ABSTRACT

Pedagogic Conversational Agents are computer applications that can interact with students in natural language. They have been used with satisfactory results on the instruction of several domains. The authors believe that they could also be useful for the instruction of Secondary Physics and Chemistry Education. Therefore, in this paper, the authors present a procedure to create an agent for that domain. First, teachers have to introduce the exercises with their correct answers. Secondly, students will be presented the exercises, and if the students know the answer, and if it is correct, more difficult exercises will be presented. Otherwise, step-by-step natural language support will be provided to guide the student towards the solution. It is the authors’ hypothesis that this innovative teaching method will be satisfactory and useful for teachers and students, and that by following the procedure more computer programmers can be encouraged to develop agents for other domains to be used by teachers and students at class.

Keywords: Blended Learning, Instruction, Natural Language Interaction, Pedagogic Conversational Agent, Science Education

INTRODUCTION

Pedagogic Conversational Agents (PCAs) can be defined as “lifelike autonomous characters that cohabite the learning environment creating a rich interface face-to-face with students” (Johnson, Rickel, & Lester, 2000). These agents can present human features such as emotions, empathy, intelligence or humour. Moreover, they can interact with the students in text or/and voice, and have some kind of graphical animation.

PCAs can adopt many different roles such as teachers, tutors, students or companions. In any case, the goal is to support the educational process. For instance, when the agents are
used in the role of teachers their goal can be to transmit new knowledge to the students, or to review previous knowledge; while when the agents are used as students, their goal can be to ask the student for information with the belief that whenever students are able to teach information is because they understand it; or, when the agents are used in the role of companions, their goal can be to encourage the students to keep working and devote more effort to the task until its completion.

Domains in which pedagogic agents have successfully been applied are many. For instance, in Biology (Lester, Converse, Kahler, Barlow, Stone, & Bhogal, 1997), Language (Ryokai, Vaucele, & Cassell, 2003; Massaro, Ouni, Cohen, & Clark, 2005; Reategui, Polonia, & Roland, 2007), Maths (Robison, McQuiggan, & Lester, 2009), Computer Science (Graesser et al., 2008) or Science (Biswas, Roscoe, Jeong, & Sulcer, 2009). In particular, in this paper, the focus is on how to extend the use of the agents for the Science domain. It is our belief that using PCAs teaching complex exercises such as Secondary Physics and Chemistry exercises is a satisfactory and useful innovative teaching method.

The reason why it is not common to find such technology in the current classrooms could be found in the lack of knowledge about its existence or, even in the belief that it is too complex or expensive to develop such kind of agent. This is the reason why we would like to propose a simple procedure to create a Secondary Physics and Chemistry PCA, and to show how it can be used in class, and some results of the satisfaction reached both by the teachers and students when using it.

The paper is organized as follows: the next section reviews the related work; the following then describes the proposed procedure; the case study in which the procedure was applied and the results achieved is presented; and, the last section ends the paper with some conclusions and lines of future work.

PEDAGOGIC CONVERSATIONAL AGENTS

In this section, an overview of the field of Pedagogic Conversational Agents (PCAs) is presented to introduce the basic necessary context for anyone who wants to create new agents. It is out of the scope of this paper to accomplish a complete review of the state-of-the-art of the field.

Appearance

The appearance of the agent is a key issue in the design of a PCA. There are studies indicating that a human form for the agent provides advantages to the student-system interaction (Lester et al., 1997; Cassell & Tartaro, 2007). Figure 1 shows a sample of agent with human appearance.

However, it should be noted that it may not be true for all cases. In particular, some researchers have warned that creating agents that look like perfect humans creates the expectation that it is possible to keep a perfect dialogue with the agent (Norman, 1994; King & Ohya, 1996; Koda & Maes, 1996).

In general, the choice of the appearance of the agent should be dependent on the nature of the task (Mencia, 2011) and the personal features and skills of the users (Xiao, 2006). Figure 2 shows some samples of agents represented by animals, when their goal is just to provide support to the students, so that they do not feel alone when working with the computer (Chen, Liao, Chien & Chan, 2009), and Figure 3 shows agents represented by little children as animated characters who seek the help of the students because they do not know how to complete the homework (Biswas et al., 2009).

Techniques

There are several techniques to develop an agent. In this section, some of them will be mentioned according to their level of difficulty. A first and
Online Graduate Students’ Perceptions of Face-to-Face Classroom Instruction
www.igi-global.com/article/online-graduate-students-perceptions-face/67802?camid=4v1a