



# ON THE CONSTRUCTION AND RESEARCH OF INTERDISCIPLINARY PRACTICAL TEACHING PLATFORM UNDER CLOUD ENVIRONMENT

WENYA TIAN

Information Technology Department, Zhejiang Economic & Trade Polytechnic Xiasha higher education  
park Xuelin Street NO.280, Hangzhou, China

E-mail: [twy@zjiet.edu.cn](mailto:twy@zjiet.edu.cn)

## ABSTRACT

With the rapid development of Internet information technology, professional teaching softwares and simulation system are set up in higher vocational colleges. And they are widely used in practical teaching. Since the Interdisciplinary Practical Teaching has been carried out across the whole school, the shortage of training places becomes a contradiction. To build a shared "interconnection", professional and practical teaching platform is the urgent problem of college. Only by this, it can break through the limitation of the practice sites shortage, and promote the sharing of professional teaching resources. By using the virtualization and cloud computing technology, this paper constructs the interdisciplinary practical teaching platform under cloud environment, which can effectively solve the above problems in higher vocational colleges, thus to innovate the practical teaching mode.

## 1. INTRODUCTION

In recent years, many higher vocational colleges, especially some of the excellent vocational colleges have been making full use of modern education technology to promote digitalization of resources. Some national, provincial, and college level excellent course websites have been established as well as some shared professional teaching resource, which all have promoted the sharing of good quality professional teaching resources. But many professional teaching resources are courseware, test library, video, etc, and materials on relevant skills training, simulation demonstration, experimental operation, which aims to improve students' vocational ability training are less. Let alone the ones about shared specialized teaching platform are little. What's more, the practical teaching platform that uses cloud computing to realize the sharing of teaching resources has never been reported.

Zhejiang Economic and Trade Polytechnic has five experiment and training bases, such as the economic and management, computer application and software technology, etc. And the economic and management training base can be divided into five training centers, including financial accounting, international trade, industry and commerce management, cultural tourism. With the rapid development of information technology and its thorough application, a batch of professional

teaching software and simulation system are set up to be widely used in the student's experiment and practical teaching, and they have been playing a bigger role in improving the students' practical ability.

This year, the school puts forward the interdisciplinary cultivation system of "one person, more posts; one post, multi-capability" for the financial major students. It aims to improve the students' employment competitiveness by learning more professional skills. With the growing of all professional training projects, repetitive construction of training bases and the shortage problem are also increasing. To build a shared "interconnection", professional and practical teaching platform is the urgent problem of college. Only by this, it can break through the limitation of the practice sites shortage, and promote the sharing of professional teaching resources.

Based on this background, this paper presents an interdisciplinary practical teaching platform under the cloud environment. It can achieve the sharing of professional practical teaching resources, and realize the use of network space to be "everyone passes, always passes", which is a beneficial exploration.

## 2. "TEACHING AND LEARNING" UNDER CLOUD ENVIRONMENT

## 2.1 Cloud Education

"Cloud Education" is the integrated product of network technology and education development, whose essence is a service platform of education information. It is to break the education informatization boundary for all schools, teachers and students, to provide a usable, equal platform through the "one-stop" application and "cloud" concept. To some extent, by the unified and diverse platform, the education department, schools, teachers, students, parents and other related persons (such as education software developers), can enter the platform to play different roles, thus to realize teaching, management, learning, communication and other kinds of application tools, let "education realizes information" in this platform.

Cloud education has two characteristics: first, the cloud computing properties. This is the basic technical property, mainly is the resources virtualization. By proper infrastructure construction, separate the management function from the the entity of resources, then shield the details of the bottom system hardware and software through the virtualization to simplify the business application deployment, thus improve the utilization of resources, and realize the integration of resources allocation and vitality; All products, processes are implemented based on open standards. Second, education attribute, this is the intermediate process level attribute. For the system users (learners, teachers, teaching managers), this is the education strategy, such as the content resources, process document, etc. to meet the education purpose.

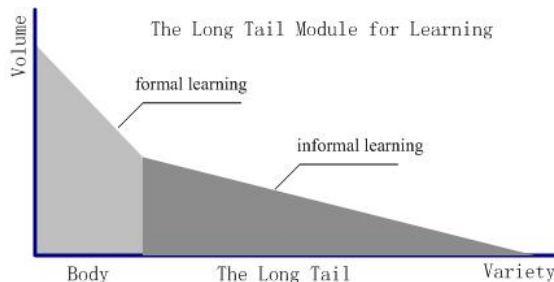


Figure 1 Long Tail Study Theory

## 2.2 Cloud Learning

The learning under cloud environment can be called as "cloud learning". Compared with the formal learning, it can be regarded as "long tail learning", as shown in figure 1. Long tail learning is a metaphor risen in the network education era. It has similarities with the mobile flood learning, informal learning, miniature learning and network learning. With the implementing of quality

education, and the advocating and practicing of learning society that changed from lifelong learning to full life study, modern learners' learning content, learning method, learning style are diversified. These informal learning occupies the common demand of learning, and compared with the formal learning, it share the greater market share.

## 2.3 Practical Teaching under Cloud Environment

The research on technology development in cloud computing education application mainly concentrates on the teaching assistant system and management auxiliary system with the focus on cloud storage and cloud desktop. On the technology application mode and method of research, the cloud computing technology in higher education are researched a lot, followed by general education, and its application in the basic education is rare. Research on cloud computing application in training center focuses on the software industry, the one on higher vocational colleges is not available. So the training center construction under cloud environment should pay attention to the following several aspects:

(1) In the development of application technology, first of all, it should strengthen the integration of application technology and practical teaching, thus make the development of technology based on the practical teaching; Second, it should pay attention to the practice of application technology, thus makes it real be helpful in training and teaching activities, and facilitating the optimization and innovation of application technology.

(2) Strengthen the research on the mode and method of cloud computing technology application, thus to provide constructive methodology, and make the most use of the advanced technology.

(3) Strengthen the application research on cloud computing technology in practical teaching, popularize and promote the application of cloud computing in higher vocational education. Therefore, the higher vocational educators will be aware of the changes brought by cloud computing age, and make cloud computing technology be better used in vocational education.

## 3. INTERDISCIPLINARY PRACTICAL TEACHING PLATFORM CONSTRUCTION UNDER CLOUD ENVIRONMENT

This platform construction mainly focuses on four aspects, including education cloud support system, private cloud of training base, private cloud

of software, that is service, and education cloud deployment implementation.

### 3.1 Education Cloud Support System

The cloud computing public service support system mainly includes: data resource center, cloud computing hardware layer, general service layer, application service layer.

The teaching resource under the cloud environment should have the following features: first, stable and rapid. It should operate stably with a strong, convenient and quick search and inquiry function; Second, the data storage should be standard, and clearly be categorized. It has standard unification and classification, thus be convenient for users to edit and beneficial to the sustainable construction. Third, the resources should be in the

safety clouds. All the information data are in the clouds, and the local needs not retain and backup. Fourth, the operating platform should be user-friendly. At all levels of all types of users can quickly find the needed resources and the corresponding functions, and can easily control and deal with the clouds .

#### 3.1.1 Network Structure

By using the independent practical teaching private network, a MB desktop, gigabit backbone, unified outlet connection school network and Internet can be formed. The outside network can use the VPN or leased line to access cloud, and ensure the smooth and reliable of cloud network. The practical teaching private network structure is shown in figure 2.

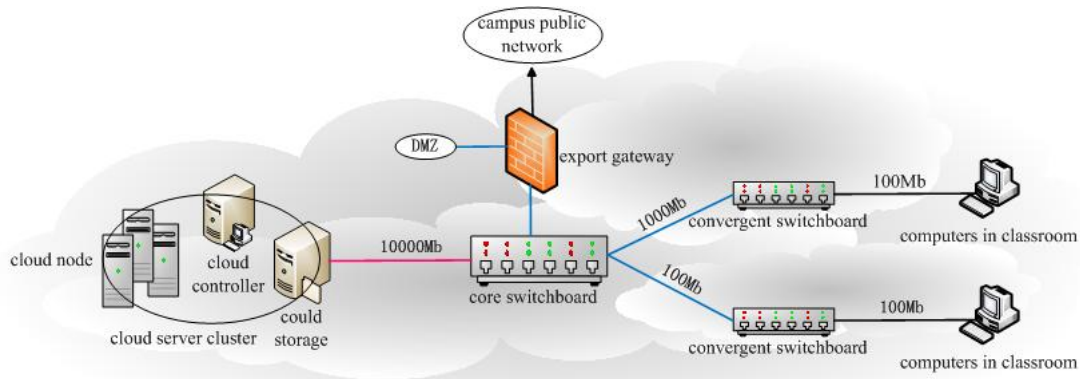


Figure 2 Practical Teaching Private Network

#### 3.1.2 Hardware System

The cloud core service and training room node cluster are mainly composed of hardware system,

which is the main body; the calculation processing storage, which is the foundation. The platform hardware layer is shown in figure 3.

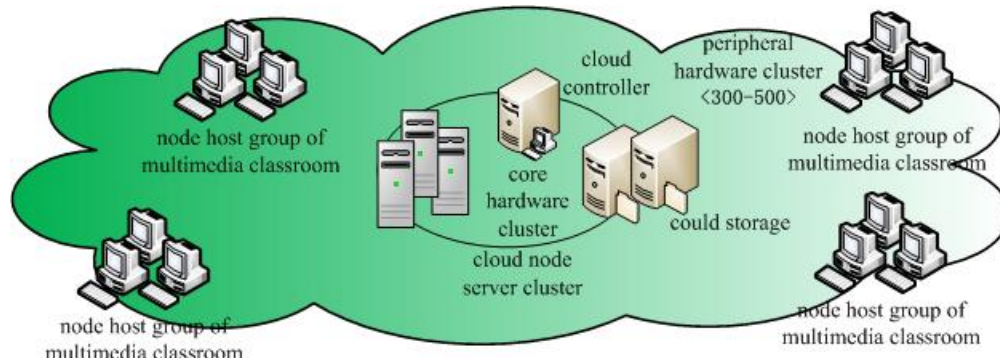


Figure 3 Platform Hardware Layer

### 3.2 Data Resource Center

Data resource center is the core of education private cloud. In this paper, the data resource center

includes the application software of the five training centers. By researching on the application software of the five training centers, there are 37 set of online teaching systems, which basically can be divided into B/S application mode and C/S application mode. The major part of database is SQL Sever, the minor part is Mysql and Oracle, among which 33 sets are B/S service mode, four sets are C/S service mode. They are distributed in 57 training indoors. There are a total of 19 servers, and more than 2100 students machines. Due to the uneven utilization, sometimes they are not enough, but sometimes they are in idle state.

Based on the analysis of the present situation, it is necessary to comprehensively integrate the software, hardware, and resources, thus to provide support for mass data information resources, and deep resources sharing and unified service application based on cloud platform.

In data resource center, construct the special cloud server. By integrating the training center computer, software and hardware system, construct the basic cloud platform system. The data resource center is shown in figure 4.

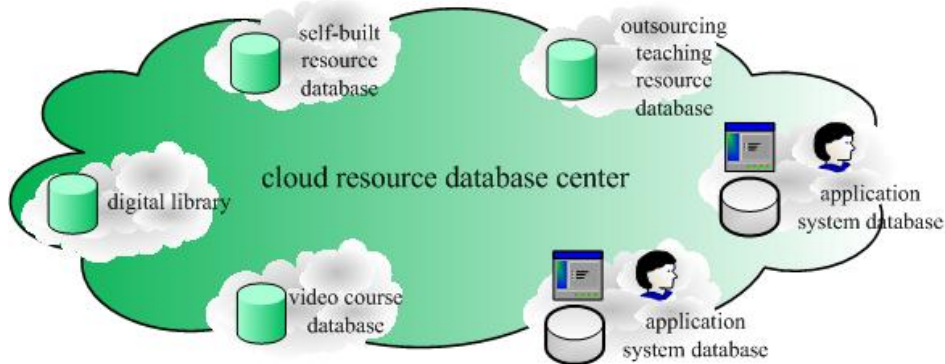


Figure 4 Data Resource Center

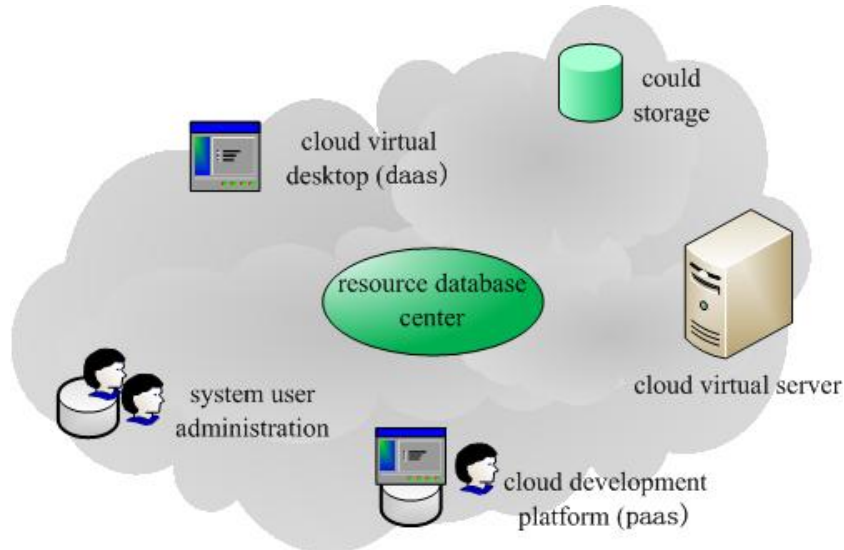


Figure 5 The cloud core universal service

In the data resource center, the application software is divided into three categories: the new application system, the old application system, and the unmovable application.

(1) the new application system: as for the new system application, deploy in the specialized server directly;

(2) the old application system: it needs to be migrated to the cloud platform;

(3) unmovable application: it needs to provide unified service interface.

### 3.3 To realize the sharing of education resources by using the education cloud support system

Private cloud is the platform for a certain organization to be used alone. The education private cloud construction scale is the five training bases of ZETP.

#### 3.3.1 Technology Layer of Education Private Cloud

This layer is the foundation of education cloud layer, mainly used to provide hardware infrastructure deployment services, entity or virtual

computing, storage, and network resources for the users. In order to optimize the hardware in the allocation of resources, this paper introduces the virtualization technology. With the help of Xen, KVM, VMware tools, it can provide high reliable, strong customized, extendable scale IaaS layer service. It mainly provides data center management and optimization.

#### 3.3.2 Universal Service Layer of Education Cloud

This layer is the universal service layer of education cloud, mainly including: cloud virtual desktop service, cloud storage service, tool software support services. They are shown in figure 5.

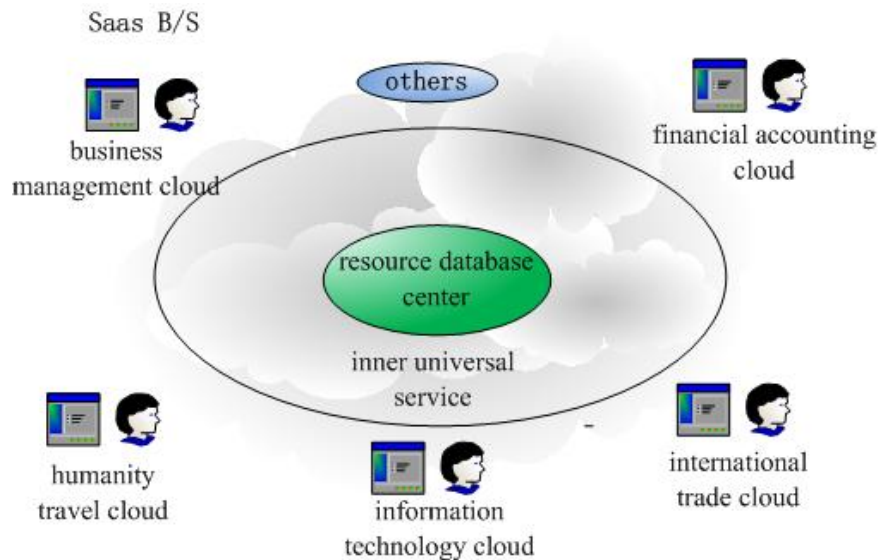


Figure 6 Application Server Tier of Private Cloud

#### (1) Cloud Virtual Desktop Service daas

Cloud desktop is based on distributed cloud computing storage technology, and it integrates the essence applications on Internet, relies on high encryption algorithm, to provide the most convenient, abundant, and secure service for all levels of Internet users. The cloud desktop can provide Internet users the desktop system based on the Internet browser, and it can provide the personalized online to the largest degree of convenience as well as the management of common functions.

In this paper, since the user group of some training centers is small, and the users' computers are controllable, the cloud desktop is used. The cloud desktop is mainly used to offer teachers, students, managers the convenient and safe Internet

desktop system of cloud service, and it can also provide resources navigation and other general functions, personalized functions, by which users can freely use common tools, customized website icons, personalized desktop style, etc according to the classification management; it can expand all kinds of Internet portal function, such as search engine integrated function, network favorites, etc.

#### (2) Cloud Storage Service

Cloud storage is the system that can use the application softwares to get various types of storage equipment work together and externally provide data storage and business access function. It is based on the cluster application, grid technology or distributed file system, and other functions. When the core of cloud computing system operation and treatment is the storage and management of large



amounts of data, the cloud computing system will need to be configured a large amount of storage equipments, then the cloud computing system is turned into a cloud storage system. So the cloud storage is the cloud computing system with its core of data storage and management.

In this paper, the cloud storage service of education cloud is mainly the cloud storage of digital resource center resources and the personal storage space of teachers, students, managers, which can ensure the security of the data and the convenient use.

### (3) General Software Service

This layer is mainly to provide users with general software service, the service provider will be authorized to manage and maintenance the software. It not only provides users Internet application, but also software offline operation and local data storage. Thus the users can use general software and services anywhere.

#### 3.3.3 Service Layer of Private Cloud

This layer is the outermost layer of private cloud service, that is the specific software service. In this paper, the development of "Interdisciplinary Practical Teaching Platform under Cloud Environment" deploys the education cloud resources, makes it cooperate with financial students' practical teaching. This layer is mainly to deploy the 37 sets online teaching system of the five training centers. According to the departments and professional distribution, it is divided into five clouds: "business management cloud", "humanity travel clouds", "information technology cloud", "international trade cloud", "financial accounting cloud", for the whole learning services. They are shown in figure 6.

#### (1) Virtualization use of some software based on the cloud desktop

The application software in five training centers can be divided into two categories: B/S application mode, C/S application mode. The major part of database is SQL Sever, the minor part is Mysql and Oracle. It can be completed by the virtual desktop and Web virtual service.

#### (2) Business Management Cloud

It is mainly used to deploy the systems used in the Business Administration Department. The systems include the TOP - BOSS competition management system, YinNaTe business management comprehensive training system, Shenzhen Huaruan chain distribution management system, Shenzhen Huaruan distribution management system, Shenzhen Huaruan third party

logistics (international logistics) management system, Aopai CRM teaching system, Aopai human resource practice platform, Zheke agricultural products agent skills assessment system, CNEE - CY port container yard management teaching training system, CNEE - IF international forwarding Documents of Application to Customs teaching training system, CNEE - LL supply chain and logistics integrated teaching training system and other systems, which are mainly to provide the practical teaching services for business management class.

#### (3) Humanity Travel Cloud

It is mainly used for the humanity travel department to deploy four systems. The Xi 'an Yuanhua exhibition management system, Beijing trade show audience information management system, swift horse hotel management system, exhibition design curriculum. The four systems are mainly to provide the practical teaching services for humanity travel class.

#### (4) Information Technology Cloud

It is mainly to deploy the five systems, including the Information technology department doctoral adviser's future network marketing practice system, Zheke electronic business logistics system, Zheke electronic commerce basic practical system, Zhongjiaochangxiang sand table simulation management system, Shanghai Chenwu bird sand table comprehensive training system. They are mainly for the practical teaching services for Information technology students.

#### (5) International Trade Cloud

It is mainly used to deploy the systems in the international trade department. The blue pigeon campus network language discipline platform, NewClass digital language laboratory system are included. They are mainly to provide the practical teaching services for international trade students.

#### (5) Financial Accounting Cloud

WangZhongWang audit and comprehensive practice platform, cost accounting practice teaching platform, cashier practice training teaching platform, financial management practice teaching platform, basic accounting practice teaching platform, accounting post separation practical teaching platform and other 16 systems. They are mainly used to provide the practical teaching services for financial accounting students.

In the education cloud deployment process, an education institution or team provides the whole operation of the project, including the online



service of students, teachers, management personnel.

#### 4. KEY TECHNOLOGY

##### 4.1 Distribution and Storage Technology of Mass Data

Cloud computing needs to adopt distributed storage way to store data, and use the redundancy storage method to guarantee the reliability of data storage. It is mainly used in very large scale data storage, data encryption box safety guarantee and continue to improve the I/O rate, etc. Cloud computing system needs to satisfy the needs of a lot of students parallelly. Thus, it needs to have an in-depth study on the storage technology which has high throughput rate and high transfer rate.

##### 4.2 Application Virtualization Technology

Application virtualization technology is used to provide multi-users the remote access of centralized application of resources, which is used as a kind of service to deliver to the users. It can separate the matured application of calculation logic and display logic, namely the interface abstraction, and it needs not the clients to install software. The user accesses application virtualization with the user's human-computer interaction data delivering to the server, the server will open independent session to run the application logic, and the the realistic logic transfer will be transferred to the user, thus the user can enjoy the in the application just like in the local. Application virtualization basically has two ways: desktop virtualization and software virtualization. This paper is mainly to the study the desktop virtualization and Web server virtualization, so as to achieve the application virtualization of softwares in different training centers, and apply different technologies in different training softwares.

##### (1) Unified Interface Authentication of the Front End Interface

In the cloud deployment process, it focuses on the software virtualization application. The application software within the license authorized is installed as legal or original. The unified the authentication of license problem of both application software as the sever and multiple software applications will restrict the operation of project.

How to implement all users' practical teaching service in the unified authentication is the key technology of the platform.

##### (2) Stratified Quarantine Service based on the User Permission

When the cloud computing data center provide virtual storage and virtual computing service to the students, teachers, management personnel, it faces different levels of users, including the software application level, teaching management level and comprehensive management level. Different levels of users have different access permissions, and overlap can't appear in the data storage and calculation.

Based on the one-way pointer hierarchical user isolation method, this paper matches the "layer" the user can access to the user permissions. The upper nodes users can get the pointer of lower nodes users, and lower nodes user is not allowed to reverse access the upper nodes. Without authorization the nodes in the same layer cannot visit each other, thus to effectively guarantee the data separation for different user permissions.

#### 5. CASE STUDY OF THE PLATFORM

The Interdisciplinary Practical Teaching Platform under Cloud Environment is tested in the two practical teaching centers in the Economics and Management Department. Half a year passed, it has achieved the desired effect: substantially reduce the hardware and software's management and maintenance cost; reduce the repeated construction, and eliminate the information island; improve the sharing of resources, and achieve the resources "on-demand distribution", thus improve the utilization rate of the training rooms; it is convenient for the dispatching of teachers, training bases, and the resources, thus optimize the whole process of practical teaching. The practice effect is shown in table 1.

#### 6. CONCLUSION

This paper introduces the Interdisciplinary Practical Teaching Platform under Cloud Environment from education cloud support system, private cloud of training base, private cloud of software, that is service, and education cloud deployment implementation. It is a rare opportunity as well as a challenge for the arrival of cloud computing to the information construction of higher vocational colleges. By implementing the cloud computing technology, the public cloud of education resources can be established, thus it can provide the corresponding cloud services, and promote the resources integration process among different departments and different majors. Finally, it can meet the needs of Interdisciplinary Practical Teaching of schools. The Interdisciplinary Practical Teaching Platform under Cloud Environment can achieve the sharing of teaching resources, and



realize the use of network space to be "everyone passes, always passes". Meanwhile, it realizes the resources "on-demand distribution" among different professional teachers and students, thus it lays a

solid foundation to explore the Interdisciplinary Practical Teaching modes in higher vocational colleges.

Table 1 Comparative Table of the Interdisciplinary Practical Teaching Platform under Cloud Environment

Subject	Column	Before the Construction of Platform	After the Construction of Platform
practical teaching bases	the number of beneficial department	2	6
	the number of deployed practical teaching bases	48	48
	utilization rate of computer rooms	80%	150%
	the number of supported teaching courses	20	35
	the number of repeated software buying	3 sets	0 set
students	the number of beneficial students	3000	8000
	study time per day of supported students	8 hours	24 hours
	study bases of supported students	Practical teaching bases	anywhere in the campus
	degree of students' satisfaction	60%	90.3%
	supportive degree of Interdisciplinary talents culture	25%	95.5%
teachers	supportive time for after-class assistance	8 hours	24hours
	supportive degree of student-teacher interaction	40.3%	95.6%
	degree of teachers' satisfaction	62%	90.1%
Management personnel	supportive degree of unified management	10.0%	96.4%
	corresponding rate of management	70.2%	95.3%

**ACKNOWLEDGMENT**

This work is supported in part by Zhejiang Science and Technology Program No. 2010C13005.

**REFERENCES**

[1] Gob le, C. & Bechhofer, S. ( 2005) . On to G rid: A Semantic G rid Reference Architecture. CT Watch Quarterly, Volum e 1, Numb er 4, November 2005.

[2] Li Xiaofeng. Sharing Platform Construction of High-quality Curriculum in Wuhan University [J].China Education Information,2008(15).  
 [3] IBM. Google and IBM announced university initiative to address internet scale computing challenges [EB /OL]. ( 2007-10-08) [2008-10-15] . <http://www-03.ibm.com/press/us/en/pressrelease/22414.wss>  
 [4] Dong Yaozu, Zhou Zhengwei. X86-based System Virtual Machine Development and Application [J]. Computer Engineering, 2006, 32(13): 71-73.





- [5] Wood T. Black-box and Gray-box Strategies for Virtual Machine Migration[C]//Proceedings of the 4th Int'l Conference on Networked Systems Design & Implementation. [S. l.]: IEEE Press,2007.
- [6] Liu Pengcheng, Yang Ziyi, Song Xiang, et al. Heterogeneous Live Migration of Virtual Machines[C]//Proc. of the Int'l Workshop on Virtualization Technology. Beijing, China: [s. n.], 2008.
- [7] Yang Zhihe. Research on Ontology and Technical Specification of Educational Resource Cloud Services [D]. East China Normal University. 2012
- [8] Xu Qi. On Online Teaching Service Platform for Autonomous Learning. China Education Information,2011(3)
- [9] Luo Junzhou, Jin Jiahui, Song Aibo, Dong Fang. cloud computing: Framework and Key Technology[J]. Telecommunication Journal,2011(7)
- [10] Schubert L.The future of cloud computing:Opportuntie for european cloud computing beyond. <http://cordis.europa.eu/fp7/ict/ssai/docs/cloudreport-final.pdf> . 2010.