

DECIDING ON DIFFERENT HINTING TECHNIQUES IN ASSESSMENTS FOR INTELLIGENT TUTORING SYSTEMS

PEDRO J. MUÑOZ-MERINO, CARLOS DELGADO KLOOS
AND MARIO MUÑOZ-ORGANERO

Department of Telematic Engineering
Universidad Carlos III de Madrid
Av. Universidad, 30. E-28911 Leganés (Madrid) Spain
{pedmume; cdk; munozm}@it.uc3m.es

Received September 2009; revised March 2010

ABSTRACT. *Intelligent Tutoring Systems (ITSs) must take advantage of their high computing capabilities and capacity for information retrieval in order to provide the most effective methodologies for improving students' learning. One type of ITS provides assessments to students and some help as a hint, when they do not know how to solve a problem. Our thesis is that the type of hinting techniques used without changing the contents can influence the learning gains and aptitudes of students. We have implemented some hinting techniques as an extension to the XTutor ITS. We found that some hinting techniques can produce a significant increase in students' knowledge with respect to others, but the improvement and direction of the comparison depended on some other factors such as the topics to which it was applied. We conclude that proper adaptation of hinting techniques based on different information of the systems will imply better student learning gains. In addition, the results of a student survey, which includes the students' ratings of the different hinting features they interacted with, leads to high variances, which reinforce the idea of the importance of adaptation of hinting techniques in these types of systems.*

Keywords: Adaptive systems, Decision support, Intelligent tutoring systems, Educational technology

1. **Introduction.** The adaptation of different aspects of the user experience depending on different parameters is useful in hypermedia systems [1]. Paper [1] distinguishes two general different types of adaptation: presentation (regarding different contents) and navigation (regarding the different links available to follow). Adaptive hypermedia systems can be applied in education to adapt the content and the links, and can take into account the user model [2]. The quality of an educational system can be improved by introducing intelligence and adaptation [3]. Therefore, the proliferation of a wide spectrum of adaptive systems in education is not surprising [4-6].

It is important to improve the quality of the learning/teaching process, and the introduction of assessments plays a key role [7-9]. There are several strategies in computer assisted assessment. In this work, we focus on the provision of hints. The underlying concept behind it is that a student can request some help from the Intelligent Tutoring System (ITS) when he/she is not able to answer a given problem in the assessment. This forces the student to make discoveries during the learning process. Several authors have reported on the benefits of this strategy ([10-12]). Based on this concept, there are several possibilities and techniques related to hints, and some hinting tutors have been implemented [13-17]. Frequent ways of measuring the efficiency and quality of these systems in the literature have been introduced through the measure of the students' learning gains and students' surveys.