Research on the Organization Model of Ubiquitous Learning Resource

—the Structure of Learning Cell and its Runtime Environment

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With the development of pervasive computing and Internet technologies, information space will be blended with physical space seamlessly to form a ubiquitous information space combing reality with fantasy. All of them make learning become more and more ubiquitous, which means learning happens anytime, anywhere and on demand. Current researches on ubiquitous learning mainly focus on the construction of conceptual models and supporting environments. However, how to organize learning resources to satisfy the needs of anytime, anywhere, on demand and adaptive learning is an emerging problem. Current learning technologies concern with learning resources sharing in a closed structure, which neglect the sustainable development and evolutionary capability of learning resources, the dynamic and generative connections between learning resources as well as between learners and teachers. Our research focus on solving that problem: to research on the organization model of learning resources and to explore on the organizational framework theory and practical foundations of learning resources within the context of ubiquitous learning supported by pervasive computing technology.

1. Research Questions

Based on learning object, our research will propose a new description and package mechanism, named by Learning Cell (L.C), for learning resources, which can better support informal learning, and the community construction and sharing of learning resources with the essential features of evolutionary. L.C has the basic features of semantic aggregation, self-tracing, evolution, cognitive network connectivity and miniaturization. L.C should satisfy the needs of evolutionary development, learning on demand, collaborative editing and dynamic adapting to users and contexts. The core design idea of L.C is to introduce temporal dimension and social cognitive networking into the concept of learning resources to make it evolve over time. The version changes, historical records and generated information will all be stored. Meanwhile, the network
of knowledge relationship consisting of knowledge and people will be formed. The network will be used to promote students’ knowledge construction and the sharing of collective wisdom during the process of knowledge evolution. Specific research questions are as follows:

1.1 The logical structure and organizational characteristics of ubiquitous learning resources in pervasive computing environment

The general development trend of ubiquitous learning resources is generative, adaptive, intelligent and evolutionary. Current learning object technologies merely concern with the sharing and management of constructed resources, while neglecting the life cycle and the learning wisdom accumulated during the application process, which is unable to adapt itself to the future development of ubiquitous learning. This research attempts to explore a new way of organizing learning resources named LC. It not only provides resources related to users’ learning, but also a series of activities and tools as well as the social cognitive network. LC is not a static learning material to learners but a constant channel to acquire information and knowledge. Figure 1 displays the basic flow of interactions among learners, LC and other users. With the essential features of openness, generative, evolution, connection, cohesiveness, intelligence and adaptation, LC can realize the evolutionary growth of learning resources and aggregate learning resources and people to form knowledge relationship network. As the further development of learning object and learning design technologies, LC will bring about some new features to learning resources.
1.2 Aggregation Model based on semantics and to control orderly development of resources with semantic gene (knowledge ontology)

LC is a new organizing method for learning resources. The main distinction of LC from learning object or online courses based on SCORM is the application of semantic web and ontology technologies to make learning resource like a living organism, which keeps evolving and growing under the control of internal semantic genes. This research will apply ontology and semantic web technologies creatively to construct the aggregation model of ubiquitous learning resource.

1.3 Cognitive network computing model for learning resources and expanding sharing range from the materialized resources to social cognitive network

Related specifications and standards of traditional learning resources are constrained to materialized resources, neglecting the factor of people. Besides materialized resources, there are also human resources connected through materialized resources, which is one key distinction between LC and traditional package model of learning resource. However, how to realize the sharing of dynamic social cognitive network through constructing cognitive network model based on users’ interactions and procedural data is one of the urgent problems in need of solution.

2. Research methods

This research has applied the modeling method, development method and empirical research method. The technical route is as follows:

2.1 The construction of knowledge ontology model for LC

We have planned to use OWL language recommended by W3C as the basic description language for knowledge ontology. According to general knowledge classification theory, we have designed several basic knowledge types and corresponding attributes. Extended knowledge ontologies can be inherited from basic ontologies. The operations with knowledge ontology are based on Jena framework published by HP Lab, as well as the ontology searching language SPARQL recommended by W3C.

2.2 Automatic semantic connection and the construction of social cognitive network

On the one hand, automatic semantic connections among LCs could be built
through constructing the similarity or equivalence relationship of field key words; on the other hand, automatic semantic connections could be constructed by analyzing users' learning routes to find out more relationships among LCs. In addition, part of the automatic connections can be realized through inference engines.

2.3 Realization of the evolutionary feature of LC

The core of research on ubiquitous learning resources design is how to realize the orderly control of learning resources. Current e-Learning usually takes Web2.0 as the core technologies in resources evolution, which has brought about a lot of unsatisfactory isolated resources in open environment. LC is expected to realize orderly control on ubiquitous learning resources with semantic technologies.

3. Research findings

So far, We have successfully constructed the concept model and information model for LC, designed the package standards, developed the online knowledge ontology co-editing environment and realized the collaborative content editing, version control, and to some extent the knowledge evolution. We have also realized the visualization and sharing of knowledge relationship network with Flex technology and successfully constructed the visual modeling environment for knowledge structure. Next, we will strive for breakthroughs in the orderly evolution of learning resources, including the design and implementation of evolutionary mechanism, the construction of evolutionary model and the development of supporting environments.

We have already released the LCPS (Learning Cell Prototype System) at present. You can access it through this URL: http://lcell.bnu.edu.cn.