Chapter I
Moving Towards a Generic, Service–Based Architecture for Flexible Teaching and Learning Activities

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ABSTRACT

Modern, computer-supported learning must go far beyond simply delivering learning content in a one-fit-for-all approach to students. It instead should include a variety of didactic aspects and cognitive characteristics. Furthermore, diverse systems and information must be taken into account for individualized learning processes. In light of this information, the objective of this chapter is to delineate an open, distributed, and service-based architecture for flexible teaching and learning activities. Backed by relevant research strands in this context, an architecture for an enhanced e-learning system developed within the AdeLE research project shall be depicted and experiences gained so far will be discussed. Based on this, a proposal is given for a generic and flexible architecture for adaptive e-learning towards the end of this chapter.

INTRODUCTION

The increasing amount of knowledge and its dynamic requires efficient and improved learning activities in all educational settings, such as in general school, university and vocational education. e-learning can be very useful for various learning activities in these educational settings. There is no doubt, however, that modern, computer-based learning support must go far beyond simply delivering learning content in a one-fit-for-all approach to students. From

the teacher's perspective, didactic aspects must be considered by flexible sequences of learning assets or more generalized by a flexible chain of learning activities. From the student's viewpoint, pre-knowledge, preferred learning styles, and learning media must be adequately considered for personalization purposes built on context-sensitive and fine-grained user profiles.

From the perspective of information and communications technology (ICT), various systems and applications must be taken into account in order to access the required information, process it and deliver individually-tailored learning activities to students based on their learning situation and environmental context.

In light of the situation stated so far, the AdeLE research project was began in 2003 for the purpose of developing an enhanced and flexible computer-based learning solution. The AdeLE project addresses the following research and development objectives:

1. The support of various learning and teaching paradigms.
2. The personalized retrieval, management and presentation of relevant and topical information for learning activities.
3. The improvement of knowledge about user behavior in the field of human-computer interaction and, in particular, of computer-based learning activities for the purpose to gain new insights and input for (1) and (2) as well.

Based on the goals stated above, AdeLE's research results include (1) a solution approach for a student-centered environment, (2) a personalized knowledge transfer process by utilizing static and dynamic e-learning knowledge repositories, and (3) the application of fine-grained information about the students, which is gained from user input (such as user record data and summative assessments) and user observation (such as real-time gaze movement tracking and content tracking).

It results in the development and implementation of an enhanced adaptive e-learning system by applying a service-based approach.

The objective of this chapter is to delineate the architecture of AdeLE's enhanced e-learning system, discuss experiences gained so far and—backed by that—propose a generic architecture for a multi-purpose e-learning system for flexible teaching and learning activities.

BACKGROUND

As clearly pointed out in Bransford, Brown and Cocking (2000), educational goals have significantly changed in recent decades. The modern, knowledge-based society expects much more from students and teachers than ever before. Consequently, the consideration of various learning and teaching styles (Ramsay & Ransley, 1986; Felder, 1993; Riding, 1997; Bransford, Brown, & Cocking 2000) becomes increasingly important. Information and communication technologies (ICT) can foster learning activities in many ways (Bransford, Brown, & Cocking, 2000; Oblinger & Oblinger, 2005), such as technical presentation support in traditional learning or e-learning. Financial aspects relating to the creation and maintenance of learning material, especially in the context of various teaching and learning styles, are also becoming increasingly important. Thus, the reuse of learning material, as well as interchangeability of content and organizational information, such as user information, is a key requirement. Consequently, various e-learning standards for content description and exchange as well as for didactical goals and student information have emerged, such as IMS and ADL SCORM (Paramythis & Loidl-Reisinger, 2004). By narrowing down to future-oriented e-learning systems, based on the situation stated so far, it is obvious that such systems must be flexible and adaptable in order to consider diverse didactic goals and student's learning needs.

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