Architecture for an Adaptive and Intelligent Tutoring System that Considers the Learner’s Multiple Intelligences

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ABSTRACT

The majority of adaptive and intelligent tutoring systems (AITS) are dedicated to a specific domain, allowing them to offer accurate models of the domain and the learner. The analysis produced from traces left by the users is didactically very precise and specific to the domain in question. It allows one to guide the learner in case of difficulty and to offer her/him some support. This paper’s objective was to develop an (AITS), adapted for letting the learners work in several disciplinary fields of the University of the Annaba. In this context, its constraint is threefold: to represent knowledge relative to several disciplinary domains, to propose interactive activities to the learners based on multiple intelligences, and finally, to be able to support student guidance in her/his course by proposing her/him relevant support activities when she/he meets difficulties. The proposed system covers all important properties such as hypertext component, adaptive sequencing, problem-solving support, intelligent solution analysis and adaptive presentation while available systems have only some of them.

Keywords: Adaptive Hypermedia, Cognitive Overload, Curriculum Sequencing, Disorientation, E-Learning, Intelligent Tutoring System, Multiple Intelligences, Trace

1. INTRODUCTION

An adaptive and intelligent tutoring system (AITS) is currently a hot research and development area (Chen et al, 2005; Hwang et al, 2003; Lee et al, 2009; Papanikolaou et al, 2002; Tang et al, 2005). They have two useful benefits: classroom independence and platform independence. AITS provide intelligence and student adaptability, inheriting properties from Intelligent Tutoring Systems (ITS) and Adaptive Hypermedia Systems (AHS). Intelligent Tutoring Systems (ITS) are computer-aided instructional systems with models of instructional content that specify what to teach, and teaching strategies that specify how to teach. Adaptive Hypermedia Systems adapt the content of a hypermedia page to the user’s goals, knowledge, preferences and other user’s information for each individual user interacting with the system (Dabbagh et al, 2007; Cristea et al, 2003; Hong et al, 2007; Huang et al, 2007; Bai et al, 2008; Chen, 2008; Bhaskar et al, 2010; Chu et al, 2011).

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To design AITS which can manage both different disciplinary domains and a guide for the learner is difficult. The specialization of the analysis treatments is responsible for the loss of reusability for the other disciplinary domains. The analysis is didactic and thus strongly connected to the domain concerned. It results that an AITS is consequently, specialized to a type of taught knowledge and not easily transposable to other domains. To propose a model transposable to different domains of learning, the former has to take into account this diversity and to situate the learning activity. In this paper, we will show how to produce AITS model parameterized by the domain of learning.

The rest of the paper is organized as follows: section 2 provides the literature review on adaptive and intelligent tutoring systems. Next, we present multiple intelligences which used as a basis for designing adaptation mechanism in section 3. In section 4 we will give an overview on the overall architecture of the adaptive and intelligent tutoring system. The experiments that have been conducted will be presented in Section 5. Section 6 will discuss the results of the experiment. We will conclude the paper in Section 7 along with the further works of the study.

2. RELATED RESEARCH

Figure 1 show that Adaptive and Intelligent tutoring systems (AITS) may be considered as an intersection between adaptive hypermedia (AHS) system and intelligent tutoring system (ITS). More specifically, it may be said that from AHS they inherit adaptive presentation and adaptive navigation support:

The goal of the adaptive presentation technology is to adapt the content of a hypermedia page to the user’s goals, knowledge and other information stored in the user model. In a system with adaptive presentation, the pages are not static, but adaptively generated or assembled from pieces for each user.

The goal of the adaptive navigation support technology is to support the student in hyperspace orientation and navigation by changing the appearance of visible links. Adaptive navigation support can be considered as an extension of curriculum sequencing technology into a hypermedia context. It shares the same goal - to help students to find an “optimal path” through the learning material. At the same time, adaptive navigation support guides students implicitly and leaves the choice of the next knowledge item to be learned and next problem to be solved to them.

Whereas from (ITS) they usually incorporate some of the next functionalities (Brusilovsky et al, 2003; Peña, 2004):

1. **Curriculum Sequencing**: suggesting to student the “optimal” learning path, understood as the planned sequence of activities and contents that he/she must accomplish within the knowledge domain.

2. **Intelligent Analysis of Solutions**: More than assessment, its goal is to discover the mistakes committed by student, looking for plausible causes with the aim of helping him/her to correct them.

3. **Problems Solving Support**: To provide intelligent help, to student when he/she faces a specific activity. This functionality differs from the previous one because it is not remedial, so is not performed just when a mistake in the student reasoning is detected, but as some sort of continuous guidance. The goal of interactive problem solving support is to provide the student with intelligent help on each step of problem solving, from giving a hint to executing the next step for the student. In an example-based problem solving context, students solve new problems using as help examples from their earlier experience.

Some well-documented AITS are: AdaptWeb (Oliveira et al., 2003), MAS-PLANG (Peña, 2004), ZOSMAT (Keleş et al., 2009), AMPLIA (Vicari et al., 2008) and CIA (Moreno et al., 2009). According to these systems, we can conclude:

Most of these systems based their adaptation to user’s skill level. Other learner features
Adaptive Animation of Human Motion for E-Learning Applications
Frederick W.B. Li, Rynson W.H Lau, Taku Komura, Meng Wang and Becky Siu (2007). *International Journal of Distance Education Technologies* (pp. 74-85).
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