Object Oriented Concept Based Cloud Smart Education System

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Abstract. The aims of education evolve along with the development and change of the human society. However, the effectiveness of education is an ever-las ting topic in educations domain. Because of the difference and diversity between education, traditional methods, technology, and idea cannot guarantee the education effectiveness. Smart education, the top end of ICT in education, has received increasing attention globally. Education object oriented concept provides a possible way to match the diversity of individual needs in smart education. Cloud computing technology also offers the infrastructure for the realization of smart education.

Introduction

In recent years, the development of new technology especially the ICT (Information Communication Technology) accelerates the updating of education methods, education environments, and education ideas.

According to [1], early attempts of using technology in education can be traced back to 1924, with the Pressey Testing Machine, and Skinner’s Teaching Machine in 1954. However, the high cost prevents their ubiquitous uptake as an educational tool. During the last years, with the development of information technology and personal computer, Computer Assisted Instruction (CAI) and Computer-based training (CBI) began to emerge [2,3]. Following this, the rapid development of Internet provides new possibility for people to obtain useful information via the Internet. Websites were becoming commonly used to facilitate distance learning and learning management systems. Consequently, E-learning, a fast and effective way to spread knowledge to learners in different parts of the world, entered people's vision. According to [4], "E-learning uses the Internet or other digital content for learning and teaching activities, which takes full advantage of modern educational technology provided with a new mechanism of communication and resource rich learning environment to achieve a new way of learning". During the era of Web 2.0, Internet brought convenience to instructors and administrators of E-learning platforms based on the interactivity. However, some drawbacks of the traditional web-based E-learning mode cannot be ignored. According to [4], system constructions and maintenance need a lot of investment. Other problems such as dealing with dynamic demands on getting information and knowledge anywhere and anytime, handling rapid storage growth requirements, cost controlling, greater flexibility, and lack of personalization have to be faced and solved[5][6].

Web 3.0 may be a good selection for the future E-learning system. This new environment supports the creation of a new generation of applications that are able to run on a wide range of hardware devices, like mobile phones or PDAs, while storing their data inside the cloud [7]. Cloud computing, a natural evolution of grid and utility computing, has become a major point of interest in many fields, with its potential for providing enhanced service environments along with the advantages of scalability, flexibility, accessibility, reliability, and high performance while reducing IT-related operating costs [8][9]. It is no doubt that the cloud computing also attracted much attention in the field of education with its potential for delivering economical, securable, reliable, and sharable education services [10].

The remainder of this paper is organized as follows. Section 2 describes the definition and characteristics of object oriented and cloud computing. Section 3 presents the proposed smart
education system based on cloud computing. Finally, section 4 summarizes the paper and outlines research directions for future works.

Object Oriented Concept and Cloud Computing

In this section, the definition and characteristics of object oriented and cloud computing will be introduced. Also the application of object oriented concept in education will also be proposed and explained.

Object Oriented Concept

The term Object Oriented is commonly used in programming area as opposed to the procedure-based program.

Procedure-based programming focuses on how to accomplish a task. As a result, a program can be seen as a collection of functions, or simply as a list of instructions to the computer. The programmer has to determine and control the consequence in which the computer processes the instructions.

However, as the hardware and software became increasingly complex, the problem of software quality maintenance has to be considered. Furthermore, some certain types of problems might better be visualized as interacting objects or as interrelated words, concepts, and ideas.

Object oriented programming (OOP) in part addresses this problem by strongly emphasizing modularity in software. OOP is an approach to formulate program as a series of objects and methods that interact to perform a specific task [11] [12]. In OOP, each object is capable of receive messages, processing data, and sending messages to other objects. Each object can be seen as an independent little machine with a distinct role or responsibility. OOP is intend to promote greater flexibility and maintainability in programming, and is widely popular in large-scale software engineering.

As described previous, OOP was proposed to solve the software crisis during the complex software era. Inspired by the OOP concept, object oriented education (OOE) mechanism is proposed. As far as we know, this is the first time that the concept of object oriented was used in education area.

Unlike the procedure-based programming, OOP is cognitively similar to the way human beings perceive the real world [13]. Using the object-oriented approach, programmers may be able to visualize the solutions to problems more easily. The same way, the OOE is expected to achieve good results.

In this new OOE system, the learner is treated as a "CLASS" with the equivalent level of education provider. Then the process of learning or communication can be considered as the messages sending between different objects.

Cloud Computing and Its Characteristics

In recently years, cloud computing, a new style of computing, has attracted a great deal of interest from different fields. Cloud computing provides enhanced service environments along with the advantages of scalability, flexibility, accessibility, reliability, and high performance while reducing IT-related operating costs [14][15].

However, the main idea behind cloud computing is not a new one. In the 1960s, John McCarthy already predicted that computing facilities will be provided to the general public like a utility [16]. The term cloud has also been used in various fields several decades ago. Cloud computing was first mentioned by Christophe Bisciglia at Google in 2006, though more attention was paid to it after Google launched “Google Apps” in 2007, and it really started to gain popularity still after Apple launched iCloud in 2011 [17].

According to the National Institute of Standards and Technology (NIST), cloud computing has five essential characteristics, four deployment models, and three service models [18]. On-demand self-service, rapid elasticity, measured service, broad network access, and resource pooling are five essential characteristics. A deployment model defines the purpose of the cloud and the nature of how the cloud is located, public, private, community and hybrid cloud are four deployment models. In the deployment model, different cloud types are an expression of the manner in which infrastructure is
deployed. Three service types including Infrastructure as a Service (IaaS), Platform as Service (PaaS), and Software as a Service (SaaS) have been universally accepted.

Because of the above mentioned advantages, cloud computing has attracted a great deal of interest in the field of education. As one of the new technology trends, cloud computing likely has a significant influence on the teaching and learning environment.

**Cloud Computing Based Smart Education System**

As mentioned above, cloud computing has some advantages that may overcome the problems in conventional E-learning environment. More and more universities are leveraging cloud computing for economic reasons as well as for more advanced teaching, instruction, and data sharing. Based on the investigation of education cloud in different educational institutions, a smart education system including smart teaching, smart learning, smart management, smart evaluation, and smart service is proposed.

**System Function and Architecture Analysis**

In the "Internet +" environment, education informationization focuses on teaching by using modern technology to provide strong assistance. On the one hand, the modern technology is expected to enhance efficiency of teachers engaged in regular teaching activities. In the meantime, it is also expected to improve student learning outcomes.

How to improve the quality of teaching is the eternal topic of higher education. To improve the quality of teaching, the various factors influencing the teaching quality have to be analyzed. For example, examination is the key link to check teaching quality. Hence, using which method and how to manage fair, efficient, high quality examination is need to study. In addition, big data technology also provides an effective way to evaluate the status of students and makes it possible to provide personalized learning resources. Furthermore, mobile terminal App is essential for learners to study anytime, anywhere, anyway, and any pace.

**Overview of the Proposed System**

Through the above analysis, the proposed smart education system includes the following sub-systems: intelligent test subsystem, teaching quantity evolution subsystem, intelligent resources recommendation system, learning communities App based on social networks, personalized learning resources push App, and interactive real time evaluation App. Overall architecture of the system is shown in Figure 1.

![Overall architecture of the smart education system](image)

**Functions of Subsystems**

- **Intelligent exam system.** Effective network test management including examination registration, examination monitor, examination paper status check, test affair management, user management.
**Teaching quantity evolution subsystem.** Evaluation the effect of the proposed system including student assessment, teaching element evaluation, peer evaluation, self evaluation, evaluation management, personal information management.

**Overall architecture and intelligent resources recommendation subsystem.** Is the base of the system and provide authority management, resources management, and data support for all sub systems. Including authority management, Web teaching resources crawling, teaching resource management, resource recommendation, database access interface.

**Learning communities App based on social networks.** Community resource management, group chat, single chat, user management, and other functions.

**Personalized learning resources push App.** online courses browsing, discussion, online notes course collections, advice collection and other services.

**Interactive real-time evaluation App.** ask questions, answer questions, answer test, personal information management, and test paper management.

Figure 2 presents the interactive model of the proposed system.

![Interactive mode of the proposed system](image)

**Conclusion and Future work**

In order to overcome problems of the conventional education forms, a cloud computing based smart education system is proposed. The proposed system combines the concept of object oriented and the advantages of scalability, flexibility, accessibility, reliability, and high performance of cloud computing. The system includes several sub-systems such as intelligent test subsystem, teaching quantity evolution subsystem, intelligent resources recommendation system, learning communities App based on social networks, personalized learning resources push App, and interactive real time evaluation App. The new system has been deployed and is expected to improve the effectiveness and efficiency of the teaching. By considering the development of new technology, big data and deep learning may be adopted in the future work to evaluate the learner's status and recommend more accurate and personalized resources and learning strategy.

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