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Construction and Implementation of Innovation Computer Network Practical Teaching System

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Abstract

This paper aims at the deficiency analysis of computer network practical teaching in universities, focusing on the goals of teaching practice. On the practical teaching system, content and form etc, this paper uses practical teaching in all aspects of personnel training, and puts forward a set of integrated practical teaching program which is suitable for talents training.

Index Terms: Computer Network; Practical Teaching; Teaching Reform; Innovative Experiment

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1. Problems facing in the computer network practical teaching

Computer network practical teaching is an important way to improve students' practical hands-on ability, cultivate students engineering experience systematically, and promote overall development of students. However, in the traditional practical teaching, there are some problems on no clear focus for experiments, poor teaching results, and low experimental efficiency and so on. Some outstanding performances are in the following areas:

1.1. Theoretical teaching is out of line with practical aspect seriously

Currently, teaching content and teaching methods of computer networks courses are remained mostly in the relatively backward stage, for example, theoretical knowledge of switchboard and router pimples and relative agreements have been explained in class, but few refers to specific applications of the agreement in practical using and implementation, so that the students do not understand theoretical knowledge profound, and have only a hazy notion on basic knowledge of networking. Due to lack of practical ability, it results that the ability of students to solve practical problems is not high, and causes the students after graduation can not meet the community demand for talent.

1.2. Unreasonable practical teaching schedule

While many colleges and universities have arranged many aspects such as the perception of training, course experiments, curriculum design, graduate internships and other practical aspects, but it lacks integrity to technical application ability and lacks standardized management and a clear assessment system. Many aspects are of their own ways which are out of lines with each other. Students are difficult to form a whole and reasonable knowledge construction on the knowledge and skills, and it is difficult for them to form technical applications ability. Also, most of the traditional experimental teaching is emphasis on operation and repeated experiments. The theoretical content is based on the validation experiment and individual experiment training, and integrated and designed experiments are too few. It do not have enough attention on the curriculum design, which is not conducive to students comprehensive practice ability and difficult to cultivate students innovation ability.

1.3. Traditional experimental teaching is behind the development of the current network technology

As network technology has developed rapidly, teaching resources are lacking, which make the experiment content has a large deviation with the current advanced technology. Laboratory environment design is not suitable for practical teaching, so the experimental design is difficult to keep up with the applications. Presently, there is a wide range of network products. Network products have good packaging with relatively simple application, while there is no specific description and analysis for network products in teaching materials. For the lack of practical experience of the teachers, they are only staying in the theory stage for the network devices, and the monotony of teaching methods can not mobilize the enthusiasm and subjective initiative of the students, or even it makes the students feel that the knowledge is "not practical, not enough, not handy and no use."

2. Optimize the practical teaching system

2.1. Create an optimized and relatively independent practical teaching system

On the one hand, scientific and rational design of teaching is beneficial to improve students' computer skills, engineering design capabilities, social practice ability and the proficiency and innovation capacity of professional knowledge. On the other hand, it can stimulate enthusiasm for students to learn professional knowledge and can improve their interest of the professional knowledge learning and application. The reform and innovation of practical teaching system is not simply to adjust the experiment items, it needs to change the present independent, fragmented and repetitive situations of theoretical courses and experimental teaching, to delete or update these experiments and practical items that do not meet the modern scientific development, so it will be concise to establish an overall optimization and relative independent practical teaching system. The practical aspects shall be like progressive layers from the school skill training to off-campus internship, from a point to a facet, which can help to train students in all aspects of skills and problem solving skills. To this end, we will divide the practical session into two stages, i.e. courses teaching stage and graduation design stage. In the first phase, it includes perceptual practice, curriculum experiment, curriculum design, interterm practice (integrated practice) and other aspects. In the second stage, it includes 7-week internship in companies, and 8 weeks of graduation design aspects. In the first phase, it focuses on the cultivation of professional skill cognition, professional skills, professional practical skills, while quality development and integrated skill training in the second stage. The specific aspects are divided into the following areas:

- 1) *On-site teaching*: Taking advantages of good research cooperation, organize the students to visit and research the network center of their own university and other enterprises, to understand present more advanced network technology. Invite network engineers to explain the server applications, network

- topology, network equipment and network technology used, network management methods and knowledge and skills of other aspects, and to deepen their understanding of theoretical teaching content.
- 2) *Curricular experiment*: Starting from the teaching content, it aims to master the basic teaching unit of the operational capacity and implement this teaching step, which is the aids and strength for curriculum theory teaching. The experiment gives students a better understanding of curriculum theory and knowledge, and it is based on the school laboratory.
 - 3) *Courses Practical Training*: It is designed to train students' application and skills to complete the project. It is key element for students to understand the professional knowledge, to be familiar with the professional equipments and master basic skills. It aims to cultivate hands-on ability and application ability of students.
 - 4) *Curriculum Design*: The curriculum design is a designed step to train the students' comprehensive ability. It will improve students' ability to analyze problems, apply knowledge and solve problems, and it will cultivate comprehensive strategies of the students.
 - 5) *Integrated Practice*: Through participation in applied research projects, it will construct links and application among relative skills under the guidance of teachers through comprehensive skill training. It will promote the professional capabilities of students, along with innovation mentality and flexibility to solve practical problems.
 - 6) *Combination of production, teaching and research*: Through the production practice or participation in the production of school projects, at the production line and in schedule tasks, the students will complete the comprehensive training of professional competence, comprehensive strategies and social ability in a real business environment. Through internships in companies, it will enable the students to experience the environment in companies, to complete the stride from the theory to practice, and improve the competitiveness of graduates.
 - 7) *Graduation design*: It aims at the completion of professional integrated skills. Through the integrated application of basic theory and related skills, it will enhance students' ability to use knowledge and skills, to train their comprehensive strategies, and to solve problems. It will develop students' innovation ability.

2.2. Construct a practical teaching theory which complementary to the theory teaching

Change the traditional practical teaching mode of "experiment turn around with teaching theory". Through measures of teaching method and mode innovation, the innovative practical activity design, innovative methods of assessment and so on, make the students have innovation demand of learning in a complete real problem situation. Motivate and stimulate students' internal innovation impulse, innovative thinking, and stimulate their learning initiative. According to the principles of novelty, operability, practical, pioneering and gradation, we optimize and integrate the experiments, and divided them into 4 categories. 1) Basic experiment. Its main aims are to master basic knowledge and skills. 2) Comprehensive experiments. Its main aims are to strengthen students' ability of operating and their comprehensive analysis ability. These experiments involve many courses knowledge's generally. The students do not only apply their knowledge learned, but also understand and mastered the other relevant knowledge's during the process of referring information and designing the experiment plan. 3) Designed experiment. These experiments in addition to consider choosing project design with appropriate difficulty, also it needs to introduce specific design method to the students, and guide them to design a feasible experiment scheme. 4) Innovative experiments. These experiments have clear purpose and certain conditions, but there is no embodiment. According to the given experiment demands, the students design experiments themselves and obtain experiment results independently. The purpose is to develop the skill to explore new methods or skills. From the discipline construction of computer network, professional ability and integrated quality training are our principle line. We will disintegrate each application ability, and implement the refined abilities into each teaching step according to the orders of "network learning", "network organizing", "network managing" and "network constructing. Through the integration of related courses, we will delete the repeated contents, and make and overall arrangement of practical teaching contents to form

systematical and layering teaching steps. We will notice the links and supports between every step, and implement the practical teaching gradually to make sure the knowledge and ability cultivation are synchronously. For example, the content of network operating systems will be merged into the operating system for teaching; network database will be merged into the network programming design courses to teach; Internet and its applications, network management technology and other contents will be taken as a self-study in extra-curricular completed by the students; the rest parts will be integrated in accordance with the profession to network capacity requirements of compute. According to the principles of the separation of practical teaching and theoretical teaching, independent courses of practical teaching, and independent assessment, it will be set up four parts as computer networks, network construction practice, network security technology and web page design and making, and the latter three parts are mainly practical teaching.

3. Reform the practical teaching methods

3.1. Network experimental method .based on simulated software

Computer network experiments have a higher requirement of experimental environment, and their manipulation is also destructive to some extent. Teaching with simulated software, can eliminate the impact of experimental environment. For example, the use of PacketTracer, simulator of Cisco, to simulate the transmission process of network flow by way of simulating the working process of networking protocol enables students to master the configuration methods and process of network equipment, understand the functions and application surroundings of various network devices more visualized and comprehensively, enhance the understanding of the network principle, protocols, and realize a transition from the sense to the generalization in learning.

3.2. Network experiments based on virtual machines

If the network experimental equipment can not meet the needs of teaching, to construct virtual network with the VM ware and Virtual PC software can solve the problem. Formed on each PC, the single virtual machine LAN can simulate some computer network technology phenomena or laboratory equipment through the virtual experiment so as to create benevolent conditions for students to engage in innovative activities. To carry out the innovative experiments under the virtual network surroundings, which rids itself completely of the constraints of the original experimental conditions and enables the exploration within the deeper and wider field of knowledge cannot be matched by the traditional experimental models.

3.3. Task-driven interactive teaching method

Task-driven approach attributes a lot to helps student master the methods of identifying and solving problems, inspire students to be in wide discussion and improve their overall ability to use knowledge and of hands-on practice. The teachers should make clear requirements, assign the tasks timely and keep abreast of the students' operating conditions. For instance, many families have begun to build small local area home network. By analyzing the requirements of home network, the teachers can design a practical teaching subject of wireless LAN networking with the family network background. The students would discuss and design the topic at first, and then introduce their solutions to the problem before the class followed by the commendation of teachers. Such a teaching pattern guarantees the students' full participation of the teaching process and stimulates their thirst for active participation in the practical teaching.

3.4. Case Method

As the network technology is practical, every network engineer project is a good teaching case. The case teaching method includes three steps: first the teacher explains the experiment centered on the case, and then have students reflect and discuss what they have learnt should be used and what programs should be adopted in the experiment. Finally the teacher explains the knowledge required in the experiment, the general process of experiment and the questions existing in the experiment. The students can master related manipulation and design methods through the case analysis, independent design. This case method can train the students' capability to solve practical problems and make a solid foundation for them to adapt to and be competent for their future job after graduation.

4. The characteristics and innovation of practical teaching reform

4.1. Open

Openness refers to the open practical teaching environment based on the network environment t, which from the time and space, breaks the closed nature of experimental space, and provides students with more convenient experimental environment so as to offer the self-learning conditions to the students, and meanwhile improve the efficiency of laboratory equipment. Open experimental system has the characteristics of authenticity, cutting-edge, fitness, multilevel nature, and flexible scalability, which provides a relaxed leaning environment and experiment space for students with different levels. The students can employ the equipment in the laboratory to do experiments by a previous appointment through the campus network. For students who do not accomplish or fail the experiment within the planned hours, they can complement or choose the experiment again, so they have time to find out the reasons for the failure.

4.2. Interaction

Through the establishment of practical teaching coaching websites, providing network-experiment-concerned product technology materials, a series of experimental guides, network application software, network management software and network development tools and other related information, the students can gain available reference for their preview, which changes the "universal" teaching mode and is beneficent to form the students' good habits of independent study and gratifies the individual learning of the students.

4.3. Practical

Practicality refers to the employment demand oriented, adjusting experiment project. In the experiment content selection to grasp professional skill and practice ability as the key point, pay attention to practical, reduce the verification, demonstration experiment, careful arrangement comprehensive and designing experiments in this discipline development, pay attention to the latest technological knowledge, permeability of related disciplines theory and skills, make comprehensive and designing experiments occupies the proportion of the course. With project development mode of operation of organization, each experiment project practice teaching is the background description, make students in experimental before they clearly know this experiment technology related to concrete applied to any occasion, stimulating study interest.

5. Conclusion

The reform of practical teaching is a long and arduous task. Only with the unremitting efforts and unremitting exploration, and by treating the cultivation of the students' capabilities as an important task of practical teaching, practical teaching can be developed well.

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