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Exploring the Use of Pedagogical Agents in Online Human Service Courses

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Abstract

Human service educators have long struggled with how to best provide students with the communication skills required of entry-level human service professionals. Traditional methods of teaching in this domain include role-plays and case studies. While teaching such skills is easier in a traditional face-to-face environment, it becomes more complex with an emphasis on delivery of instruction at a distance. One way to solve this dilemma may be through the development of interactive web-based learning environments to teach helping skills. This paper describes the evaluation of three environments designed to meet this need. In the interactive environment, learners play the role of a human services helper while an animated agent portrays a client. In the modeling environment, participants observe a client-helper interaction between two agents. The helper-client script environment presents the students a text-based script. Data were collected to assess skill acquisition and usability. Findings indicate improvement in skills and positive user perceptions in all three environments.

Introduction

A primary goal in training human service professionals (HSPs) is to give them effective helping skills to work with clients on a daily basis. HSP services vary depending upon the employment setting and the clients. Despite this broad array of settings, HSPs share a primary purpose: to assist individuals and communities in functioning as effectively as possible (National Organization for Human Services [NOHS], 2004). Communication skills are so important for the HSP that the Council for Standards in Human Service Education [CSHSE] identifies effective communication strategies and skills as one of the 12 skill sets that entry- and mid-level human services workers use daily in their jobs (n.d.).

Human service educators face constant challenges to provide learning experiences that assist students in developing their skills for use with clients, co-workers, and supervisors. Human service programs offered through distance learning face even more difficulties as educators struggle with designing online and interactive video courses that provide opportunities for helping skills practice along with the evaluation of such skills. Techniques used in traditional classes such as role-plays, group work, and even videotapes are much more difficult to adapt for use in a distance learning setting. Add to this the challenge of large class sizes often found in distance learning, and teaching interpersonal communication skills at a distance becomes even more overwhelming.

To remedy this issue, educators may want to consider other less traditional methods to provide opportunities for their distance-learning students to learn and practice helping skills appropriate for the field. This idea is not without precedent as systems to supplement similar skills such as crisis intervention are being developed and tested (Seabury, 2003). This paper describes a web-based learning environment designed to provide online training in essential

skills. Three systems were compared, two employing pedagogical agents and one consisting of a script of a helper-client interaction.

Pedagogical Agents in Distance Learning

Pedagogical agents are computerized animated characters used as tutors in computer-based instructional environments. Such characters allow designers to create environments where learners can interact with a conversational partner to obtain advice, feedback, or instruction.

Consistent with early findings of human-computer interaction, agents allow for a realistic social interaction (Reeves & Nass, 1996). By using advanced technologies such as artificial intelligence, agents can be designed to support or facilitate learning by providing a teacher-student interaction with the learner (Shaw, Johnson, & Ganeshan, 1999; Slater, 2000).

Pedagogical agents have been used in many capacities and have been shown to be effective in teaching, largely due to their impression of a realistic social interaction (Atkinson, 2002; Lester, Converse, Kahler, et al., 1997; Moreno, Mayer, Spires & Lester, 2001).

Pedagogical agents are primarily designed so that a single user engages in an interaction with a single agent. However, some research focuses on learning when users are exposed to two types of agent environments: interactive environments where the learner directly interacts with the agent and vicarious environments where learners observe agent-agent interactions (Craig, Driscoll & Gholson, 2004). Findings from the aforementioned study indicated that learning gains were greater when learners interacted directly with the pedagogical agent (attributed to the active learning occurring during the interactions) while observance of a collaborative tutoring session produced smaller learning gains. The results from this study merit further investigation in domains where learners may benefit by observing effective interactions as a model of

appropriate behavior, such as in human services, consistent with findings in social learning theory (Bandura, 1977).

Some of the current uses of pedagogical agents include their presence in multimedia instructional environments teaching middle school botany (Moreno, Mayer & Lester, 2000), instructional planning (Baylor, 2002), computer literacy (Gilbert, Wilson & Gupta, 2005; Graesser et al., 1999), conceptual physics (Graesser, VanLehn, Rose, Jordan, & Harter, 2001), foreign language and culture for military personnel (Johnson, 2004), role playing (Prendinger & Ishizuka, 2001) and applications such as interviewing, negotiation, and patient assessment (Hubal & Guinn, 2001; Hubal, Frank & Guinn, 2003). In all of these instances, evaluations have supported the use of agents as a viable replication of a human-human interaction and as an effective tool in online learning. It is conceivable to think that another possible application for pedagogical agent environments is in teaching communication skills through the simulated interviews or through the vicarious observation of an interview between helpers and their clients. It is also important to compare these agent-inhabited environments with the presentation of an effective scenario via hypertext to determine that resources necessary for pedagogical agent development are well used.

Purpose of this Study

The purpose of this study was to investigate the use of pedagogical agents to assist human services students at a distance in practicing helping skills. The rationale for this investigation is the increasing call to deliver human services instruction to a large number of students at a distance. By determining if pedagogical agent learning environments are an effective delivery mode for practicing these types of skills, the researchers hope to add to the tools available for distance education in human services. In addition, this study will examine

whether the type of instruction provided by the pedagogical agent (interactive or modeling) is differentially effective.

This study answered the following specific research questions:

- Are web-based pedagogical agent environments effective tools for the practice of communication skills for online human services students?
- Are there differences in skill acquisition when human services students interact with a pedagogical agent in a case study learning activity compared to reading text-based case studies?
- Are there differences in skill acquisition when human services students observe an interaction between two pedagogical agents (modeling) compared to when they interact with the pedagogical agent in a case study learning activity (interactive)?

Study Design/Methodology

Participants

The participant pool included all students enrolled in human services courses during the last half of summer 2005. Three instructors offered extra credit to those students who participated in the pilot study. As an added incentive for participation, the researchers offered the chance to win a retail gift certificate when participants completed the experiment.

Instruments

Pre- and Posttest

Pre- and posttests were used to determine knowledge levels of the participants. Both pre-test and posttest were based on the Carkhuff Helping Skills Model (Carkhuff, 2000) and contained two components: a scenario followed by an open-ended measure of Helping Skills and a scenario followed by a Discriminating Measure of pre-written helper statements. In the Helping

Skills component, participants were asked to imagine that they had been talking to the client for approximately 15 minutes then were asked to read the scenario that followed. They were next asked to write down the exact words they would use when speaking with the client. These open-ended responses were then rated to provide the Helping Skills Score for each participant. The next component, the Discriminating Measure, asked participants to again imagine having been talking to the client for approximately 15 minutes and read the same scenario as before. This time they were given helping responses, one at a time, and asked to rate the effectiveness of each response on a scale of 1 (very ineffective) to 5 (very effective). These responses were then scored to provide a Discriminating Measure for each participant. Appendix A shows a sample of the assessments used in both the pre and post tests.

Web-based Environments

Three web-based instructional environments were created using Macromedia's *Authorware 7.1* (<http://www.macromedia.com/>). Two of the three environments included animated pedagogical agents created using *Microsoft Agent Character Editor* (<http://www.microsoft.com/msagent/default.asp>). Following are brief descriptions of the final environments used in the study. Appendix B shows screen shots of each environment.

Text. The text control condition is web-based consisting of a helper-client script commonly found in human services instruction. Users read three dialog turns and advanced the screen by clicking a Continue button.

Modeling . In the modeling agent environment, two pedagogical agents interact in a simulated case study environment using the same helper-client script as used in the text condition. Users observed two computerized agents (a Helping professional and her client) as

they portrayed the script. Users hear two dialog turns and advance the program by clicking a Continue button.

Interactive. In the interactive environment, the agent portrays a client, and users play the role of Helper. Users listen to the agent speak a prescribed script. Users then choose from a list of responses (each at a different level of helping), which then determine the next response from the agent.

Attitude Measure

Five Likert-type questions were used to determine the users' perception of the instructional environments. Items assessed the user's perceptions of the learning environments, including interest level and believability of the material using a rating scale ranging from 1 (strongly agree) to 6 (strongly disagree). Identical questions were given in each condition although the wording was adjusted to fit the constraints of the environment (i.e., the word "agent" was replaced by "material" in the text condition). Appendix C lists these items.

Procedure

Participants were either contacted directly by their instructors or by the researchers via email. For the larger groups, instructors were asked to create three groups of students and randomly assign each group to one condition. For the smaller groups, the researchers simply assigned one of the three conditions to the entire class. The researchers did the same with the remaining groups. Students received emails containing a brief overview of the study, instructions, and a link to their condition. When participants accessed the link, they viewed the informed consent form and were instructed to read over and click "Next" to indicate they understood the terms of the experiment. There were then directed to a page listing system requirements and links to necessary plug-ins tailored to each condition. After downloads were

completed, the participants clicked “Next” and were taken to the pretest. Once they completed the two-part pretest, participants started their assigned instructional unit. After the instructional unit, they completed the posttest, the attitude measures, and were asked to contribute any comments to improve the instructional unit. Data was collected and stored in a database for analysis.

Data Analysis

Pre- and posttest. The open-ended measure of Helping Skills was scored by two raters based on the Carkhuff Helping Skills Model (Carkhuff, 2000). Both raters completed approximately 4 hours of training until they had attained inter-rater agreement of 94% on the Carkhuff scale. Reliability was computed based on inter-rater agreement on 76% of the observations used for the pilot study. Participant responses on both the pre- and post-test received a Helping Skills Score between 1 and 5. An Analysis of Covariance (ANCOVA) using the pretest score as a covariate was used to determine if there were significant differences in Helping Skills Scores between conditions.

The Discriminating Measure of pre-written helping statements was scored using the Discriminating Response Score Sheet (see Appendix D). The expert’s rating of each response was subtracted from the student’s rating for the response, with the differences added together, then divided by 5 to compute the final Discriminating Measure Score. An ANCOVA (using the pretest score as a covariate) was used to determine if there were significant differences in Discriminating Measure Scores between conditions.

Attitudinal measure. Items from the attitude measure were combined to create a single attitude measure. Cronbach’s alpha for this scale was calculated at .899, so it was determined

that this was a reliable scale. An Analysis of Variance (ANOVA) was used to determine if there were significant differences in user perceptions of the environment between conditions.

Findings

Demographics

A total of 46 participants completed the study in one of three conditions (interactive, text only or modeling). One hundred percent of the participants were female. The majority of participants (70%) were completing their courses via distance learning, with the remaining 30% taking their courses on the main campus. Eighty three percent of the participants indicated their major was human services, and the majority were at the end of their studies (13%) completing all of their required courses by the end of the summer term.

Learning Outcomes

Programming issues resulted in a loss of some data from the pre and posttests. The decision was made to drop the participants with missing data. Therefore, in the analyses described below, data from only 24 participants are included. Before the Analyses of Covariance was run on both Helping Skills and Discriminating Measure, the researchers conducted an examination of the means to look for indications of differences in skill level. Findings indicated that the Helping Skills Scores showed improvement from pre-test to post test for the interactive condition ($MD = .21$) and for the helper-client script condition ($MD = .17$), but not for the modeling condition ($MD = .03$). Because of the method of scoring, improvement in the Discriminating Measure Score is evidenced in a decreased score. Although all three conditions showing learning gains in the Discriminating Measure from pre-test to post-test (interactive $MD = .18$; script $MD = .33$; modeling $MD = .24$), the improvement was not statistically significant. Table 1 shows these means for each condition separated by skill.

Table 1
Mean Comparisons of Pre- and Posttests by Condition

Condition	<u>Communication Skills</u>		<u>Discriminating Measure</u>	
	Pre	Post	Pre	Post
Interactive	2.23 (.68)	2.44 (.68)	1.07 (.24)	.89 (.32)
Helper-Client Script	2.23 (.77)	2.40 (.81)	1.13 (.35)	.80 (.34)
Modeling	2.43 (1.17)	2.40 (.65)	1.12 (.31)	.88 (.35)

() = standard deviation

Two ANCOVA were used to determine if there were significant differences in the posttests across conditions. To control for prior knowledge, pretest scores were used as a covariate in both analyses. In the Helping Skills Assessment, no significant differences were found ($F(2, 24) = .005, p = .995; MS = .002$), but the means indicate a slightly better performance in the interactive condition. Significant differences were also not evident in the Discriminating Measure posttest ($F(2, 24) = .170; p = .844; MS = .023$). The largest difference between the means (indicating better performance) was with the helper-client script condition.

The lack of significant findings is probably due in large part to the small sample size used in this experiment. However, plans are already underway for a second round of implementation, this time with a greater number of students from various educational backgrounds. We do feel that these findings are important as they serve as a proof of concept and a good means of formative evaluation.

User Perceptions

A One-Way ANOVA was used to determine if there were any significant differences in participant attitudes across the different conditions. No significant differences were found ($F(2, 21) = .507; p = .609$). However, it should be noted that the means from all conditions indicate a

positive perception of the environments in terms of interest, motivation, helpfulness and believability. Table 2 shows the mean responses for each condition.

Table 2

Mean Responses to Attitude Scale

Condition	Mean Response
Interactive	2.27 (1.04)
Helper-client Script	1.98 (.86)
Modeling	2.52 (1.24)

() = standard deviation

1=strongly agree; 2=somewhat agree; 3=agree; 4=disagree; 5=somewhat disagree; 6=strongly disagree

Formative Comments

Formative comments were collected from participants on the topic of programming and usability improvements. Participants were simply asked to provide the researchers with any comments they might have. The majority of comments were positive. Negative comments, for the most part, focused on technological issues related to the implementation of the pedagogical agents

Conclusions

Future Research

As this was a pilot study, the next step is to incorporate what was learned from this pilot into a revised web-based environment. Recommendations for change to the project, most of which will result in deviations from our original proposal, follow:

- The combination of useful elements from all three environments into one web-based learning environment.

- Converting the module to a more flexible platform to allow for improvements in the animated character including a better voice and the ability to gesture.
- Several adjustments will be made to the assessments to get a clearer picture of the effectiveness of the environment. First, instead of only one scenario as offered in the pilot, we want to offer 5 scenarios, providing a better measure of both the communication skills and the discrimination abilities of the research participants.
- In future evaluations, students from the Educational Curriculum and Instruction Department will be used as a comparison group with Human Services majors to help fine-tune the instruction so that it is effective for content novices.
- An increased sample size of evaluation participations to make more general conclusions about the effectiveness of the environments.
- As a means of formative evaluation, the ability to make comments to the designers will remain in the program.
- A comparison of performance scores and attitudes between those students taking the course through distance learning and those in the face-to-face environment is also planned.

The data collected during this experiment is informative to both human services and educational technology researchers by adding to existing literature on the implementation of pedagogical agent environments in various learning situations. Findings support the idea that elements from all three environments are effective tools for practicing essential helping skills. Additionally, the practical significance of this study is the creation of an effective learning environment that can be implemented efficiently with a large number of students.

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Appendix A
Sample Assessment

Part I.

Before you begin this program, we would like to explore your current knowledge of helping skills.

Imagine that you have been talking to the following client for about 15 minutes. The client is a 25-year old woman who is having problems at work. She says:

“I am so tired of being treated this way! The boss keeps one eye on me constantly. Every time I make a decision, he tells me I’m wrong. If I don’t make a decision and go to him for help, he tells me I should be making my own decisions. He says that’s what he pays me for. It seems no matter what I do, I just can’t win. I am so tired of this. I can’t wait ’til I find another job, but he’s not gonna give me a good reference.’

Now type what you would say to this client – the exact words you would use if you were actually speaking to this woman:

Part II.

The human service field requires professionals to be able to discriminate between possible helping responses to determine the effectiveness of a helping response. This next section will give us an idea of your current skill level at judging the effectiveness of a response.

Imagine that you have been talking to the following client for about 15 minutes. The client is a 25-year old woman who is having problems at work. She says:

“I am so tired of being treated this way! The boss keeps one eye on me constantly. Every time I make a decision, he tells me I’m wrong. If I don’t make a decision and go to him for help, he tells me I should be making my own decisions. He says that’s what he pays me for. It seems no matter what I do, I just can’t win. I am so tired of this. I can’t wait ’til I find another job, but he’s not gonna give me a good reference.’

Listed below are several alternative responses that might have been made by someone trying to help this client. Next to each response, type in a number to indicate your rating of the effectiveness of the response. Use the following scale:

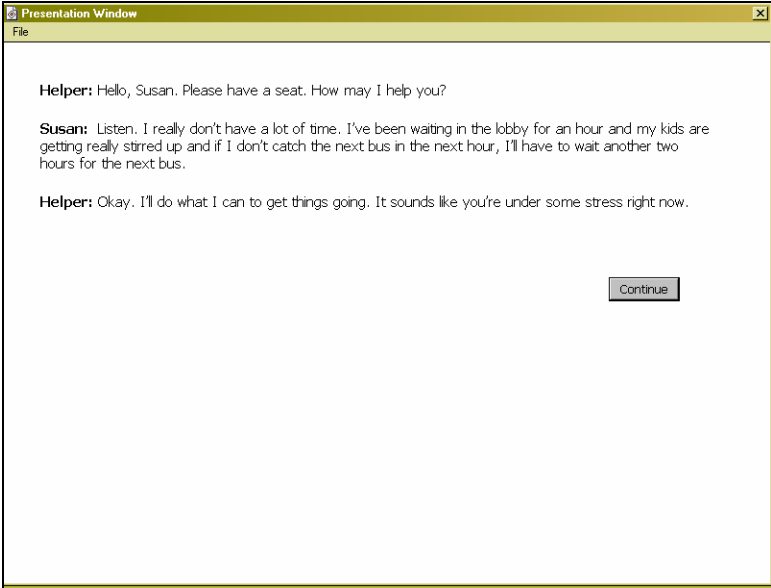
- 1.0 = Very ineffective
 2.0 = Ineffective
 3.0 = Minimally effective
 4.0 = Very effective
 5.0 = Extremely effective

- _____ a. “You feel angry because your boss won’t let you make decisions on your own and take responsibility for them.”
- _____ b. “It *is* a pretty tough work world out there, you know.”
- _____ c. “You feel discouraged because you can’t demonstrate that you’re able and willing to make decisions and take responsibility for them and you want to prove yourself. A first step might be to list all the things you could do to prove you are capable of making good decisions. Then, choose one to start with that your boss could accept.”
- _____ d. “In other words, your boss seems to be unwilling to let you make decisions on your own, too afraid that you’ll make bad ones...maybe not trusting you to choose well”

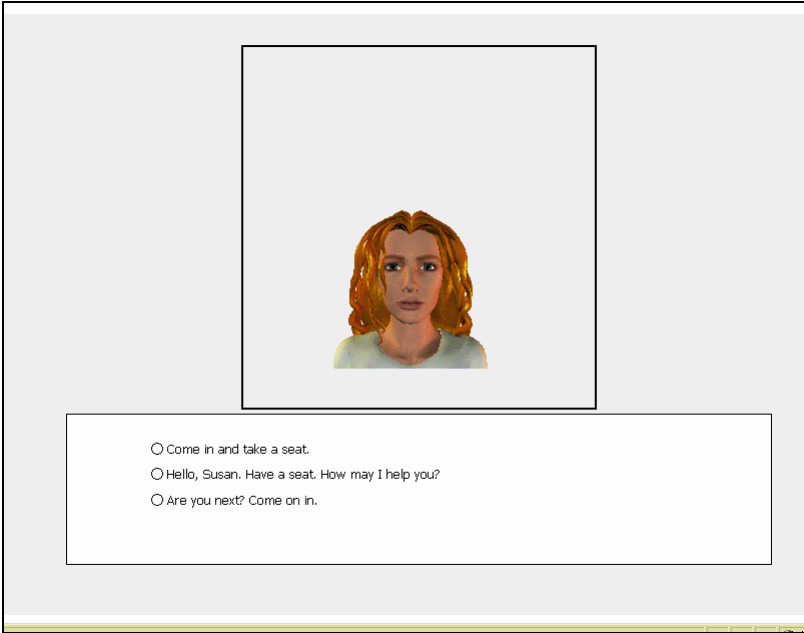
Appendix B

Screen shots of the environments

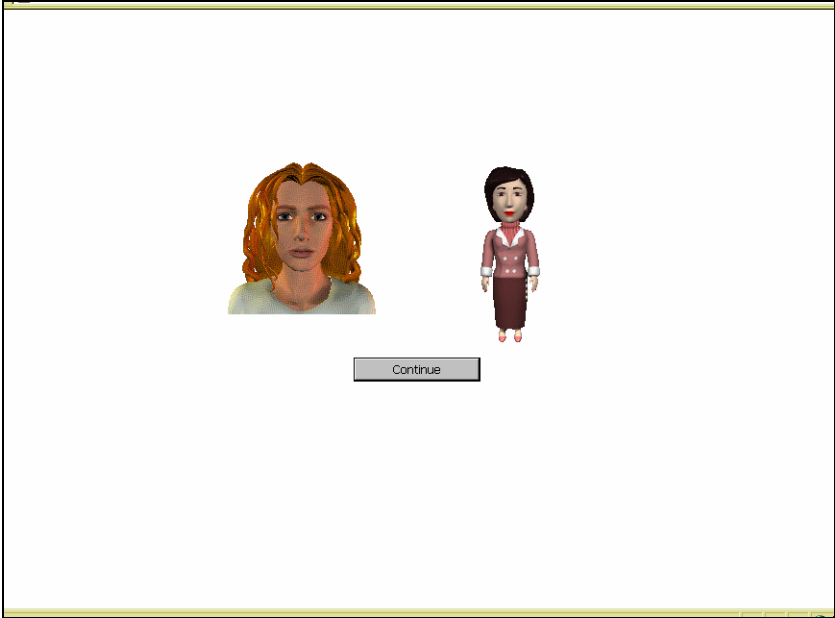
Screen from the Text Only environment



Screen from the Interactive environment



Screen from the modeling environment



Appendix C

User Perception Items

Interactive:

1. My interactions encouraged the development of my knowledge in this area.
2. Interacting with the agent increased my interest in the subject.
3. My interactions with the agent were motivating.
4. My interactions with the agent were helpful in learning about Human Services counseling.
5. I believed what the agent had to say.

Case Study Summary:

1. My interactions encouraged the development of my knowledge in this area
2. Interacting with the material increased my interest in the subject
3. My interactions with the material were motivating
4. My interactions with the material were helpful in learning about Human Services counseling
5. I believed what the material had to say

Appendix D

Discriminating Response Score Sheet

Response	Student Rating		Expert Rating		Difference
A	_____	-	<u>3</u>	=	_____
B	_____	-	<u>1</u>	=	_____
C	_____	-	<u>5</u>	=	_____
D	_____	-	<u>2</u>	=	_____
E	_____	-	<u>4</u>	=	_____
			TOTAL	=	_____
	Student Discrimination Score (TOTAL divided by 5)			=	_____

.5 is the desired Discrimination Score (Carkhuff, 2000)