

# Study of Ubiquitous Learning Environment Based on Ubiquitous Computing

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## Abstract

*With the continuous development of computing, communication, digital media and embedded computing and devices, Ubiquitous computing has made great changes for people to consider information technology. U-learning environment based on the ubiquitous computing makes students to access the study resources more easily and more conveniently. This paper analyses the ubiquitous computing and u-learning, and then discuss the functionality and model of u-learning environment based on ubiquitous computing, and aim at constructing a synergic environment for both inside and outside school and making ubiquitous studying everywhere.*

## 1. Introduction

With the technology of computer, communication and digital media and the continuous development of embedded computing and devices, software and hardware of information technology have taken great changes. This kind of changes makes the network space that made up of computers and communication and people's life space, workspace and study space inosculates as a whole. Ubiquitous computing comes into being in this condition.

So-called ubiquitous computing refers to a mode of computing in anywhere and at anytime. As long as needed, information can be accessed by some kind of devices. Ubiquitous computing has two key characteristics, one is ubiquitous, which means accessing information at any place and any time, another is transparency, which means in the environment with embedded devices, communication devices and other computing devices, the devices can communicate with each other and provide users with some services without being known by the user, so to minimize the user's intervention [1].

In the information age, ubiquitous computing can reduce the complexity of using devices, and make people's life easier and more efficient. Actually, ubiquitous computing is the nature extension of network computing, it makes both PC and other cabinet smart

devices to connect with the network, so make it easy for people to access information instantly.

This paper mainly introduces the concept of ubiquitous computing and ubiquitous learning, design of the ubiquitous learning environment and some main problems in ubiquitous learning. It is helpful for deep study in distributed teaching system.

## 2. Ubiquitous Computing and Ubiquitous Learning

Mark Weiser is often referred to as the father of ubiquitous computing. He coined the term in 1991 to describe a future in which invisible computers, embedded in everyday objects, replace PCs [2]. He advocated the use of computer should meet the people's habits, come into people's everyday environment and tools, and interact with the user independently. At present the main application areas of ubiquitous computing include smart terminal devices (such as Mobile Web 2.0 applications on iPhones), intelligent space (such as smart classroom), and RFID tags for business identification and so on. The main study area of Ubiquitous computing involves theoretical modeling, natural machine interaction, context-aware, ubiquitous networks, intelligent space, system software, and information's capture and transfer etc [3-5].

Using ubiquitous computing in human's study, the most important thing is to build a ubiquitous learning environment for learning. Ubiquitous Learning means learning in any place and any time, learning interwoven in people's daily life. Whether in school or out school, people can obtain the appropriate resources to carry out the ubiquitous meaningful learning at the right time and right place.

Ubiquitous learning is characterized by ubiquitous and Context Sensitivity, by ubiquitous, it refers to the study is interwoven in everyday life, omnipresent, and it is difficult to detect their presence. Context Sensitivity means environment information around the learner and device information can be gathered and the learner can be provided with learning activity and content [4].

## 3. Design of Ubiquitous Learning Environment

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Ubiquitous Learning Environment is an integrated learning environment, a variety of educational institutions, workshops, community and families are integrated as a whole. Ubiquitous Learning Environment is characterized by the Ubiquitous nature of learning, and is reflected in the following three aspects: (1) ubiquitous learning behavior; (2) ubiquitous learning interface; (3) ubiquitous learning support services [5].

In Ubiquitous learning environment, learners can get knowledge in unlimited database, gained learning materials and curriculum from the super media library, whether words, sounds, graphics or images; they can interact with teachers or partners at any time.

### 3.1 Function of Ubiquitous Learning Environment

Learning Environment is characterized by the Ubiquitous nature of learning; the learner can get learning content and interact with teachers and partners at any place and any time. So the main function of Ubiquitous Learning Environment is:

(1) Provide learners with plenty of teaching resources. These teaching resources may be stored in some teaching platform's servers or stored in some res directly. These teaching resources should be able to meet the different levels of the students' individual requirements. These resources can be presented to learners in different ways, such as text-based knowledge, answer, video, audio or other information. Of course, you can specify different types of content's presentation for different types and levels of learners.

(2) Provide multi-dimensional interactive intelligent learning environment, which means multiple modalities of learning. The master ratio of learners is different according to different ways of knowledge. If the learner involve in explanation directly, he (or she) can master more than seeing or hearing. Therefore, ubiquitous learning environment should provide more multi-dimensional interactive learning environment with learners.

(3) Provide perceived collaborative learning environment. Computer-supported collaborative learning use computer networks to establish collaborative learning environment in which teachers and students, students and students can have collaborative learning on the basis of discussion, collaboration and communication, but most of the collaboration cannot be apperceived at present. Ubiquitous computing technology can provide a more convenient platform for collaborative learning, that makes all kinds of devices and virtual environments, study participants come together to constitute an effective learning community, participants can perceive the

presence of partners. It plays an active role in stimulating learners' interests and enhancing learning efficiency.

(4) Provide user-friendly interface between user and computer. After finding resources by sensor and other devices, it needs a user-friendly interface to present the knowledge to the learner. Such as TANGO ,which is based on PDA on the basis of the technology of Toshiba's Genio-e and the RFID tag reader and also wireless technology, its user interface is a simple interface, in which the interface provides learner with questions and answers to show the contents of resources[6].

### 3.2 Model of Ubiquitous Learning Environment

In the ubiquitous learning environment, there are two basic aspects including educational environment and educational services. The educational environment mainly includes educational resource library, ubiquitous learning terminals and communications infrastructure and communication protocols. The educational services mainly include intelligent educational services, distance education services, the supply services of educational resources and comprehensive website. Specific model of the ubiquitous learning environment is shown in Figure 1.

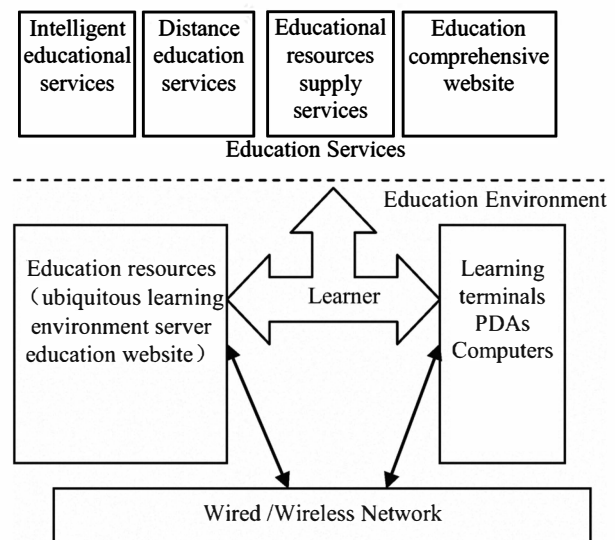


Figure 1 Model of Ubiquitous Learning Environment

(1) Ubiquitous Learning Environment Server Module. To supply ubiquitous educational services, it is necessary to integrate a variety of teaching resources and build the server.

(2) Communication Module. For the communication between learning terminal devices and servers, we need the appropriate communication media and communication protocols. The current communication can be achieved by radio, 3G and other wired or wireless network and the corresponding communication protocols, such as service

access protocol, service security protocol, and service discovery protocol and so on.

(3) Mobile Devices. In the ubiquitous learning environment, the major equipment involved includes ubiquitous mobile devices that can receive information, such as smart phones, PDA, computers and so on.

(4) Sensors. Sensors will be used to apperceive students' contextual information and environmental contextual information, such as RFID (radio frequency identification) sensor. These sensors will be placed adjacent to the objects/devices [7]. For example, adjacent sensors can detect the student's presence and send data about the object to the student's PDA. At the same time, the object will access the ubiquitous learning environment server module and request information about the student. The interactive model is enacted by a semantic matchmaker that can perform semantic reasoning for context oriented service discovery and access based on learner ontology and service ontology [8].

### 3.3 Main Problems in Ubiquitous Learning

At present, some ubiquitous learning environment is being studied and constructed, however, in order to achieve its original purpose, it also faces some problems. The solution of these problems is critical for the construction and implementation of ubiquitous learning environment.

(1) Construction of resources. In order to meet the learners' personalized learning in the ubiquitous learning environment, and facilitate the realization of dynamic generation of learning resources and building space for the ubiquity of learning resources, the construction of resources plays a decisive role. At present, a new type of resource organization - "learning cell" is in the research and attempts [4].

(2) Resource Discovery and Interaction. At present, the discovery of learning resources is completed primarily through context-aware and semantic web technologies. However, there is still some difficulty in the context classification, modeling and the use of related middleware technologies to resolve the resource discovery and interaction

(3) Standards of Ubiquitous Learning. The initial target of ubiquitous learning is to get knowledge in the information controls at anytime and anywhere. However, there is still no uniform standard for ubiquitous computing and ubiquitous learning. So it requires the various research institutions and organizations come together to develop a uniform standard, so to truly realize the seamless connection between the various devices.

(4) Safety. It requires safety policy to ensure the security of data and management of learners' access in the communication process, and also guarantee that the learners can really access the learning resources at

anywhere and anytime seamlessly. At present, to achieve the target mainly through the security control protocol and the corresponding access control policy.

(5) The cost of implementing. It requires much fund to establish the software and hardware environment for constructing the ubiquitous learning environment. Although many countries and institutions have invested considerable efforts for research, but the current needed cost for the ubiquitous computing environment remained relatively more, it is a restriction for the research and development of ubiquitous learning environment.

### 4. Conclusion

Although ubiquitous learning environment is still under study, waiting for further development and use, but it made a new idea for today's education and teaching concept, learning can really be done at anytime, anywhere, and using any device. With further study of ubiquitous learning and continuous development of various communications technologies, ubiquitous learning environment will become a main direction in the ubiquitous computing environment in the future.

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