Using Conceptual Models to Implement Natural Language Pedagogic Agent-Student Conversations

Diana Pérez-Marín, Universidad Rey Juan Carlos, Madrid, Spain
Carlos Caballero, Universidad Rey Juan Carlos, Madrid, Spain

ABSTRACT
The last several decades have seen a growing trend in incorporating pedagogic conversational agents in interactive learning environments. Software systems have increasingly integrated intelligent virtual agents that can interact with students in natural language to fulfill specific tasks such as reviewing content or providing tutor training. The use of an agent-based approach in education has shown many benefits. However, certain design and development issues are still unresolved. This article focuses on the potentials of employing conceptual models to generate agent-student dialog and introduces a new mixed-initiative general domain agent called JARO. The authors report on the procedure for creating the initial conceptual model and discuss its use in guiding agent-student conversations adapted to students’ individual learning needs. The stages of implementation of the model as well as the model’s viability tested in a proof-of-concept experiment are addressed.

Keywords: Computer-Based Education, Game-Based Learning, Interactive Learning Environments, Interactive Software Systems, Natural Language Interaction Technology, Pedagogic Conversational Agent, Student Model

INTRODUCTION
The last several decades have seen a growing trend in incorporating pedagogic conversational agents in interactive learning environments such as computer-based learning, e-learning, and blended learning. Among the recent advances is the introduction of natural language interaction technology, which allows for maintaining conversations between the student and the computer in a human-like manner by using artificial intelligence engines (Kerry, Ellis, & Bull, 2009). A pedagogic conversational agent (PCA) can be viewed as a computer system that interacts with a student in a natural language to help review content or provide training. Such agents can assume the role of a lecturer, instructor, tutor, or even of a peer student.

DOI: 10.4018/ijicst.2013070103
The use of animated pedagogic agents has shown many benefits for education. One such benefit is “the Persona Effect,” which is described as the presence of an interactive agent in an educational computer environment that has a positive influence in the students’ perception of their learning experience (Lester et al., 1997). Another advantageous phenomenon is “the Proteus Effect,” according to which students are motivated to achieve the features of the agents and become more like them (Bailenson, Yee, Blascovich, & Guadagno, 2008; Yee & Bailenson, 2007). Finally, research has revealed “the Protégé Effect,” in which students can make greater efforts to teach their conversation agents than to study on their own (Chase et al., 2009).

However, there are both design and development issues that need to be resolved regarding the implementation of PCAs in interactive learning environments (Mencia, 2011). For example, there is still no standard to evaluate the specific features of pedagogic conversational agents that are necessary to enhance learning, promote student engagement, and show progress in learning of specific content. This article focuses on the possibilities of utilizing a knowledge representation format for enabling agent-student interaction. The authors present a procedure for using student modeling mechanism to guide the agent-student dialog. The proposed procedure has been implemented in a new mixed-initiative general domain agent called JARO tested in a proof-of-concept experiment with a group of students. The article provides a review of related work and details the procedure for model development and its implementation. The authors conclude with a discussion of the experiment performed to test the model’s viability and directions for future work.

RELATED WORK

Software systems increasingly integrate pedagogic conversational agents that can interact with students in a natural language to fulfill specific tasks such as reviewing content or providing tutorial training. Pedagogic agents can cohabit the learning environment creating a rich, personalized face-to-face interface for interaction with students (Johnson, Rickel, & Lester, 2000). In this section an overview of ten PCAs, is provided. The agents were selected based on the design features or functionality that they introduce.

Herman the Bug

Lester et al. (1997) created one of the first pedagogic agents for children: Herman the Bug. There were five modes where the agent could be used with different combinations of gestures and verbal directions. The specific application domain in which Herman was tested was biology. Figure 1 demonstrates a snapshot of one of the modes of the agent.

A total of 100 students used Herman to design a plant (20 students per each of the five modes) and it was observed that just the presence of the agent had a positive impact on the students—even the ones using the muted agent. However, no real conversation in a natural language occurred in any of the modes, and the interaction was limited to sound clips previously recorded to give the students advice on how to complete the task of designing the plant.

Steve

Rickel and Johnson (1999) created Steve (Soar Training Expert for Virtual Environments), a personalized virtual agent able to interact face-to-face with students in a 3D virtual word (see Figure 2). This pedagogic agent was tested in the navy training area of application.

The virtual agent can collaborate with students through their avatars in a 3D virtual environment of the ship to complete certain tasks. It also avoids giving orders to students. In addition, Steve can make suggestions according to the social intelligence model, which may include information about the student’s goals, plans, emotions, motivations, and personality. However, Johnson (2003) points at some of the problems with this model, such as...
17 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:

www.igi-global.com/article/using-conceptual-models-to-implement-natural-language-pedagogic-agent-student-conversations/105655?camid=4v1

This title is available in InfoSci-Journals, InfoSci-Journal Disciplines Communications and Social Science, InfoSci-Communications, Online Engagement, and Media eJournal Collection, InfoSci-Networking, Mobile Applications, and Web Technologies eJournal Collection. Recommend this product to your librarian:

www.igi-global.com/e-resources/library-recommendation/?id=2

Related Content

"Hey, Look at My Body!": An Exploratory Study of Body Display on Facebook among Hong Kong Young Adults
www.igi-global.com/article/hey-look-at-my-body/115159?camid=4v1a

Guidelines for Designing Easy-to-Use Interactive Television Services: Experiences from the ArviD Programme
www.igi-global.com/chapter/guidelines-designing-easy-use-interactive/24515?camid=4v1a

In Search of Social Television
www.igi-global.com/chapter/search-social-television/29196?camid=4v1a