Design and Implementation of Cloud Classroom

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Abstract
The Open University of China (OUC) is a new kind of higher education institution that offers open and distance education using modern information technology. OUC will depend on the Cloud Platform on Distance Education to provide degree and non-degree continuing education, and the Cloud Classroom was an important part of terminal system which can connect to the Cloud Platform on Distance Education.

The core idea of the cloud-classroom is interaction and sharing. The Cloud Classroom was the learning environment, which based on the digital equipment, take the high-quality educational resources transmission for the target, take the dynamic feedback as the feature, and provide resources and service for learners. Through the interconnection of the cloud-classrooms, the interconnection of branch campuses will be complete, and it will achieve the interconnection between people.

This paper talks about the definition, theoretical foundation, functional analysis, and technical architecture of cloud-classroom. Then, the authors take some good examples about how to teach by the cloud-classroom, take some research on the application mode of cloud-classroom, and explain the important influence of cloud-classroom for the Open University of China.

Introduction
More and more educational institutions are using educational technologies and online learning materials to help students achieve satisfactory learning effects. However, there is a university has done this job for more than thirty years in China, and its name is "the Open University of China", which was established in 1979 under the Deng Xiaoping's instructions.

The Open University of China (OUC), which is directly administered by China's Ministry of Education, is a new kind of higher education institution that offers open and distance education using information technology. The OUC is dedicated to both degree and non-degree continuing education, and it boasts an educational network spanning multiple industries, provinces (cities) and regions. The educational network covers both urban and rural areas, and includes headquarters, branches, colleges and
learning centers. The university network operates in accordance with the principles of “unified strategy, common platform, resource sharing, relative independence, decentralized development and distinctive characteristics”. At present, 3.59 million students (1.09 million undergraduate students, 2.5 million associate degree students) are actively enrolled, including 200,000 farmers, 100,000 military personnel and more than 6,000 disabled students. Meanwhile, it has more than 100 thousand teachers all over the country, and they live in different provinces and different cities, in the service at different levels schools, such as branches, colleges and learning centers.

The university always teaches by the support of informational technology. At first, it teaches with television and radio, to broadcast the learning materials and resource to students. The OUCI carries out distance educational activities using an integration of three networks, including a satellite TV network, computer network, and people's network. This integration has become a prominent feature and strength of the open education in China. In recent years, with the rapid development of technology, the university begins to use the cloud computing technology and video conferencing to build more personalized, and more practical learning environment to promote the learning. Teaching methods improved by the technological change. So, in the future, OUC will depend on the Cloud Platform on Distance Education (CPDE) to provide degree and non-degree continuing education. The OUC will take the construction of CPDE as a starting point and the CPDE will be the important support for learning environment. The CPDE will offer the learning environment including teaching, learning, administration, services and researching, and multi-terminal access environment including cloud-classroom, mobile phone, cloud TV and cloud office. Among them, the cloud-classroom was an important terminal to connect to the CPDE.

What is the cloud-classroom of OUC

The concept of cloud-classrooms emerges in china at 2012. At first, the cloud-classroom indicated the computer classroom which constructed by cloud computing, just like desktop cloud. Then, the implication change, it was used in the other kind of classroom, which can link together with video conference technology and can support massive distance education activities in real-time. At this class, the students can participate in the lesson by real classroom, PC, PAD and mobile phone.

Face-to-face teaching is one part of the OUC teaching mode. Nowadays, classroom is not confined to a fixed location. It can be physical classroom or online learning space. The project, started last year, was in the construction of the first phase. Interworking, interconnection, interaction, and other field will be take more attention on.

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students can participate in the lesson by real classroom, PC, PAD and mobile phone.

The project, started last year, was in the construction of the first phase. Interworking, interconnection, interaction, and other fields will be given more attention. At present, the cloud-classroom is an educational system supported by cloud computing, and it includes real classroom and virtual classroom. The real classroom was built in branches, colleges and learning centers of OUC. The virtual classroom is supported by cloud-classroom platform, and students and teachers can visit by PC, PAD and mobile phone. The cloud-classroom system was built by the headquarters of OUC, which follows the principle of unified standards, common platform, multi-stage deployment, hierarchical management.

The core idea of the cloud-classroom is interaction and sharing, and the cloud-classroom was learning environment, which based on the digital equipment, take the high-quality educational resources transmission for the target, take the dynamic feedback as the feature, and provide resources and service for learners. Through the interconnection of the cloud-classrooms, we will complete the interconnection of branch campuses, and achieve the interconnection between people.

This paper will focus on the cloud-classroom's definition, theoretical foundation, function, technical architecture, application mode and other aspects. We had built the cloud-classrooms in the learning center, and cloud-classrooms across the country will be connected into a whole. Through the interconnection of the cloud-classrooms, we will complete the interconnection of branch campus, in order to achieve the interconnection between people.

How to design the cloud-classroom

Application Requirements

The distance education needs large-scale network broadcast teaching. In OUC, there may be thousands of students need to attend class in same course and same profession. The original techniques cannot support so many teachers while giving students real-time instruction.

The teaching and learning need distance interaction. Interaction is an important aspect of teaching, but also an integral part of the learning process. Even in distance learning, interaction was also the main instructional way that exchange opinions, promote learning, and mutual influence between teachers and students.

The teacher team need distance discussion. The campus covers all the country, so the teacher teams across the country. They need
as often as regular to exchange views and experiences, to work together in the same course, which requires a collaboration system to support teacher team in teaching and research.

**Design principles**

**Advanced**

The system must advance with the times, and use the advanced technology, and allow different terminals to visit. The new technology will bring new ideas and new ways of thinking, will bring innovative application mode. Application of new technologies will have more possibilities in teaching.

**Practicality**

The core main points of system design is practicality, and will focus on the convenient, easy operation, fast response and other practical principles. Without the practicality, the educational technology show harm without a profit. Therefore, the system either from the physical space or from the virtual space, it is practical to focus.

**Stability**

Stability is the basis of applications. Without a stable system cannot have a good application, so in the process of design the system, the sophisticated technology should been used in order to support the stability of the system. Here, the author thinks that after years of development, video conferencing and virtual computing technology is relatively mature.

**Function design**

The cloud-classroom of OUC should support a variety of network and meet the conditions of teaching, conferences, and other educational services to carry out the examination. It has online face-to-face teaching, remote teaching, course recording and broadcasting, webcast teaching, video conferencing, examination monitoring and other functions. Specific information as follows.

(1) **Real-time remote teaching**

The cloud-classroom can teaching for different places across the country, the teacher can complete the teaching face to face with students, the students can receive the teaching and interactive questions in different classroom while participating in a classroom and be able to interact live with the teacher at any time, you can also with PAD, mobile phone or Web client to achieve at home remote broadcast learning complete line of high quality classroom and western classroom docking to achieve quality resource sharing.
(2) Recording and broadcasting courses
The cloud-classroom can record all the courses which lesson in it. And the courses will be automatically stored in the cloud and also can be broadcasting to all the students, who can receive the course at home, at office or at bus. The recording and broadcasting system will be interconnected with the learning platform via an interface, so the resources been presented on the learning platform. The good teacher can teaching for all the students across the country, and the knowledge spread throughout with the cloud-classroom.

(3) Remote classroom observation and teaching seminars
The teachers, living in different places, can observe and learn class with companion, and also they can take teaching seminars. The experts can achieve remote lectures, observation and evaluation, guidance, and promote the development of backward areas faculty.

(4) Remote interview and respondent
The students and teachers can remote interview and respondent in different cities by the cloud-classroom. The system support us to recording the interview process, to analysis the interview activities, questions and interactive.
(5) **High-definition Video Conference**

Our teachers are across the country, they work and living in different provinces, different cities, but they have the same students, although who are also come from all the country. So the teachers, offsite teams, can collective lesson planning, discuss and exchanges in the cloud-classroom with high-definition video conference. The cloud-classroom are all around the country, it can support the remote interaction with seminar teaching team or research team to support the national coordination of the teaching, the work will be more effectively and more efficiency.

**How to build the cloud-classroom**

**System architecture**

The cloud-classroom is a system, which has four or more levels, just like the university organizational structure. The cloud-classroom construction project consists of two parts. The part one is the construction of cloud-classroom terminal, the part two is construction of control management system. The terminals were flattening organization, and there were four levels including headquarters, branches, colleges and learning centers. Every level has the cloud-classroom, and they are interconnected and interworking can interactive each other. The control management system is two-story structure, namely the control center, and respectively in the headquarters and branches, where have better and more technical personnel to operation and maintenance the system. This is a classroom network, and the system will centralize management, unified maintenance, interoperability and content sharing.

At every level, there is a cloud-classroom. The cloud-classrooms are interconnection and interworking. And, two level control centers also are built, at headquarters and branches, where have better and more technical personnel to operation and maintenance the system. This is a classroom network. The system will centralize management, unified maintenance, interoperability and content sharing.

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The construction of cloud-classroom terminal, the part two is construction of control management system. The terminals were flattening organization, and there were four levels including headquarters, branches, colleges and learning centers. Every level has the cloud-classroom, and they can interact with each other. The control management system is two-story structure, namely the control center, and respectively in the headquarters and branch.

All the cloud-classroom are open for the world, when teachers take lesson in one, all the other classrooms can receive the lesson if they are willing to, and they can interact with each other by some cloud-classroom, mobile phone, PAD or PC. The students will take the same lesson with one whom from his a million miles. The System architecture diagram as follows.

Collaboration Construction

The construction of cloud-classroom is a systematic project, and we take a condominium model between headquarters and its branches. As headquarters, it was the center, and it's primarily responsibility was design, equipment procurement, installation and deployment, and so on. But the other branches and learning centers should according to the unified planning and design, to prepare and complete the classroom environment, decoration style, decoration materials, lighting, temperature and humidity, network, desks and chairs, indoor culture, etc. They clear division of labor and work together.

The modern information technology as a link from the headquarters to learning center relying on high-speed internet. The cloud-classroom has interoperability, and we should explore new teaching application mode based on cloud-classroom, promote educational model and change management model to enhance the capacity of information technology application in teaching institutions of distance education, improve the personnel training quality of Open University of China.
The cloud-classroom is the extension and effective expansion of the CPDE. It was build based on the physical learning centers which cover all over the country, and it combined online learning and offline face-to-face service perfectly. The first batch of 63 real cloud-classrooms have been constructed in the western region of China last year, such as Guangxi province, Xinjiang province, Tibet province etc..., and the real cloud-classrooms cover seven provincial cities and more than 40 municipal cities, which form the open and virtual university system all over the country.

At Present, the planning of cloud-classroom has been included in the Main Points of Education Informatization Construction in 2014, which is public by the Chinese Ministry of Education Ministry of China. This year, the other fourteen provinces will be cover, and more than two hundred cloud-classrooms will be constructing. So, the construction and research about the cloud-classroom will continue in the future.

The application of cloud-classroom

The cloud-classroom focuses on the real-time and original class. The system can live and recorded the class exactly including the details of teachers and students from beginning to end, and highlight the class original, and keep the lesson flow. The cloud-classroom system can maintain uninterrupted classroom environment, protect the basic elements of the teaching process, the basic elements of the same premise, the use of technology as speaker teachers to create classroom situation, as much as possible to reproduce the classroom teaching process, naturally "generate" audio-visual materials. Such a "generation" of audiovisual material if better reproduces the classroom teaching process; it may replace classroom-face to some extent.

After a period of deployment, the first batch of cloud-classrooms was complete and come into service, each branch actively explore the application mode, especially Xinjiang and Guangxi Branches. They summed up the experience and methods in the cloud-classroom applications.

The cloud-classroom of OUC is mainly used in video conferencing, teaching and training in academic and non-academic education. The cloud-classroom system can implement regional team preparation seminars, interactive learning students across regions, the remote classroom across time and space, real-time programs broadcast nationwide coverage, remote test monitoring, real-time live training seminars, and remote online real-time Q & A, and so on.

To teach based on the curriculum and teachers' voice

To teach based on the curriculum and teachers' voice, and students take more attention
on learning content and teachers’ lecture. The following figure shows one of two types.

Figure 5 the case of teach based on the curriculum and teachers’ voice

To teach with live video and courseware

To teach with the live video instruction and courseware, this splits the screen in proportion. The courseware can be displayed on a computer or mobile terminal. As shown in figure.

Figure 6 the case of teach with live video and courseware from Xinjiang province

To use the tablet PC operate display screen

Teachers and students can use iPad PAD to operate the smart machine, you can be your own 65-inch screen cast onto the smart machine, and the PAD also can be the remote cloud- classroom equipment, it can manage up to 128 devices, 1-4 device screens can be displayed simultaneously on one screen for multi-communication and interaction.

Figure 7 the case of using the tablet PC operate display screen
To use phones and other mobile device to participate in the real-time and two-way video interaction.

The system can support the mobile terminals, which under Wi-Fi, 3G or 4G signals, and the cloud-classroom to video and audio interactive two-way and real-time.

Figure 8 the case of use phones to take the two-way video interaction in Desert Highway.

In addition to exploring the application model, to take full advantage of cloud classrooms, a cloud-classroom reservation system also was been developed, the individuals and organizations can register themselves, using the principle of priority of whoever registered, to avoid human disturbance factors and improve the efficiency.
Summary

Through the cloud-classroom, the high quality teaching resources from headquarter can be spread to the western regions and remote areas, the classes from remote areas can synchronize with the cities. The cloud-classroom can connect each other, and can connect the students in rural areas and students from city. The implementation of the project effectively integrate the learning resources from "satellite TV network, computer network, and people's network", construct the digital learning environment which support multi-terminal and cross regional collaborative, ensure the quality of teaching resources in wider range sharing and application, improve the quality of distance teaching scale, and promote the online education reform.

The cloud-classroom project is a system as constantly updated as technology advances. At present, the research and application has just started, more attention, more time and more work will be put on development of technology integration, the teaching process and application experience in the future.

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