

Using Interactive Storytelling Agents to Broaden Participation in Computing

Abstract: It has been extensively documented the need for increased participation from under-represented minorities in Science, Technology, Engineering and Mathematics (STEM) fields. This research aims to address this problem by using interactive storytellers. Interactive Storytelling (IS) is a form of digital entertainment in which users create or influence a dramatic storyline through actions, either by issuing commands to the story's primary character, or acting as a general director of events in the narrative. Interactive storytelling is a medium where the story can be influenced in real-time by the user of the system. An interactive storyteller was created to teach users strategies when pursuing a doctoral degree in computing. A pilot study was conducted with five undergraduate computer science majors to collect initial feedback about the tool and their experience. Overall, students enjoyed working with the agent and were more motivated to attend graduate school.

Introduction

It has been well documented in publications such as the National Academies of Science report “Rising above the gathering storm” on the importance of increasing the workforce of science and engineering professionals [1]. With the United States minority population growing, it is a grand challenge to increase the number of underrepresented minorities in science and engineering including computing [2]. Data from the 2009 Taulbee Survey shows a trend of decreasing enrollment in computer science for African Americans from the Baccalaureate to the Masters and Doctoral level [4]. The National Science Foundation (NSF), in response to this situation, began the Broadening Participation in Computing (BPC) program in 2005. The purpose of the BPC program is “to significantly increase the number of students who are U.S. citizens and permanent residents receiving post-secondary degrees in the computing disciplines” [6,7]. The challenge with initiatives like these is the sustainability of their investment once the funding is exhausted.

Story Creation

A subject area was selected for the users of the system to create the interactive stories used in this research. Graduate school fellowship options for African American computer science programs were selected. Content for the story stemmed from a 90-minute interview with a subject matter expert. The expert served as a director of a funding agency that supported more than 1,100 underrepresented minority scholars at 83 institutions in 29 states. Even though the expert directed a single program, he indicated a strong familiarity with other similar financial awards from conversations with awardees and staff members of those awards. Interviews were audio recorded and transcribed using an online transcription service.

Once the content was collected, the story was then created. The story created in this research featured a character named “Dante” who had completed a summer research experience and from that experience was then motivated to pursue a fellowship to attend graduate school.

System Development

A system was developed to house the Interactive Storyteller. The IS consisted of an Embodied Conversational Agent (ECA) to speak directly with the user. An ECA is defined as an “anthropomorphic interface agent which engages a user in real-time dialogue, using speech, gesture, gaze, and verbal and nonverbal channels to emulate the experience of human face-to-face interaction” [8]. The agent was created using SitePal, an online

conversational agent authoring tool. Studies have shown [9] that users of ECAs prefer to interact with agents of the same ethnicity and gender, so a dark complexioned ECA was selected. The agent created was exported to a format for embedding in an HTML webpage. JavaScript was the scripting language used to program the web application. Users of the system were told portions of the story using the ECA then probed for their input. The system was designed to recognize text typed by users using a web form placed next to the ECA. User responses affected the navigation of the story's plot.

Experimental Design

A quantitative, pilot study was designed to collect initial feedback about the system. Five undergraduate computer science majors participated in the study. The student participants represented a convenience sample of available participants. Approval to conduct the study was achieved from the Institutional Review Board (IRB) of the researchers' and participants' institution. Each participant was told an interactive story by the ECA and then was given a survey instrument that included demographic, attitudinal and open-ended items. Attitudinal questions were measured using a 5-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). The survey was created and distributed using the Qualtrics software application. It was hypothesized that participants would enjoy using the system and would be more interested in attending graduate school after the experience.

Results and Conclusions

Participants in the study consisted of three juniors and two seniors. See Figure 1 below. All five participants were African American males. All five participants believed that the agent focused on the topic throughout the story. Four of the five participants either Somewhat Agreed or Strongly Agreed that they enjoyed working with the agent and understood the concepts that were presented. Three participants indicated that the visual affects helped get the point across while two users neither agreed nor disagreed.



Figure 1: User Interacting with the System

Future Studies

There were several limitations to the study that must be addressed in future experimentation. First, the sample size was too small to produce any significant results. The next study must include more participants including female participants since the content of the interactive storyteller is applicable to both males and females. Second, due to time constraints, the users of the system only had one interaction with the system. Users will interact with the system multiple times in future studies. Lastly, there was no data collected on graduate school or summer research opportunity applications submitted. Also, the data collected was all after the interaction with the application and none before. Future studies must address all of these limitations.

Acknowledgements

The Ronald E. McNair Postbaccalaureate Achievement Program at Morehouse College provided funding for the undergraduate student author of this manuscript. Additional funding was provided by the National Science Foundation, Division of Human Resource Development. Award Number: #1043330.

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