Learning Computer with Virtual Sign Animated Pedagogical Agents

Benjaporn Saksiri
Ratchasuda College, Mahidol University, Thailand
rsbss@mahidol.ac.th

Abstract

This study investigates the use of Virtual Sign Animated Pedagogical Agents (VSAPAs) in providing concept of Computers and Communication advice in response to deaf/hard of hearing (deaf/hh) students' activities in the computer based learning. The primary analysis consisted of two features: 1) testing the VSAPA persona, and 2) conducting the usability test of VSAPA learning environment. The finding indicated that their interactions with the VSAPAs in computer-based learning were positive about the learning experience.

Introduction

To increase the number of persons with hearing disabilities receiving post secondary degrees in the computing disciplines. The educators seek to engage the computing community in developing and implementing innovative methods to improve the retention of these people. This study outlined the rationale for developing interactive Virtual Sign Animated Pedagogic Agents (VSAPAs) to support computer education for deaf and hard-of-hearing college students. Key issues include the topic of computers and communication concept with rich media resources incorporating 3D sign language.

Virtual Sign Animated Pedagogical Agents (VSAPAs), i.e. computer generated 3D sign language characters with pedagogical roles are onscreen characters which help in guiding the learner during the learning experience. Computer-based technologies hold grate promise both for increasing access to knowledge and as a means of promoting learning. Because many new technologies are interactive (Greenfield and Cocking, 1996), it is now easier to create environments in which deaf/hh students can learn by doing, receive feedback, and continually refine their understanding and build new knowledge. The new technologies can also bring exciting curricula based on real world problems into the classroom and providing scaffolds and tools to enhance learning. The advent of animated agents is the result of advancements in multimedia interfaces and text-to-speech technology. These agents can display appropriate emotions through facial expressions, gestures, locomotion, and intonation variations (Cassell et al., 1994; Loyall & Bates, 1995; Towns, Callaway, Voerman, & Lester, 1998). For example, COSMO(Lester et al. 1999a) uses a recorded human voice and full-body emotive behaviors to express a wide range of pedagogically appropriate emotions. Another system, AUTOTUTOR (Graesser et al. 1999), synchronizes facial expressions and intonation variations to provide feedback that reflects the quality of students' natural language contributions. Growth in multimedia technology use and the market for online education have created a demand for computer-based delivery of educational content. Associated with this demand has been

Paper presented at the Exploring Instructional and Access Technologies Symposium
National Technical Institute for the Deaf
Rochester, New York June 2008
http://www.rit.edu/~techsym

experimentation in development of character-agents with the potential to deliver educational content via sign language. Much of this development has concentrated on achieving realistic or lifelike agents, yet there is little research on the relationship between the way in which a sign language character-agent is represented and its effectiveness as a communicator. However, deaf or hard of hearing students who learn a sign language are learning to communicate using the visual system in place of the auditory system. Manual sign languages have grammatical structures, with affixes and morphology, but they are not translations of spoken languages. The perception of sign language depends on parallel visual perception of shape, relative spatial location, and movement of the hands-a very different type of perception than the auditory perception of spoken language (Bedllugi, 1980). However, visual pathways appear to go through several stages of processing before features of written language are extracted (Blakemore, 1977; Friedman and Cocking, 1986). When a deaf individual learns to communicate with manual signs, difference nervous system processes have replaced the ones normally used for language. This research investigated the use of virtual sign animated pedagogical agents which act as a medium for delivering feedback from a computer to its users.

VSAPA Learning Environment

VSAPA learning environment, shown in figure 1(a), is a computer program that facilitates computerized learning with sign language agent. The learning environment was developed by using Macromedia Flash Player. The development of VSAPA learning environment focused on three components: VSAPA, content on computers and communication and the learning interface. The VSAPA acts as a learning companion to deaf/hh students. In the computer domain, concept of "Computers and Communication" was taught by VSAPA advice and questions were provided to the students as they learned how to communicate with sign language through Internet or offline learning. VSAPA gave explanations on hardware, software and on how to set up the communication system. The VSAPA learning environment was developed as a computer-based instructional system that specified the teaching strategies and what to teach. The instructional strategy was used to cover various aspects of sequencing and organizing the content, to specify learning activities, and to decide how to deliver the content and activities. Our design strategy was to build a user friendly system that made learning easy and animation was used as the main visual carrier of information. The contents were developed based on a 3D learning environment, and human-like animated agents. The VSAPA coordinated with the student to carry out tasks on "Computers and Communication". This included: text, sign language with the agent, animations and adjunct questions. To effectively present these materials to deaf/hh learners, the content was developed using a series of items. Each item contained a short text screen, a corresponding animation explicating that passage of text, and a Thai Sign Language version of that text. Curriculum scripts were used to organize the topics and contents of the tutorial dialog. These scripts included tutor-posed questions, didactic descriptions, sample exercises, animations, figures, and texts. Furthermore all written texts would then easily be accessible to deaf/hh students. The script for computer literacy included three subtopics: hardware, software, and system demonstration. Deaf/hh learners typically first read the text screen, viewed the TSL agent, and then watched the media animations. After completing the activities, the learner should be able to select and apply technologies to the assigned tasks (figure 1(b)).

(a) (b)

Figure 1 (a) Screenshot of VSAPA learning environment; (b) Screenshot of exercise.

Evaluation

Participants

The participants were fifteen deaf/hh students at Ratchasuda College, Mahidol University, Bangkok, Thailand. They were all fluent in TSL. These participants had basic computer experience, including Windows, keyboarding skills, and the ability to access and navigate a learning media screen. Participants were students who are enrolled in an Introduction to Computer course. The study was conducted in the computer laboratories of the Ratchasuda College. The use of human subjects for this study was approved by the Human Subjects Review Board at Mahidol University.

Process

The evaluation was carried out in the usability computer laboratory at Ratchasuda College, Mahidol University. Participants were tested individually. On arrival, participants were informed that VSAPA was being tested to meet the needs of users. They were informed that their interaction would be recorded. They were asked to sign a release form and confirm the information provided about: job description, time in job, Windows experience, computer experience, and age. They also asked to rate their initial attitude toward the use of this application, on a scale of 1 to 5, (very

unfavorably to very favorably disposed to the use of VSAPA). In addition they were tested whether VSAPA were perceived as facilitating of learning, human-like, credible and engaging by using the Agent Persona Instrument (API) (Baylor & Ryu 2003). There were 4-9 items per factor and each item was scored on a 5-point Likert-scale with 1 indicating "strongly disagree" and 5 indicating "strongly agree." These instruments were adapted to video with sign language.

Results

The mean and standard error for VSAPA persona measures was shown in figure 2. They were measured in four aspects: facilitating learning (3.94), credible (3.49), human-like (3.37) and engaging (4.01). VSAPA's expression of affect impact on learners' perception of VSAPA persona positively. VSAPA's response to learners' affect enhanced learner motivation.

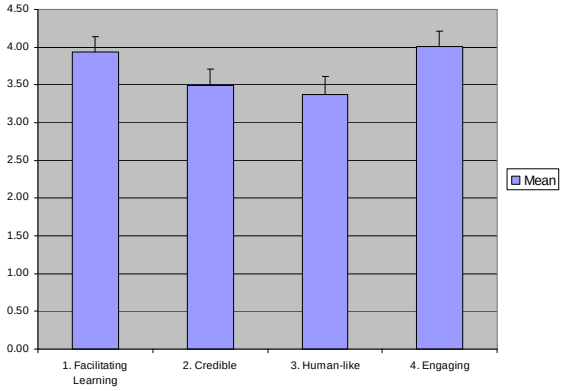

Figure 2 Mean and Standard Error for VSAPA Persona Measures

The satisfaction rates were calculated from the System Usability Scale questionnaires (Brooke, 1996). Each participant score was shown in figure 3, with score ranged from 40-70%. The mean satisfaction rate for the VSAPA learning environment was 57.4%.

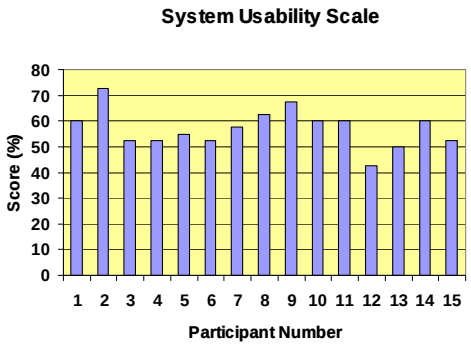

Figure 3 System Usability Scale Score

Conclusion

Virtual Sign Animated pedagogical agents offer enormous promise for interactive learning environments. Though still in the early stages of development, it is becoming apparent that this new generation of learning technologies will have a significant impact on education and training for deaf/hh learners.

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