

Chapter 17

Dynamic Generation of Adaptive Tutoring

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ABSTRACT

Adaptive Educational Systems are able to alter an online course as per the needs of each student. Existing technologies require significant time and effort to design and build such courses. This chapter offers a solution allowing instructors to build a practical adaptive system as they upload their lessons and tests to the online site. The system asks the instructor to associate multiple choice answers that are incorrect with error pattern names and to associate the error patterns with lessons students need to review. The result is that the adaptable system is dynamically built as the course progresses. A student views a student profile screen that is adapted to that student's level of knowledge and displays that student's misconceptions. On the other hand, an instructor can use a reports view of the system to extract common error co-occurrences and infer information about the difficulties faced by students in that course.

INTRODUCTION

Learning on the Internet has faced many challenges along the years, the most critical of which is that students are sometimes “lost in hyperspace” (Carroll, 1982). The main cause of this is that users face cognitive overload, when the learning process is interrupted by navigational concerns.

Learners are concerned with recalling the page they navigated from and the path they followed which results in low efficiency learning (Nunes & Fowell, 1996).

The main culprits for the disorientation that is faced by learners includes:

- a. Learners have an incomplete conceptual model of the organization and structure of information (Elm & Wood, 1985).

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- b. Users experience a lack of closure because they do not know how much longer the lesson continues before it ends (Shneiderman, 1992).
- c. Users lose track as they digress towards interesting information and forget their main goals of learning (Foss, 1989).

The problem is therefore both a design problem as well as a user problem. Designers of courseware should take these issues into account when designing educational systems to avoid the disorientation that can occur. On the other hand, users are adapting to the new world by adjusting their approach to learning.

Adaptable educational systems present one solution to this problem. Adaptive Systems are defined as systems that capable of four main tasks:

1. To manage explicitly defined learning routes adapted to each user.
2. To monitor and record the activities of students.
3. To automatically infer user trends and store them into a learner profile system.
4. To act upon available knowledge by making recommendations, or altering the course of instruction (Boticario, et al., 2006).

Brusilovsky (2004) indicated that adaptive educational systems went through three different generations. The systems that were designed during the first generation offered adaptive navigational support, adaptive presentation, direct guidance, sorting of links, hiding of links, and annotating links in different colors.

The second generation systems focused on creating adaptive web-based educational systems with a limited number of adaptive features. They also focused on producing new techniques for adaptation, as in AHA (De Bra & Calvi, 1998), which explored several approaches to link removal, while INSPIRE explored learning styles (Papanikolaou, et al., 2003). These systems also

focused on development frameworks to develop adaptable learning systems.

The third generation did not register any increase in the implementation of adaptive learning system in real courses except by those who designed their own systems. Instead, educators went on to use online learning management systems as in Edu20.org and Blackboard (Blackboard Inc., 2002). These systems allow educators to upload notes offer online quizzes, and gradebooks.

Brusilovsky (2004) indicates that every single function that an LMS has, there is a matching function in adaptive systems that can do the task better. Yet, the influence of adaptive systems on education is extremely limited.

Boticario et al. (2006) indicate that building adaptive scenarios is a very complex task that covers the full life cycle of the learning process. In fact, the task is so daunting that it may dissuade many educators from following this path to build learning systems because after all that effort, the learning materials on the system may be out-of-date.

The only existing platform to develop adaptive hypermedia courses is AHA (De Bra, et al., 1998). AHA is an open source platform that can be downloaded for development of online hypertext adaptive systems. It is an extremely rich platform that allows possibilities to adapt the page content in different ways, presentation of links, with or without icons ahead of the links, to enable the same link to lead to different pages based upon the values in the user model.

However, AHA requires a full course analysis and design prior to building the adaptable course. Although the overhead required to design such systems has been significantly reduced, it is still a daunting overhead to instructors who do not know about adaptable system architecture and how it works.

This paper attempts to resolve this main critical issue by allowing educators to use an online adaptive system that generates adaptive tests. An instructor, adds lesson units, and adds multiple

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