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Research on the Construction and Management of Open Computer Laboratory

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***Abstract*—Based on the actual situation of computer laboratories in Colleges and universities, aiming at cultivating engineering talents in the new era, this paper analyses the problems faced by computer laboratories and their disadvantages, and puts forward an idea for the construction of open computer laboratories in cloudless environment. It effectively alleviates the limitation of laboratory time, location and project caused by the low configuration conditions. Making the best use of existing resources to provide more space for students to think and study independently. It promotes the development of students' innovative entrepreneurship projects and cultivates students' scientific research thinking ability. It provides a reference model for universities with many tasks and lack of funds. This paper systematically presents the framework and layout of open laboratory construction. The technical essentials and solutions to common problems in the process of management are elaborated in detail. In the research, the method of combining software platform development with hardware resources is used to maximize the utilization rate of laboratory resources. It provides a new way to create an efficient and shared computer laboratory.**

Keywords—Laboratory construction; Experiment item; Laboratory management; Maintenance and repair;

I. INTRODUCTION

Computer experiment teaching in Colleges and universities has always been an important part of teaching. The construction and management of computer laboratory directly affects the effect of experiment teaching. With the deepening of discipline development, the scope of interdisciplinary and integration between various disciplines and computer disciplines has expanded. Therefore, whether from the development of disciplines or from the cultivation of students' practical and innovative abilities, we need humanized experimental sites.

The number of comprehensive experiments to cultivate innovative ability is increasing, and the number of design experiments to cultivate practical ability is also increasing. The increasing number of experiments results in serious shortage of experimental infrastructure resources. In the case of prominent contradictions, how to maximize the utilization of existing resources and solve more experimental needs are the important reasons for promoting the construction of open Laboratory. It also the new demand for technological innovation and management of computer laboratories in Colleges and universities.

A. Open Laboratory Is for the Need of Cultivating Innovative Talent.

Chairman (CPC) Xi Jinping pointed out at the APEC Summit in 2014 that we should change from consumption-driven, investment-driven to innovation-driven. Laboratories in Colleges and universities will play an important role in scientific research, innovation and social services, and those are irreplaceable to train students' innovative and practical abilities as well. Talents training in Colleges and universities must meet the needs of social development and transformation. Open laboratory provides humanized practice platform for students with its inclusive characteristics.

B. Open Laboratory Is for the Need of Training New Engineering Talents

With the continuous development of scientific research technology, the degree of integration of computer technology and other professional technologies are deepening. For example, the integration and development of electrical engineering, material, mechanical automation and computer technology makes the experimental types more complex. Traditional confirmatory experiments can not meet the needs of teaching in terms of creativity and inquiry,

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and the number of comprehensive experimental projects is increasing. This change has a direct impact on the distribution of traditional experimental resources and the reform of the construction of experimental environment. Open laboratories can make up for the shortage of resources and provide more comprehensive and complex experimental projects.

C. Open laboratory is more suitable for Students' Individualized Learning Needs [1]

Network technology makes the teaching form more diversified. College students' acquisition of knowledge is not limited to a form of classroom learning. Network courseware, courseware and video-on-demand of high-quality courses can become the way for students to acquire knowledge. Open laboratory can provide students with necessary learning places by various ways. At the same time, students can also be free from the limitations of time and place, and to meet the personalized learning needs by using the campus network as the media, and virtual technology to achieve self-selection of learning content, and learning time. [2]

II. Construction Framework of Open Laboratory

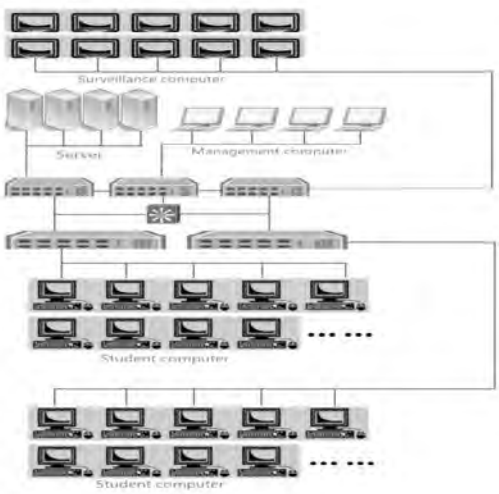

Fig. 1. Open Computer Laboratory Architecture

As can be seen from Figure 1, the campus network is on the basis of constructing an open laboratory. Servers, managers, students, monitors, switches and routers are the necessary hardware devices. For qualified colleges and universities, some management work can be assisted by electronic devices such as access control or card. These hardware resources should be combined with software management platform in order to truly realize the open laboratory.

III. Advantages and Solved Problems of Open Computer Laboratory [3] [4]

Realize the all-day use of the laboratory. The utilization rate of equipment in the computer room has been improved. The outstanding performance is to solve the utilization of idle equipment during the idle period. The conversion technology of the system can be used in the computer room which was used only for a few weeks or months. Reduce the waste of resources in idle laboratories. Put the idle equipment into the new demand in time to maximize the use of experimental resources.

Applying information platform to manage and dynamically allocate computer room resources. In the spare time, students can continue to study through the reservation system. The students' experiment time was prolonged. This method of allocating experimental resources is more scientific and reasonable.

Servers provide different platform development environments, students can choose the platform to experiment according to their own needs. Most of the traditional experiments are to verify the content of the classroom. Students' comprehensive experiments are few, and their creativity can not be fully developed. Open laboratory can respect students' ideas and let students have their own space to do experiments. It provides relaxed conditions for students' autonomous experiment.

The location of the experiment is not limited to the computer lab, but also includes all places where the server can be logged in. For example, experiments can also be carried out in libraries, dormitories or lawns. This makes the experiment time and place more flexible and free.

Laboratories need not invest too much in hardware configuration. By making full use of existing laboratory equipment resources, it can alleviate the shortage of funds for laboratory construction in local colleges and universities.

The experimental links of basic computer courses basically belong to manual management. The lab report can only be uploaded to the shared disk space. This is an improvement over handwritten experimental reports, but it has not yet reached the level of automation. Open laboratory improves the automation of experimental teaching. The Students can automatically detect the experimental results in the experiment. Students' experimental status, data, results are automatically completed, stored and recorded by the system. Teachers can accurately get to know the students' learning situation according to the feedback data and information.

Developing course platform software for language programming. Previously, when students did C language programming experiments, they needed the environment of C language programming on the students' computers to experiment. Now we just need to install the developed software on the server side. Students can log on to the server directly and enter the platform environment for programming. It is not necessary to consider whether the C language software is installed on the equipment used by each individual. For example, C language programming is a compulsory public basic course for engineering majors. The key technology is to determine the basic framework of Web mode. Code Mirror is the main front-end editor, TCC or GCC is the main choice for C language compiler, JFinal is the main background framework and JQuery technology is the template for front-end, MySQL database is for data management.

Expand and reform the functions of the examination system. The examination system not only supports the final examination task, but also supports the daily experiment teaching task. And let the student's programming environment have N-S diagram to follow. The scoring strategy of external scripts is the key to improve the scoring scheme of the examination system. The coding of scoring scripts is an important link. It is not only necessary to input test data according to the program design, but also to set the output format. It is not only necessary to consider the coverage of program branches, but also to make the data not easy to construct manually.

IV. Operation and Management of Open Laboratory

A. Maintenance of Open Laboratory and its key point

With the increase of the number and time of using computers, the number of virus attacks and computer crashes will increase. Accordingly, the workload of administrators in maintenance will increase. Therefore, whether administrators have the ability to deal with computer faults quickly is an important guarantee for maintaining the normal operation of computer laboratories. [5]

1) Administrators should be skilled in holding fast batch repair equipment skills

Computer laboratory machines have the same specifications and configuration. For computers with the same configuration, cloning technology between hard disk and hard disk is especially suitable for system installation operation, common software such as GHOST. In the absence of backup files, the system can physically connect the two hard disks to be cloned, and then use GHOST software to clone the whole hard disk.

Although cloning technology can be used to re-transmit the system, it takes a long time. To improve this situation, we should first backup the partition through GHOST before the repair task occurs, and then save the backup files on the installation disk and non-C disk. When the computer system is destroyed, the computer system is re-installed by using the backup data information of GHOST software. If the backup file of the computer is damaged, the backup file stored on the boot disk can be restored to the system.

2) Network simultaneous transmission technology also known as disk monitor technology [6]

Each computer can have a variety of computer environments. Students and teachers can prepare different system environments for the computer by using simultaneous transmission technology before going on the computer according to the needs of experimental tasks. This technology breaks the traditional computer system installation mode. Through this network simultaneous transmission technology, the switching between computers in different operating environments can be realized, and the multi-mode of one-machine system can be realized. Its function is the same as that any computer can have a new system environment in a relatively short period of time. However, compared with cloud desktop technology, the application of network simultaneous transmission technology handover is more like the process of replication and installation. For the system environment switching with high demand for instantaneity, network simultaneous transmission technology still has limitations.

a) It can complete the system installation of dozens or even hundreds of computers in a short time, and the installation time is short. It can reduce the labor intensity of repeatedly installing the same type of computer. It shortens the time of installing machines in batches.

b) It can automatically assign IP addresses to all computers in the computer room.

c) Hard disk protection function can be realized to prevent virus and mal-operation.

d) The computer can be restored to the previous operating environment to reduce the cost of computer maintenance.

e) Maintenance personnel are allowed to use incremental simultaneous transmission to add data remotely to any computer in the computer room.

The system software can be repaired and installed by using PXE quick start client and running Ghost clone technology. The remote PE start can also be realized by modifying boot loader, and the remote installation can be managed and maintained. Both of them have the functions of efficient and fast recovery system in a short time.

Computer and server must install security protection software to reduce the chance of virus intrusion. The use of Internet network will increase the invasion of computer viruses. Insecure external storage devices can also increase the probability of computer virus transmission. Some computer viruses spread very fast, so we must do a good job of anti-virus and anti-hacker work. One of the measures to prevent virus infection is to physically shield the storage interface of computer peripherals. The software needed by students can be downloaded from the server. The second is to install restore software on the client computer. Third is to timely repair of system loopholes.

Do a good job of heat dissipation treatment of equipment. Because the computer in open laboratory has the characteristics of working for a long time, the phenomenon of heat accumulation or ash accumulation of equipment is more serious than that in ordinary laboratory. Hardware overheating can also easily lead to computer failures, so for the computer-intensive laboratories, we should pay attention to the heat dissipation of equipment, especially in the high temperature season to add indoor air conditioning and other heat dissipation equipment. Administrators should regularly clean and dust the computer hardware while managing the environmental hygiene work of the laboratory, so as to improve the service life of the computer equipment.

In software, do a good job of backing up system files and common software of computers and servers, in order to be used when repairing computer systems. On the hardware, we should reserve the fragile hardware equipment to ensure that when the computer hardware is damaged, replaceable hardware can be replaced in time.

The remote monitoring technology is applied to the management of computer room. Open computer laboratories need to be equipped with monitoring equipment. One is to monitor the instant use of equipment, and the other is to monitor the flow of personnel in the laboratory room, and transmit the collected video data to the management machine and the monitor, so that an administrator can supervise multiple laboratories simultaneously through the management machine and the monitor. It is to understand the flow and use of laboratory personnel through the management machine. Installation of supervisory machines and supervisory machines saves personnel expenses, and saves much time and effort in laboratory management. It can also manage computers and computer personnel through information platform software.

For conditional schools, IC card technology can also be used to assist management. Only by swiping the card through the entrance guard, the boarding personnel can automatically complete the tasks of identity verification, attendance, designated number of operating equipment and other boarding verification tasks.

B. Establishment of Lab Rules and Regulations

Because there are many kinds of computer projects in open computer laboratory and the time of computer is flexible and changeable, there are many people in computer laboratory and their mobility is strong. The first is to establish and complete various management rules and regulations, and the second is to strictly implement the various systems to ensure the normal operation of the laboratory. Such as "Computer Room Management System", "Computer Equipment Safety Operation Process", "Laboratory Safety Fire Prevention System", "Laboratory Health Management System" and so on. New trainees should read and comprehend the regulations carefully before boarding the aircraft.

C. Laboratory Safety Management

For laboratories, safety is always the first priority. Computer labs are places where people are concentrated. Based on this characteristic, we must do a good job in the safety of fire prevention and theft prevention. On the one hand, we should ensure personnel safety. On the other hand, we should ensure the safety of facilities. Many schools focus on teaching and neglect safety work. For example, the aging problems of power supply circuit. Regular safety checks should be carried out on the power lines and overdue components of the laboratory to detect hidden dangers in time. Avoid fire caused by line aging or damage. Classroom ventilation and heat dissipation, safe entrance and exit, anti-theft guardrail, alarm monitoring system should be regular inspected.

D. Strengthening the Construction of Teachers in Laboratories

In addition to the management content, the assessment of laboratory should also include the assessment of scientific research strength. To change the weak situation of laboratory technical strength, one is to introduce high-level talents to join the laboratory team and improve the overall strength level. The second is to formulate and improve the teacher training system to create and provide a good learning platform for teachers. Third, laboratory personnel should understand the latest developments of computer laboratories and make clear the direction of development of laboratories. Fourth, we should build up a team of student administrators to select students who are interested in the management .

V. CONCLUSION

Computer experiment is an important part of College teaching. In addition to the professional and non-professional computer teaching tasks, the laboratory should also undertake other tasks such as examinations, data access, electronic course selection, examination results and document notification and so on. It has the characteristics of large number of experimenters and wide coverage. Open laboratory combines excellent software platform with existing hardware resources. It effectively expands the function and scope of the laboratory, prolongs the use time of the laboratory, makes the experimental study more individualized, and meets the training needs of engineering students in the new era. Open laboratory is recognized by teachers and students because of its low investment, convenient management, high efficiency and strong inclusiveness. It provides a reference model for laboratories that can not apply cloud technology for the time being, and has great application value and popularization significance.

REFERENCES

[1] Zhen Zhang, Yaqing Wan, “Construction of Computer Laboratories in Foreign Universities and Its Role in Teaching,” [J].Laboratory Research and Exploration, March 2011, pp.317-319.

[2] Shan Liao, “Analysis of Computer Laboratory Management and Innovation in Experimental Teaching,” [J].Wireless Interconnect Technology, vol.15, 2017, pp.121-122.

[3] Yiming Li, “Construction Practice of Laboratory Management Informatization in Local Universities,” [J].Experimental Technology and Management, August 2015, pp.223-225.

[4] Zhixiong Chen "Discussion on Management Technology of Computer Laboratories in Colleges and Universities,” August 2016, PP.185-187.

[5] Wanshuan Chai, “Speeding up the Construction of Open Laboratory and Promoting the Training of Applied Talents,” [J].Laboratory Science, April 2016, pp.174-177.

[6] Shi Chen and Gen Wu, “The Promoting Role of the Opening and Evaluation Mechanism of State Key Laboratories in the Construction of Departmental Laboratories,” [J].Experimental Technology and Management, November 2011, pp.172-175.