Chapter 35
A Customizable Language Learning Support System Using Ontology–Driven Engine

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ABSTRACT

This article proposes a framework for web-based language learning support systems designed to provide customizable pedagogical procedures based on the analysis of characteristics of both learner and course. This framework employs a course-centered ontology and a teaching method ontology as the foundation for the student model, which includes learner knowledge status and learning preferences. A prototype system has been developed based on this framework. The system was evaluated by means of analysis of learner data from the international language department of a Chinese university. The average learning achievement of the students in the experimental group, who studied with the learning support system, was significantly better than that of the control group, who studied with the tradition learning management system while taking the same Japanese course as the experimental group.

1. INTRODUCTION

In recent years, numerous commercial products have been developed based on different learning/content management systems (LMSs/CMSs), such as Moodle.

These products provide platforms for communication and collaboration among instructors and students. Instructors use the platforms to efficiently manage the learning materials; learners are able to conveniently download the materials they need. Furthermore, all the users can discuss related issues by using the communication tools of

these platforms. However, the learning materials in those systems are normally organized in a tree structure with divisions based on either textbook chapters or class schedules; the leaf nodes are used to represent learning materials.

One problem with the tree structure in older systems is the difficulty of emphasizing the relation between two leaf nodes, especially when there are numerous branches between them. As is the case in other education fields, in language teaching the presentation of the similarities and contrasts between knowledge points (KPs) is indispensable. However, older LMSs/CMSs, which organize the learning materials in a tree structure, cannot characterize grammatical relations between KPs for student comprehension, especially when the KPs are located in different teaching content clusters which are far apart in the tree structure (for example, one in section 2 of lesson 1, another in section 3 of lesson 10). Even worse, in those older systems it is difficult for students to locate the learning materials which directly address the relations between KPs they are studying.

Another problem in older LMSs/CMSs is that they cannot satisfy the complicated requirements of learners, especially with regard to differences in learning abilities. Even for a group of leaners who have the same learning objective, different learner may have individual knowledge structure, learning preferences and learning styles. These individual characteristics will lead to learning abilities differences and complicated requirements. A learning support system serves as a mediator between the learner and the learning objects (LOs). Such a system's assistance to a learner would be more effective if it could provide LOs appropriate to the learner's characteristics. However, the older systems simply provide the same learning materials to every student; this limits the effectiveness of those learning support systems.

To address the above two problems, we present a framework for web-based language learning support systems, intended to provide pedagogical procedures by using ontological engine to analyze the characteristics of both learners and courses. A customizable language learning support system (CLLSS) based on this framework provides LOs according to the learner's knowledge structure and learning preferences by means of the alignment of a course-centered ontology (i.e. an ontology based on a specific course) and a teaching method ontology. This prototype system also makes use of the course-centered ontology to provide learners (a) a visual representation of every KP (including displaying its essential properties and related KPs) ; and (b) a pedagogical approach which enable the learner to compare an unlearned KP with all its related KPs, especially with those acquired KPs..

2. ONTOLOGIES BASIS

Recently, ontologies have been used in many research fields to facilitate information sharing and interaction, especially in knowledge-based systems.

An ontology consists of a set of hierarchically organized concepts and the relations between them, and thus can explain objects appearing in the target world as their instances (Mizoguchi, 2003). From the knowledge-based system point of view, ontology is considered as a hierarchical network, where nodes represent concepts and arches or arrows represent the relations which exist between related concepts.

A number of existing intelligent e-learning systems using various ontological engines provide support for teachers in designing efficient instructions or directly provide students with personalized learning solutions. SMARTIES (Hayashi, Bourdeau, & Mizoguchi, 2009), a theory-aware authoring system using a top-down approach to the support of learning/instructional scenario design by teachers, employs OMNIBUS (Hayashi, Bourdeau, & Mizoguchi, 2006), an task ontology (Mizoguchi, 1995) that covers different learning/

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