Assessing Past, Present, and Future Interactions with Virtual Patients

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ABSTRACT

Virtual patients have proven to be an effective educational tool for learning and applying clinical examination skills. Interactive virtual patient scenarios provide opportunities for medical students to practice and improve verbal and nonverbal communication through the use of performance feedback. This feedback helps students to understand the ways in which they are perceived by their patients which otherwise could not be analyzed by health professionals. Evidence supports that interactive VPs fill a niche in medical education and testing for scenarios that cannot be practiced outside the virtual environment or with standardized patients. Not only are virtual patients effective in medical curriculum, as evidenced by various studies, they are applicable in understanding the ways in which learning occurs and can be implemented into a number of educational settings. In this article, the authors summarize seven years of findings on the use of virtual patients. They also describe current efforts at implementing virtual patients in community scenarios. The paper concludes with avenues for future directions with virtual human patients.

Keywords: Interactive Virtual Patient Scenarios, Medical Curriculum, Medical Educational Tool, Verbal and Non-Verbal Communication, Virtual Patients

INTRODUCTION

The Virtual Experiences Research Group (VERG) at the University of Florida along with researchers at the Research Center for Educational Technology at Kent State University have been adapting and improving the structure of virtual humans (VH), a life-sized conversational agent projected in 3-dimensional space, as means to an effective teaching tool in medical education and communication. The use of virtual patients (VP) as best practices in medical education has been implemented through the gradual development of virtual

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reality technology. We began our development of virtual patients by creating successful representations of real objects in a mixed realities environment and have evolved to developing models permitting free-flowing conversation during VH-human interactions. Our most successful VP implementation, Virtual People Factory (VPF), is currently used in the curriculum of four medical schools and has over 56 active users including VH researchers, healthcare practitioners, psychologists, and high school students (Rossen & Lok, 2012).

The purpose of this article is three-fold. First, we will summarize research on our use of virtual patients for medical education and for instruction in community organizations. The purpose of this review will be to highlight developments and learnings from almost a decade effort in this area. Such a review will provide researchers and those interested in virtual patients with direction and guidance for continuing to push the field of virtual, interactive agents. Second, we will describe current efforts at implementation of such virtual characters in two community organizations. In this case, the two organizations are museums. Data will be presented that will describe and highlight outcomes of taking a tool aimed at educating medical practitioners and adapting it for teaching adolescents about their own healthcare. The final portion of the paper will briefly describe new directions in our efforts at continuing to build, adapt, implement, and evaluate virtual humans. This will include innovative strategies for data collection and for increasing flow and engagement through multi-sensory technologies.

BRIEF DESCRIPTION OF THE TECHNOLOGY

Prior to describing the results, we begin with a description of the technology used in our virtual patient work. We define virtual patients as embodied conversational agents – computer-generated virtual characters that are controlled by a computer algorithm with whom users can conduct a conversation. This conversation is modeled as a knowledge-base of possible answers the virtual patient can give to input from the user. Input from the user can be in the form of questions or gestures.

Users may type, speak or choose from a list their questions to the virtual patient. These questions are processed by the system using a keyword-based algorithm. This algorithm chooses the best answer from the knowledge-base of the virtual patient. The virtual patient then speaks the answer using prerecorded audio.

Users may also interact with the virtual patient using gestures to perform physical examinations on the virtual patient. These user gestures can be recognized by the system using: infrared cameras tracking retro-reflective markers, a Nintendo Wiimote, a Microsoft Kinect, metaphors using keyboard and mouse, or customized sensors that resemble body parts of the virtual patient.

Depending on the requirements of each training scenario, virtual patients can be displayed as life-size on a wall using a projector or on a TV, or in smaller sizes using desktop monitors or laptop displays (see Figure 1).

REVIEW OF EXISTING FINDINGS

Historical perspectives on technological advancements are not always useful as newer technologies often replace prior conditions, outcomes, problems, and solutions. However, this review documents important findings that drive current and future planning; they set the stage for others interested in a longitudinal perspective not just on the project, but also how to build on our successes, shortcomings, and learnings.

Virtual Human Patients can Successfully be Utilized to Characterize a Doctor-Patient Conversational Model

The initial research focus was in the context of medical education; its main purpose was to improve communication between doctors and
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