College computer course reform using a cloud environment based on the MOOC mode

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ABSTRACT: The aim of this study was to examine the problems that arise from traditional university computer teaching, and to analyse the use of the massive open online course (MOOC) system by which to reform university computer teaching. Therefore, a new computer classroom teaching model has been proposed, together with a strategy for computer course teaching reform. This type of reform would use a cloud teaching environment suitable for the use of the MOOC mode.

INTRODUCTION

The information society requires the enhancement of computer knowledge and the ability of college students to apply that knowledge. The teaching of university basic computer courses designed for students of non-computer majors are in need of innovative reform. Nowadays, computers are one of the three major means of promoting the progress of human civilisation, the other two being science and technology. Hence, computer skills form an important part of college students' development [1].

Therefore, university computer courses should not only focus on training students in computer knowledge and skills, but cultivate students' ability to use computers to solve problems. A basic computer course should foster a student's awareness of computing just as mathematics and physics education fosters awareness of those disciplines.

In considering computing as being important to society, building a new teaching mode for computing has become a primary task in today's teaching reforms at colleges and universities. Recently, a new large scale network-based education learning mode, that is massive open online course (MOOC), has introduced a new method of on-line education, which has caused great interest in higher education [2][3].

Increasingly, colleges and universities will introduce MOOC into their teaching to reform their curricula and improve the quality of their teaching. The college computer course in the MOOC era changes the nature of the teaching for the students. The combination of MOOC and classroom teaching brings a new opportunity for deeper changes and reform of college computer teaching.

TRADITIONAL TEACHING AND MOOC

Traditional teaching is still the main mode of teaching at universities. In this mode, the teacher prepares course material and delivers the contents to students in lectures. Students also complete set after-school exercises. Students then take a final examination, the results of which are the main indicator of a student's learning and is the mainstay of the assessment of the student. This *teacher-focused* teaching is the traditional form and is still the main mode of teaching within many universities in China.

The national policy that encourages the colleges to broaden horizons has made many teachers realise the many disadvantages of the traditional teaching mode, e.g. old teaching content and a single teaching method. By comparison with MOOC, most class hours of a computer course can involve practical teaching. This creates favourable conditions for students by which to internalise computer knowledge and develop computer abilities.

The practical teaching content design should encourage students' innovative thinking. In problem-solving there should be an emphasis on the diversity of ways by which to solve a problem. Diverse problem-solving leading to various constructions so as to solve a problem is a great stimulus to students' thought processes.

Classroom teaching should focus on providing rich, multi-level practical training and guidance beyond the basic knowledge. Using MOOC, the organisation of classroom teaching can break down the boundaries between theory and practice and can make for a harmonious whole. The teaching place can be the practical classroom, in which teachers and students teach and learn together.

Curriculum Defined by MOOC

The curriculum is defined by MOOC. Therefore, the classroom teaching can be *student- and learning-focused*. The role of a teacher is as a *leader* who guides and controls, with an emphasis on interactive teaching. The teaching is based on problems, with students being encouraged to discuss and ask questions in solving problems. The use of a MOOC to provide teaching content lets teachers devote more time to students. The MOOC gives students the basic foundation of knowledge by which to ask questions in class and to explore the answers.

In terms of the interaction between students, teachers can better guide students in groups to co-operate to form a collective whose diversity benefits the development of each team member. As part of a deeper interaction, teachers need to provide tools by which to resolve problems of teamwork strategy and to correct student errors while, at the same time, paying attention to individual differences. This kind of teaching encourages the active participation of students. It makes students take the initiative for their learning through co-operative collaboration and practice, i.e. to *do* rather than the previous model of *hear* or *see*.

MOOC HYBRID TEACHING

The core value of a college computer course is to cultivate students' computational thinking ability. A consensus has been reached that university computer teaching reform should be guided by the need to instill computational thinking [4]. However, turning this consensus into practice requires much hard work so as to develop a complete new system.

Most current university computer teaching places the teacher at the centre, with the teacher determining what and when to teach. Teachers focus on describing the computer and its applications. There is particular stress on knowledge acquisition, with students being the passive recipients of knowledge. This method of study consists of *compliance, memorisation and imitation*. Such teaching is not good for students' development. In an ideal teaching mode, students and teachers would have a high degree of interaction and collaboration.

In traditional face-to-face teaching, although teachers and students are interacting, priority is given to the teacher's unilateral instilling of knowledge. This leads to long-term bad study habits for students. It is hard to motivate them; if there is insufficient preparation before a class, the lack of two-way interaction with teachers makes it hard to mitigate the effect. However, with MOOC, teachers can ask students to watch the MOOC teaching video and PowerPoint courseware as preparation before a class.

In teaching using the MOOC hybrid model, teachers ask questions to check whether students previewed the work before class, and include the questioning in performance appraisals to ensure students do preview the work. Teachers can promote students' learning through methods, such as active discussions and autonomous learning, as well as by guiding them to address problems encountered during preparation. This converts the one-way knowledge transfer into a targeted teaching process. The combination of on-line MOOC-based learning and classroom teaching can achieve the ideal of highly interactive teaching. A basic course is particularly well suited for this kind of teaching, since the introductory nature of the course makes it of moderate difficulty and students can learn by preview before class [5].

Mode of Thinking and Methods to Solve Computer Problems

Computational thinking is not only about computer principles, but reflects a mode of thinking and methods needed to solve computer problems. This lays a solid foundation for developing innovative applications for computers. It is easy for students to master basic computer knowledge, but it takes much time and training to develop the ability to effectively apply this knowledge. This requires computational thinking. Reformed university computer courses should teach students to not only have conceptual knowledge, but also the ability to apply that knowledge [6]. Therefore, the challenge of computer teaching reforms is to infuse this new way of thinking as an outcome of the reformed course. The reforms will cover teaching content and teaching methods, as well as introduce innovative teaching practices.

There are also two external factors that negatively influence college computer teaching. First is the compressed classroom time for practical work. The course has theoretical content, which involves a wide range of knowledge. The common practice is to spend most of the teaching time on theory and just a few hours on practical classes. This lack of practical learning makes it hard for students to digest the theoretical knowledge.

The second problem is the different level of knowledge of computers among students. University computer teaching has been faced with the problem that some students are quite knowledgeable about computers while others are quite naïve. This brings difficulty in the organisation of classroom teaching.

The greater need for computational thinking in a reformed course will make the effect of these individual differences more obvious. Classroom teaching, in the traditional way, requires that students have a roughly equivalent amount of computer knowledge in advance. The MOOC can provide a solution to the problem caused by individual differences. The MOOC-oriented new teaching mode is shown in Figure 1.

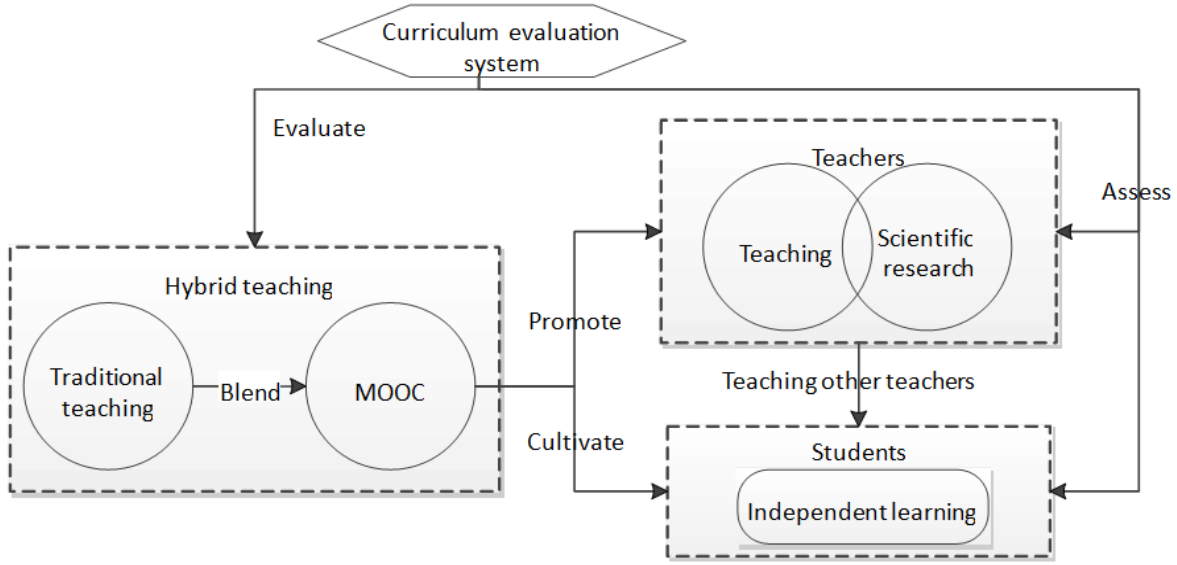

Figure 1: MOOC-oriented teaching framework.

CLOUD-BASED FRAMEWORK FOR MOOC

The teaching process for the massive open online course uses *group co-operation* with resources *accessed using seamless connections*. This has solved the various problems in the traditional teaching mode, and has played an important role in promoting this new idea in open education [7].

A cloud teaching environment represents a new technology by which to support the development of education in the information age. Cloud computing and multimedia technology provide a more extensive virtual space for the sharing of educational resources, and strong technical support for the sustainable development of MOOC. A cloud framework suitable for teaching MOOC is shown in Figure 2.

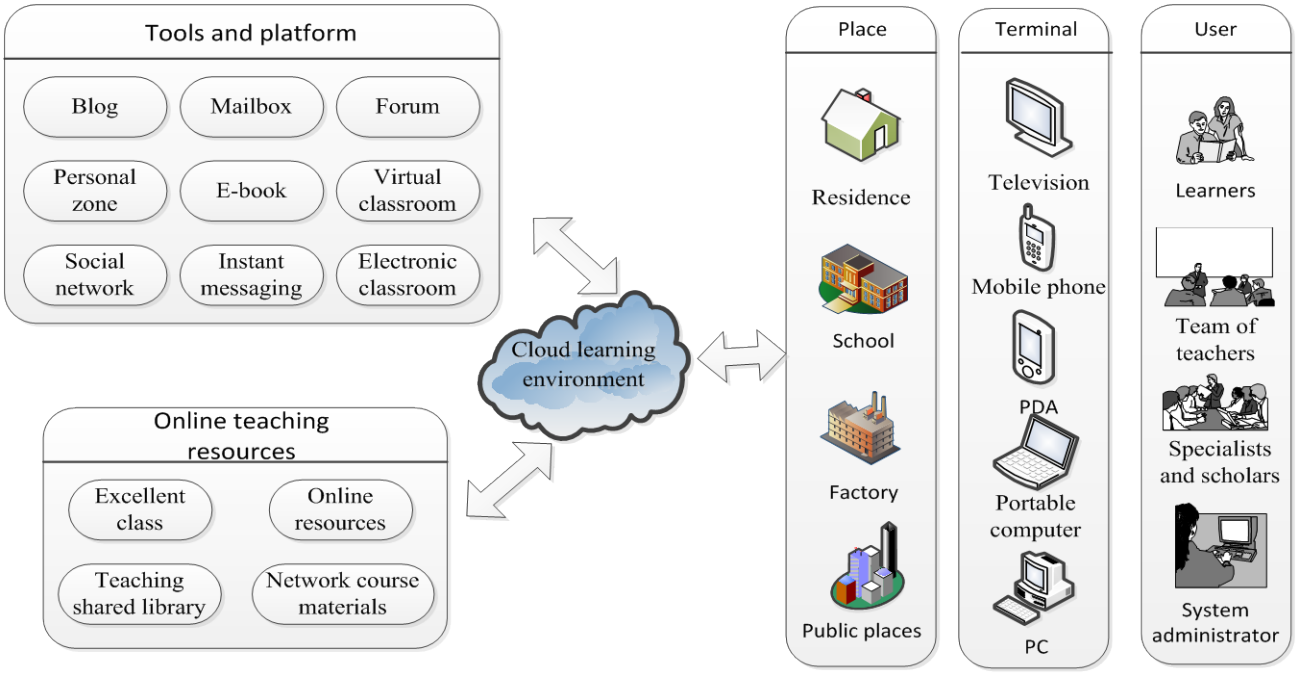

Figure 2: Cloud framework suitable for MOOC.

A cloud teaching environment provides a learning resource, teaching platform and tools for a MOOC. This reduces the cost of mass storage, management and teaching resources, but also provides the adapter services for different environments, access modes and terminals. In a cloud teaching environment, each user could be a learner, a teaching resource provider or course organiser. This conforms to the original intention of advocates of the open-learning community for MOOC.

The cloud teaching environment platform can support most participants' learning modes and characteristics. Teaching tools include the commonly used virtual classroom and learning space, Web sites, blogs, e-mail, electronic libraries and bulletin board systems (BBS). Cloud computing and mobile computing technology enable MOOC to support formal, informal, hybrid, and mobile learning modes and interaction.

In a MOOC, learners, teachers, organisers and expert teams conduct their daily study, work, management and other activities in the network environment. With support provided from a variety of locations and access terminals, MOOC can provide a more personalised service and break the constraints of time and space. This enables learners to learn at their own pace, while facilitating communication between teachers and students; it allows real-time interaction between participants and the sharing of teaching resources.

With an appropriately designed curriculum and technical teaching platform, MOOC can optimise teaching. Table 1 introduces a course design for a cloud teaching environment with a computer animation design course as an example.

Table 1: Course design suitable for the MOOC mode.

Teaching procedure	Teacher	Learners	Cloud environment tools
Preparation	Personal preparation Collective preparation	None	Preparation tools Video conference software Animated repository
Before class	Curriculum description Data transmission Arrangement of the content	Received data Teacher-student interaction	Community software Animated repository Virtual classroom
In the class	Curriculum interaction Distance education Electronic attendance	User login Distance education Course	Virtual classroom Instant messaging software Electronic library
After class	Correction of homework Curriculum feedback Task management	Submit job Teacher-student interaction	Community software Electronic library
After school	Experience sharing Expand knowledge	Independent study Interactive communication	Instant messaging software Community software E-mail
Evaluation	Homework results Examination results	Examination Certificate	Instructional management system

As can be seen from Table 1, each procedure in the cloud teaching environment is achieved through the use of network multimedia technology [8]. Students and teacher simulate course teaching according to the predefined curriculum content, which achieves the same teaching outcomes as for a non-online course. Finally, cloud resources enable rich expressive content to be added to a course, which can improve the learners' enthusiasm and engagement with the course.

CONCLUSIONS

Supported by the massive open online course mode, the new university computer classroom teaching method is to be *student-focused* and *learning-focused*. The result of this is to develop students' abilities in using computer applications and to exercise computational thinking as a way to solve problems. This constitutes a substantial extension of traditional teaching methods.

Such teaching meets the requirement of education in developing innovative abilities and fostering lifelong learning. On-line education represented by MOOC still needs further research and development, but it already has a positive role in promoting higher education reform.

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