Chapter IX
Towards a Model that Considers the Student’s Affective Dimensions in Intelligent Learning Environments

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ABSTRACT
This chapter introduces the affectivity as decision support to the action of tutor agent. It argues that computational teaching system should take into account affective factors to do the interaction more flexibly; and that a computational architecture interacting with humans must explicitly preview beliefs and affective reasoning. It is defined as an architecture to support an agent in a way of recognizing some affective factors that represent action of humans in interaction with artificial agents. The agent is modelled through mental states and is responsible for high-level reasoning. It is presented that the cognitive evaluation of emotional situations allows more flexible actions of a system due to its adaptability to human agents. Furthermore, the author hopes that these studies will also bring contributions about which and how emotions are really involved in teaching and learning situations where one of the partners is an artificial agent.

INTRODUCTION
In this chapter, we discuss the use of affective information about students to support the decision of an intelligent tutor system (ITS) on establishing pedagogic actions. Our fundamental hypotheses are that a computational educational system should take into account affectivity in a way of making interaction more flexible and adequate for each student, and, second, that a computational system in real-time interaction with human agents must explicitly foresee affective beliefs and reasoning.
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In order to demonstrate those ideas, we will present concepts and insights concerning different domains, and we will also discuss the importance of introducing affective dimensions in intelligent systems. The approach combines research on human affectivity in cognitive science, psychology, philosophy of mind theories, agents technology, and intelligent systems.

We describe an architecture to support an ITS on the recognition of some affective factors that represent action strategies of humans in interaction with artificial agents. We believe that motivation is an important affective state in human learning, and that it can be monitored and captured through observable features in student’s behavior when interacting with the system through communication interfaces. This acknowledgement is accomplished through constructions derived from human agent’s observable behavior in specific contexts. Observable features are composed of parameters that model student’s motivation. Such a motivation model is based on studies by Vygotsky (1999) and Soldato and Boulay (1995).

An educational computational system needs not only to infer the motivation, but also other affective states that are important during the teaching-learning interaction between a biological and an artificial agent. The discussion about these matters is important because the observation of the students’ behavior in the classroom gives the teacher information on how to proceed, not only in what concerns actions related to the knowledge domain, but also in affective actions. We can verify such factors in the actions taken by a teacher when he/she realizes that a student is distracted, troubled, or extremely anxious about the proposed tasks. In this sense, we present an introduction to such matters, since we believe that a discussion about them is important in the development of teaching-learning environment projects.

A prototype developed to test some of those ideas was implemented as an agent that is modeled through mental states and is responsible for the inference of the student’s affectivity and the choice of the pedagogical actions. We used agents’ computational model developed by Móra et al. (Móra, Lopez, Coelho, & Vicari, 1998) to deploy the agent as a “cognitive kernel.” We adopted a cognitive approach in the analysis of emotional situations, particularly the OCC model (Ortony, Clore, & Collins, 1988).

The agent was inserted in the intelligent tutoring system Eletrotutor III (Silveira & Viccari, 2002) as a case study. Some results obtained from the insertion of the agent in the Eletrotutor III environment will also be presented here. The Eletrotutor III is an intelligent tutoring system whose subject matter is Ohms’ Law and some of its applications. The tutor decisions are analyzed and compared with and without the proposed abilities. Results show a positive impact on adaptability of the tutor’s pedagogical action, being closer to the behavior of teachers who adapt their affective actions and tactics to the student’s affective state.

This is the first study carried out by the Artificial Intelligence group at the Federal University of Rio Grande do Sul (GIA/UFRGS) that takes into account a reasoning about affectivity involved in teaching and learning situations of human and artificial agents. The contribution of this study was to verify the importance, necessity, and feasibility of such considerations, as well as to present its advances within the research perspective of the AI group at UFRGS in what concerns the development of educational environments modeled with a multiagent architecture employing mental states metaphors.

ABOUT EMOTION AND SYSTEMS

Due to the current approaches to human learning and to the arousal of new technologies that support the creation of virtual classrooms and allow a computer-mediated social interaction, new approaches to teaching systems are necessary. It is important to consider that many computational