

## Chapter 3.13

# Assisting Learners to Dynamically Adjust Learning Processes through Software Agents

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### ABSTRACT

To make online learning more productive, software agent technology has been applied to provide services for learners in order to assist them to construct knowledge in constructivist ways. This paper is focused on the application of software agents in assisting learners to dynamically adjust learning processes. Unlike pedagogical agents, the agents in this application do not hold domain knowledge but simply assist learners to get through learning processes by a variety of supportive services. They assist learners to develop personalized preferred learning plans and to guide them to dynamically adjust learning toward their goals. In this article, the online learning process is first investigated, and an approach to assisting

learners to dynamically adjust learning is outlined. Then, the structure of the UOL (unit of learning) database that provides links between a practical learning scenario and the required services is explored. A multi-agent architecture for realizing the services is configured, and the roles of the involved agents are described. After that, the related agent algorithms for guiding learners to dynamically adjust learning are described.

### INTRODUCTION

Constructivist learning is being recognized by more and more people as a productive learning method. Although there are diverse constructivist paradigms, they share commonly epistemologi-

cal assumptions for learning (Fosnot, 1996). The fundamental epistemological assumption is that knowledge cannot be transmitted to learners but must be individually constructed and socially co-constructed by learners (Jonassen, 1999). Because constructivist learning focuses on actively constructing meaningful understandings of the study theme, it can generate more significant outcomes than other methods such as the objectivist ones (Wilson, Teslow, & Osman-Jourchoux, 1995).

According to constructivist theories for learning, learners are *active* knowledge-constructors, whereas teachers are cognitive guides who provide guidance and scaffolds to support the construction (Mayer, 1999). Unfortunately, most current online instructional systems have not really taken such roles. Mostly, they just simply deliver online course materials over the Internet without providing effective guidance on how to use these materials to construct knowledge. As a result, learners only passively receive information from the presented materials. They have not been engaged in *actively* constructing meaningful understandings of the study theme. This research is aimed by applying software agents into online learning to *actively* assist learners to construct knowledge by using constructivist methods.

The research into software agents has been a rapidly developing area of research. Already a lot of agent-based systems have been proposed, ranging from comparatively small systems such as e-mail filters to large, complex, mission-critical systems such as air-traffic control (Jennings, Sycara, & Wooldridge, 1998). In particular, pedagogical agents have been developed to take the role of a virtual tutor, a virtual learning partner, and so forth. The agents we are developing facilitate online learning through comprehensive applications of the properties agents exhibit (e.g., autonomy, learning, cooperation, reactivity, goal-driven, etc.). They work together cooperatively in order to facilitate effective knowledge construction for individual learners. They assist learners

to construct knowledge not through understanding the academic content of subjects but rather through providing a wide range of services. These services include (1) providing access to appropriate learning resources and learning strategies; (2) fostering meaningful interactions with content, teachers, and fellow learners; (3) supporting personalized learning for individual learners; (4) promoting collaborative learning among learners in groups; and (5) aiding to evaluate learning achievements in a timely and accurate manner (Pan & Hawryszkiewicz, 2004a).

This article is focused on showing how software agents are applied to assist learners to dynamically adjust learning processes. This includes (1) guiding them to develop personalized preferred learning plans that satisfy their learning needs and that match their particular learning styles; and (2) assisting them in the alignment of learning plans according to the real progress in learning. The purpose of such services is to engage learners in knowledge construction and to promote its success through providing guidance for learners to solve the problems pertaining to learning strategies that they often encounter in online learning.

## **DYNAMICALLY ADJUSTING THE LEARNING PROCESSES**

### **Online Learning and Learning Plans**

Online learning takes place in many environments rather than just at educational institutions. Learners in education institutions usually follow a particular instruction program. Other learners, however, build their knowledge through a continuous and guided process of identifying learning project goals, discussing and trying ideas, and evaluating learning outputs. Such a process, as shown in Figure 1, is initiated and driven by a learning goal. After a goal is constituted based

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