specific applications.
(4) Change the process of teaching. Questions should be spotted by learners themselves, instead of being asked by teachers.
(5) Pay attention to the association of experiments and programming. Computer programming is an important way to understand OS principle. It is suggested that teacher should provide the system programming subjects, the simulation experiment platform of OS, the teaching OS, the kernel development of business OS and so on.
(6) Pay attention to the search and association of reference material. Make sure learners have the ability to retrieve reference materials. For example, Memory management and other hardware knowledge can refer to Principles of Computer Organization, and some algorithms for process scheduling can refer to algorithms in Data Structure.

(7) Pay attention to the association of the knowledge points in previous chapter and next chapter by contracting, contacting, and simulating.
(8) Strengthen the connection if hardware and software. The OS is mainly used for managing hardware. If a mainline can be used to put the operating system principle into a large computer system, the mainline is the composition of each part of the computer.

4 Examples of the Related Thinking

A better way to learn the OS is to understand each knowledge from the point of view of an OS kernel developer.

(1) Concepts and algorithms is associated with the things in life. For example, CPU is considered as a decision maker, and OS is considered as a manager of the computer hardware and software. The computer system is a multi-layer social system. The software can be related to transportation scheduling, transportation, functional departments, social structure, social classification system, etc. In contact, the hardware is related to roads, houses, warehouses, land, vehicles, etc.
(2) Associate with software development and software engineering. The common problem of the allocation and sharing of limited resources is the compromise and the improvement of efficiency. In programming, there is a programming think that time changing space and space changing time. In control theory, there are sub-optimal control and cost control. It is a balance of resources both in programming and control theory. Therefore, we should first guide students to learn from the perspective of developers and designers, clarify the premise of limited resources, and make clear that the operation system programming is the principle of reasonable management of limited resources. For example, the application of variable in program development, memory dynamic application is closely related to the memory management in the operating system. Furthermore, the operating system program itself is in line with the development and design concept of software engineering, and the idea of software engineering can be verified here.
(3) Associate with the concept of cross points between subjects. Different subjects have different formulations and different teaching angles. If teachers can explain from different angles at the time of teaching, they will be of great help to the integration of all courses. For example, when students use the windows OS for application management, it will involve many concepts of file system, such as partition, formatting, sector, cluster, etc.; The discrete management mode of learning memory management involves hardware knowledge and computer composition principles with the same content but different expressions.
(4) The lesson will be connected closely to the experiments. Specific operation such as commands, calls, and processes should be associated with the knowledge points of the textbook.
(5) The connection between CPU execution and hardware support. Who is the working people (i.e. program), and where to place things (memory, memory, register).

(6) The connection between the windows setting and the interface of the hardware and the OS. It is necessary to identify which is a graphical interface, which is a program interface, and a command interface.
(7) Garbage collection system is associated with equipment recovery and resource recovery. This is similar to programming resource recovery.

5 Conclusion

The article give a vivid teaching method of OS course. By the method, chapters are closely related to each other, and the whole course content is easily studied. The core of this method is to enhance students' thinking skills training. Through classroom practice, this teaching method can effectively overcome the objective constraints brought by teaching materials and experimental equipment. It also maximizes the enthusiasm of the students and guides the students to study independently. Thereby, improve the learning and understanding abilities of the students, and then make students have the ability of understanding the rest of other courses.

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