The Effect of a Computerized Teaching Assistant on Student Interaction, Student Satisfaction, and Retention Rates of Students in a Distance Course

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As distance education programs proliferate and enrollments soar, faculty teaching distance courses are being pressured to increase communication and find ways to improve interaction with distance students. High attrition rates in distance courses are being partially attributed to a lack of communication and interaction with faculty (Carr, 2000). Instructors are feeling an increased burden as they deal with student expectation of 24-hours-a-day/7-days-a-week (24/7) availability and response (Young, 2002). In fact, the increased use of course Web sites, e-mail, and discussion forums have significantly increased faculty workloads in face-to-face classes as well as distance classes (Messing, 2002).

Intelligent Agents or "Knowbots", while still an emerging technology, have been touted as "a way to leverage scarce academic resources to assist students" (Knode & Knode, 2001, p. 125). An intelligent agent would be utilized as a teaching assistant, with a back-end database or knowledge base that is accessed by the user via an appealing graphic interface (e.g. cartoon character, animal picture, 3D image of the professor). These computerized teaching assistants can be programmed to answer questions, provide navigation assistance, generate e-mail responses, and even instruct and sympathize (Knode, 2001). This technology can significantly increase student interaction, without significantly increasing the instructor's workload.

The purpose of this study was to investigate the effect of a computerized teaching assistant (CTA) on student interaction, student satisfaction, and retention rates of students in a distance course. The CTA is humanoid and speaks in a human voice from recorded sound clips, to give the student the feeling that he/she is interacting with a person, not a computer program. It has been programmed to answer frequently asked questions (FAQs), provide positive feedback and encouragement to students, and to initiate contact with inactive students.

Relevance and Significance

Although the literature lacks substantive research on national retention rates in distance learning programs, reports indicate that retention rates are lower (at both the course and program level) in distance learning programs than in traditional, face-to-face programs (Carr, 2000; King 2002; Rovai, 2003). These studies indicate that there are a number of factors that contribute to this attrition. In fact, many of these factors also contribute to student attrition in traditional educational programs: time constraints, job and family responsibilities, and financial pressures. Outside of these factors, one factor that was mentioned is specific to distance courses – the lack of contact with the instructor and the resulting feeling of isolation. Picciano (2002) surveyed a group of graduate students in an online educational administration program at Hunter College in New

York City and found a strong, positive relationship between student perceptions of their interaction in the course and their perceptions of the quality and quantity of their learning.

Higher attrition rates have not stopped many college and universities from creating and expanding distance programs, nor has it stopped students from registering for distance courses. This is evidenced by the 49,690 courses offered via distance, up from 25,730 courses in 1994-5 (National Center for Education Statistics). A 2003 study by the Sloan Foundation indicated that 81 percent of all 5,010 U.S. higher education institutions offered distance education courses during fall 2002, with 97 percent of all public institutions offering at least one online or blended course, and 49 percent offering an online degree program. The study also estimated that 1.6 million students took at least one online course during the Fall 2002, and one third of these students took all of their courses online (Allen and Seaman, 2003).

Questions about the quality of distance courses, pressure from educational administration, and personal concern about retention and success in their classes have caused some faculty to feel increased pressure to provide more frequent and timely feedback to students, to respond to e-mail within a specified amount of time, and to increase interaction with students (Young, 2002). But this increased communication does not come without a cost. John Messing, Sub-Dean of Teaching Quality, Faculty Science and Agriculture at Charles Sturt University in Australia researched the hidden workload costs suspected to be associated with the use of new information and communication technologies. As course coordinator of the Graduate Diploma of Applied Science, he began archiving all of his e-mail messages in 1991. Messing traced the increase in his e-mail traffic for a ten year period, and calculated that the number of e-mail messages had grown 645 percent from 498 in 1991 to 3,212 in 2001.

He also separated the messages into five basic categories: subject content, subject management, course-related, administrative, and other. His figures indicate that e-mail messages actually decreased for subject content and subject management categories, but increased in course-related (advisory-related questions and answers for both current and prospective students) and administrative categories. He attributed much of the growth in course-related messages to an increased student expectation of almost instantaneous response. Lacking a quick enough response, students will send another e-mail message, sometimes generating three or four messages about the same question/problem in one or two days.

How can faculty increase interaction and communication with students, move it beyond the course management level, and still maintain manageable workloads? One solution would be to employ a computerized teaching assistant. The instructor would enter the answers to questions that individual students ask repeatedly each semester into a database. Students would ask their question of the CTA, which would extract the information from the database and provide the answer. If the question was not preprogrammed into the database, the CTA could generate an e-mail message to the instructor and advise the student of an expected response timeline. The CTA could also be programmed to demonstrate a procedure, provide a link to internal and external class resources, and even send reminder e-mails to students who have not yet completed an assignment. Students who are reluctant to admit to the instructor that they do not understand a concept might be more likely to ask the CTA to explain it. The CTA would also be available 24/7, and would be willing to go over a procedure as many times as it is asked.

One of the barriers to widespread adoption of knowbots as teaching assistants has been the technology. True intelligent agents that are capable of "learning" (i.e. autonomously adding information to its database) are still in the developmental phase and are cost prohibitive for most colleges. When the researcher contacted a development company about having a knowbot created for educational purposes that utilized natural language processing, she received a quote of $10,000 for initial design and development of a text-based knowbot that was "100 questions smart," i.e. programmed with answers for 100 questions. There would also be a monthly fee of $3,800 for maintenance and licensing.

Knowbots are being utilized in businesses where high cost is not a big deterrent. Companies are developing virtual assistants that give the user a tour of the company Website or explain the benefits of the company's products. Layne (2001) reported on knowbots used in the customer service area. NativeMinds, Inc. uses virtual representatives (vReps) to answer commonly-asked help-desk questions on the internal and external Websites of major corporations. The idea is to streamline redundant questions and free up "live" personnel for more productive activities. Kiwilogic, a European company, has developed natural-language interfaces called Lingubots to interact with customers using more logical conversation streams. This allows customers to ask their questions more naturally, and not have to phrase their question in unnatural "computerese" so that the computer can understand them. When a customer's question is not found in the FAQs, the caller is transferred to a real, live person for assistance.

Another company, LifeFX is working to make knowbots more human-like. They create photo-realistic images of people, animals, and imaginary creatures that respond to customer questions with spoken answers and appropriate facial expressions. The company asserts that customers will "bond" with these knowbots and will feel greater satisfaction with their interaction, and more loyalty to the site because of this bond.

Business adoption has spurred the technology forward, and affordable development packages are now becoming available that allow individuals to create virtual characters for personal and educational use. ActiveBuddy, Incorporated offers a product that allows the user to develop a customized, text-based virtual assistant that can be accessed 500 times per month for a onetime fee of $199.00. Haptek, Incorporated has a product called People Putty that for $59.95 allows individuals to create photo-realistic characters that speak using synchronized sound files, which can be incorporated into Websites or other compatible software environments. It will be a combination of these two technologies, ActiveBuddy and People Putty, that will be used for this study. The benefits of the products are the ease of development and the low cost. Although they will lack the sophistication and professional programming of previously mentioned tools, they will allow the researcher to inexpensively create tools that will initiate student interaction with the material and with the created humanoid CTA. For this study, the CTA will be created to pictorially resemble the instructor, and will be programmed to verbally respond using sound clips of the instructor's voice. Generic characters could be utilized in wide-spread adoption, or individual CTAs could be created to resemble instructors or live teaching assistants.

The potential for using knowbots to improve retention in distance classes has already been minimally explored. Thaiupathump, Bourne, and Campbell (1999) conducted a research study

using Intelligent Agents in an online workshop at Vanderbilt University. They found a significantly higher completion rate when an Intelligent Agent (or knowbot) was used in the workshop than when the workshop was offered without the use of a knowbot. They also found a moderate positive correlation between the number of times participants used the knowbots and the number of assignments completed by the participants in the session that had help from knowbots.

There were multiple knowbots used in the study that provided two main types of scheduled and on-demand assistance to workshop participants. There were knowbots responsible for tracking participants' work: required forum postings, course-reviewed message postings, and participants' homepage components. Participants could check the status of their assignments via the knowbot at any time. The knowbot was also programmed to automatically check the status of student work at designated points in the eight week term and to give a detailed report of the assignment status to each participant.

Other knowbots were designed to assist students with assignment submission. Each assignment had a tailor-made submission knowbot that notified the workshop facilitator about the submission, provided a template for the facilitator to check the participant's work, stored the results in the database, and sent a notification e-mail to report the results to the participant. The study was designed primarily to test the hypothesis that an intelligent agent improves retention rate, but additional measurement methods were employed that allowed the researchers to also examine how facilitation time, learner satisfaction, and motivation were affected by the use of knowbots in an asynchronous learning network.

Research results indicated that Intelligent Agents were effective motivators when used to remind students of missing or incomplete assignments. A participant survey was conducted at the end of the workshop, and results indicated that encouraging e-mail, immediate feedback, and reminders from the knowbots helped motivate the participants to complete assignments and the workshop. The survey results also suggested that a high number of participants in the knowbot cohort who completed the survey had positive attitudes about using the knowbots as tutors. The knowbots provided immediate feedback and offered possible solutions to help learners solve their problems.

Thaiupathump, Bourne, and Campbell (1999) tested a secondary hypothesis that using knowbots in the distance classroom would reduce time and effort of facilitators. The researchers, however, found the opposite to be true. Students in the cohort who used knowbots asked more questions than students in the other cohorts, and facilitators provided more detailed responses to these questions than to questions asked by the students in the other cohorts.
This increased facilitation time is another potential barrier to adoption of CTAs. Increases in workshop facilitation time will be problematic if the increased time is spent on "hand-holding" or step-by-step nurturing. Instead of being able to focus on facilitating discussion and interaction, many faculty get overwhelmed just handling the increased e-mail communication from students taking distance classes. Unfortunately, much of this e-mail communication is course management in nature with questions like "When will the grades for the last assignment be posted?" Young (2002) reports that some faculty feel that "e-mail can foster laziness in some students, who feel they can ask their professor how to do an assignment rather than thinking through problems themselves" (pg. 5). Students also seem bolder online, often questioning grades and disput-

ing point deductions from assignments, to the point where some faculty and graduate assistants admit that they dread checking their e-mail.

However, increases in workshop facilitation time that is spent answering content-specific questions or providing thorough, thoughtful feedback to students about assignments would be considered by most to be a positive result. Bower (2001) reports that personal interaction with students is one of the most gratifying aspects of teaching, and the loss of this interaction is one of the major concerns of distance education detractors. The Thaiupathump, Bourne, and Campbell (1999) study does not identify how the increased facilitation time is spent, and unfortunately messages related purely to course logistics were removed from the message count and analysis. The researchers acknowledge that a more thorough examination of the time the facilitators spend on various tasks is necessary to draw any firm conclusion about why facilitation time was higher for the knowbot cohort.

The Thaiupathump, Bourne, and Campbell (1999) study used only a text-based graphical user interface. This study included a humanoid virtual assistant. Reeves and Nass (1996) assert that people treat media, including computers, like they are human. Using a computerized teaching assistant that is produced with an animated 3D graphic and responds in a human voice will help reinforce the feeling that the student is actually interacting with a person. Carr (2000) reports that successful distance instructors communicate with their students regularly—sending e-mail, responding to student e-mails promptly, and posting photos of themselves on course Web pages. Prior to the beginning of the spring 2004 quarter, the BIS 101 Keyboarding course offered via distance learning at Sinclair Community College was split into two sections consisting of approximately 30 students each. Following normal registration procedures, students will self-select into one section of the course. One of the sections will be randomly selected to use a CTA during the duration of the course. Students will not be aware that one of the two sections will use a CTA. Ken Baker, Assistant Professor of Business Information Systems, has been teaching the distance section of this course for three years, and he will teach both sections of the course during the study.

The study will be designed to last for the duration of the quarter (eleven weeks). Students in the two sections will be taught by the same instructor, use identical course structure, textbooks, materials, and course management tools and interfaces. The only difference in course structure and delivery will be that the experimental group will use a computerized teaching assistant in their course section.

Retention for each course will be monitored throughout the quarter and will be analyzed and compared at the end of the quarter. All faculty/student communication for both sections will be captured, categorized, and analyzed. The number, length, and subject of all messages and communications will be recorded. The faculty member will keep a record of the purpose and amount of time spent on each class-related activity. The FAQ database will provide detailed data about who used the interface, the type of questions asked, the success of the inquiry (did the Knowbot have an answer) and dates and times of usage for analysis.

A student satisfaction survey was administered to both the control and experimental groups to solicit their opinion about the quantity and quality of interaction with the faculty member and

their satisfaction with the course. Students in the experimental group will also be asked to rate the quantity and quality of their experience with the computerized teaching assistant. The instructor will also be asked to provide feedback on any perceived differences in the quality or quantity of student interaction between the two sections.

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