

Pedagogical Agents in Online Learning

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INTRODUCTION

Lack of personalization and individualized attention are common issues facing distance education designers and instructors. This is a particularly important deficiency as research has shown that personalization can increase learning greatly in comparison to nonpersonalized, information to student, linear instruction (Clark & Mayer, 2003). Advocates of personalization cite cognitive learning theory as the basis for such an approach; when humans communicate with one another they are continuously processing information, either assimilating or disregarding data and forming an understanding of the information in context of the environment and of the person with whom they are interacting. This is a natural learning mechanism that cognitive learning theories state is the foundation for all deep and lasting instruction (Hein, 1991). Through an engagement of the natural learning mechanisms, or cognitive structures, an individual should be capable of learning efficiently and form a more thorough understanding of a topic. Personalization of text through the use of informal speech and the inclusion of virtual coaches known as pedagogical agents are used as personalizing devices. These are particularly relevant options in the design of nonmoderated e-learning, as personalization is meant to fill the void where the instructor once stood. There are exclusions however, as pedagogical agents have been used in “traditional” online classrooms as well. This article focuses on the use of pedagogical agents in e-learning that:

- Provides information on pedagogical agents strengths and weaknesses
- Provides research relevant to pedagogical agents instructional role
- Provides examples of current use
- Discusses possibilities of future implementation.

THEORY, STRENGTHS, AND WEAKNESSES

Human beings tend to interact with technology in much the same way as they interact with living people or real places (Reeves & Nass, 1996). The expectations that people assign to people and places are naturally transferred to objects that virtually represent real people and places. This relationship can be seen as one of information exchange and transfer. Media is normally used as an information disbursement modality similar to that of a human relationship where information is exchanged between one or more individuals and is either assimilated or disregarded. Technology-based information distribution can not assume all of the nuance and complexity of human interactions. Still, it is a powerful way that many engineers and programmers have attempted to harness in order to create more effective and efficient designs, programs, and learning.

This natural inclination to personalize technology can be used by instructional designers through the implementation of pedagogical agents. Pedagogical agents are computer-generated virtual mentors and are commonly created to represent real people, animals, or objects. Agents can be created by graphic artists/animators and utilized by instructional designers as virtual e-learning mentors. Pedagogical agents are commonly designed with the characteristics of a living, autonomous being; a pedagogical agent can have a voice, personality, emotional affect, and any other characteristic that can be found in a living or nonliving object. The instructional designer’s intent is to use the individual’s tendency to interact with the machine or training as though they were receiving one-to-one tutoring. One-to-one tutoring has been shown to be one of the most effective instructional modalities (Bloom, 1984); the pedagogical agent allows every learner the opportunity to interact with an instructor one-to-one.

When the computer acts as an instructor, virtually representing a living being, this would theoretically transform the person-to-machine relationship and create an environment that was as close as possible to an actual one-to-one instructional environment. Lester, Converse, Kahler, Barlow, Stone, and Bhogal (1997) have demonstrated that through this one-to-one engagement pedagogical agents can increase enjoyment of learning, increase self-regulation and efficacy, and motivate students to continue to learn about a topic or subject.

Other learning theories that are commonly cited to encourage implementation of pedagogical agents include a constructivist learning theory (CTL) and a social learning theory (SLT). Proponents of CTL would state that through the use of pedagogical agents, learners are able to interact with a more meaningful and realistic environment and thereby construct knowledge through realistic experience (Hein, 1991). CTL is centralized on the learner rather than the instructional material; this is an ideal approach for implementing a pedagogical agent as it is a one-to-one interaction focused on the learner. Pedagogical agents also allow for the creation of virtual environments that can be highly reflective and almost identical to the actual situation in which learners will utilize the information/knowledge being studied. For example, a pedagogical agent can be created to assume the role of a customer which would interact with the learner just as a living being in a customer service program, or a virtual student can be created to assist educators in honing their tutoring skills.

Social learning theories (SLT) focus on the social relationships in learning interactions; learning can occur through observation or modeling/imitation and learning does not require an observable change in behavior (Ormrod, 1999). Pedagogical agents can demonstrate tasks and procedures as well as actively involve the learner in the process, allowing for social and virtual physical involvement in learning. Social learning interactions are easily observed in an instruction utilizing pedagogical agents as it is a socially-based activity involving the learner and virtual instructor.

Instructional role has direct application to both CLT and SLT as the manipulation of pedagogical agent characteristics can affect the environment/experience as well as the social relationship of the student to the agent respectively. The pedagogical agent's instructional role can be dissected into feedback and affect components;

the two primary components can be further separated into auditory and visual categories. The combination of these characteristics creates a more believable agent and theoretically more effective one as the student would be more open to learning with a virtual tutor that seemed to be alive.

Regardless of the benefits and theoretical advocacy, pedagogical agents rely heavily on programming and many on visual technologies, making them expensive to implement. This is a major obstacle and a possible reason that they have not been implemented in mainstream instruction. Other weaknesses include issues related to the digital divide. Also, many instructors and designers may be slow to adopt such a new technology even if it is accessible. Cognitive overload is also commonly cited as a weakness, as the agent may be distracting or relaying too much information for a learner to process.

Instructional Role

It should be noted prior to reviewing the following three studies that the pedagogical agent field is still in its infancy and there is much research to be done. This is especially true for the use of pedagogical agents in adult education in contrast to childhood e-learning (Knowles, Holton, & Swanson, 2005), where there are numerous examples of pedagogical agents in use. Currently, the majority of available studies on pedagogical agents have focused on childhood to undergraduate, college-aged adult populations.

In nonmoderated e-learning, as well as some moderated online classrooms, the role of instructor is usually at least partly delegated to the learner, who manages their own learning. Pedagogical agents can virtually represent the instructor, however, it is not possible for technology to fully replace the function of a living instructor. Students must still manage themselves in a virtual learning environment that is moderated by a pedagogical agent who simply provides a learning gauge or compass to steer learners in the correct direction. Therefore, an agent would not create a limited environment, but merely a more understandable one and thus would be in alignment with andragogical theory and practice.

As a virtual representation of a living being, pedagogical agents can demonstrate the behaviors and characteristics attributed to their living counterparts. In the

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