The Interaction Behavior of Agents' Emotional Support and Competency on Learner Outcomes and Perceptions

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Method:

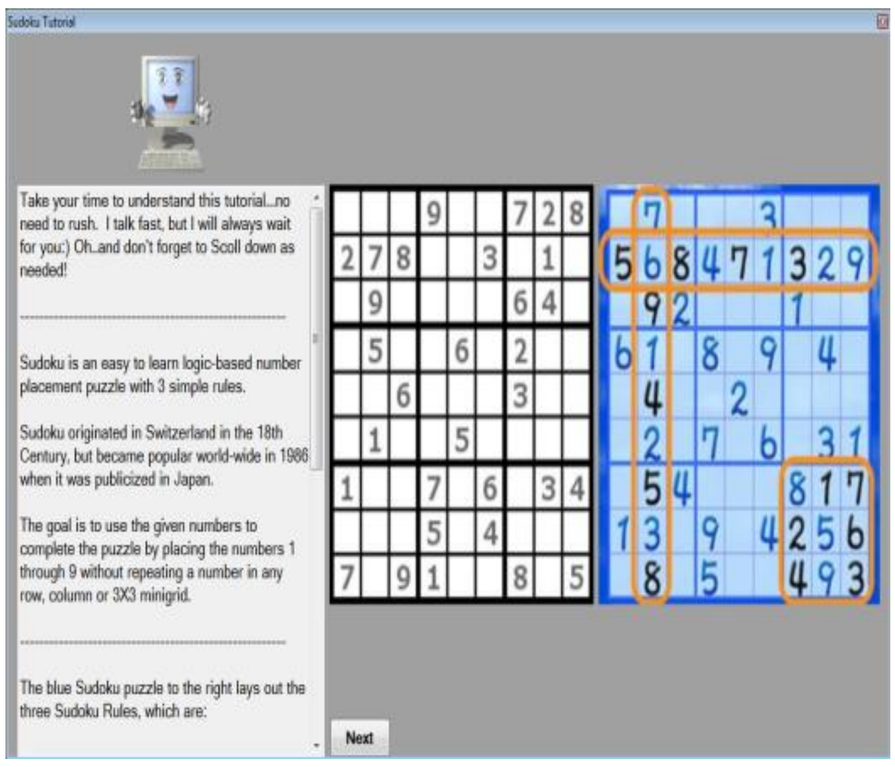
Experimental Design: An experiment based on a 2x2 mixed design manipulated two independent variables (i.e., emotional support and competency). The experiment investigated the impact of the independent variables on learners' *Sudoku Self-Efficacy (**SSE**)*, *Perceived Intelligence* (***PI***) of the agent, *Perceived Trust* (***PT***) of the agent, and performance. A learning environment, custom-built with Visual Basic.NET, was developed to teach participants how to play the game Sudoku with a pedagogical agent/virtual tutor, Audie. Audie is an animated Microsoft Agent that resembles a computer. Participants were assigned to interact with one of four experimental versions of Audie:

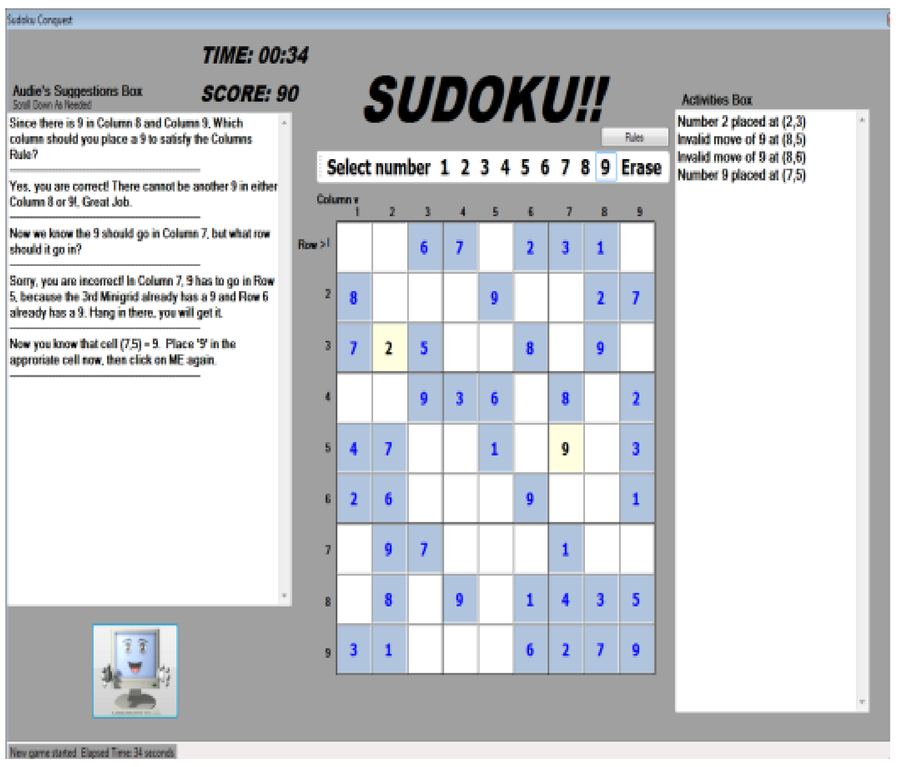
1. **Emotionally-Supportive and Competent (*ESC*)**
2. **Emotionally-Supportive Only (*ESO*)**
3. **Competent Only (*CO*)**
4. **Neither Emotionally-Supportive or Competent (*NESC*)**

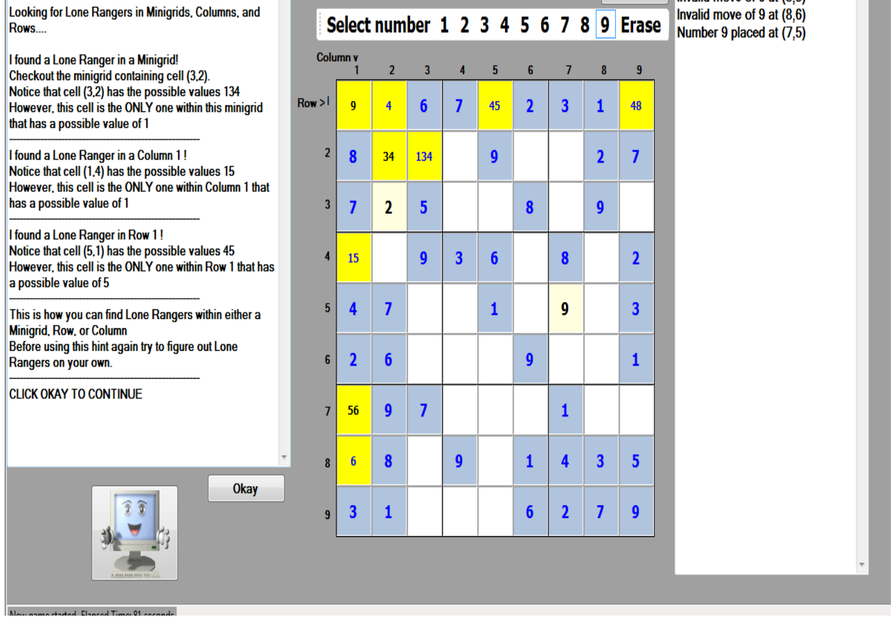
Sample Population: The population for this study was a sample of convenience and consisted of 35 volunteers (21 males and 14 females between the ages of 19 and 63). Eighty-six percent of the participants reported having advanced computer skills, and ninety-one percent believed the computer can help them learn difficult concepts. In relation to participants' initial Sudoku experience, 31% reported no prior familiarity, 31% reported a basic level of experience, and 37% reported advanced levels of experience. Of the sample, 65% were interested in increasing their Sudoku knowledge, and 86% were motivated to participate in the study. The ESC, ESO, and NESC agent conditions each consisted of 9 participants and the CO agent condition consisted of 8 participants.

Procedure: Following the pre-experiment survey, participants entered into the learning environment (shown below). The instruction was divided into four segments: a Sudoku tutorial, an interface tutorial, game 1 (a low-level difficulty puzzle for participants with no or basic Sudoku experience or a medium-level difficulty puzzle for advanced participants), and game 2 (a hard-level difficulty puzzle for all subjects). A mid-experiment survey was given between the two games and a post-experiment survey was provided after game 2.

Experimental Learning Environment:







Hypotheses

H_1: Learners who work with an ESO virtual tutor will have higher *Sudoku Self-Efficacy (SSE)* in a learned task than those who work with a CO tutor. ***(Supported)***

H_2: Learners who work with Emotionally Supportive tutor (i.e., ESO or ESC) will have a higher *Perceived Intelligence (PI)* of the tutor. ***(Supported)***

H_3: Learners who work with an Emotionally Supportive tutor will have greater *Perceived Trust (PT)* in the tutor than learners who work with a CO tutor. ***(Not Supported)***

H_4: Learners who work with an Emotionally Supportive tutor will demonstrate better performance from the learned task than those who work with a CO tutor. ***(Not Supported)***

References:

[1] Rosenberg-Kima, R., Plant, E., Baylor, A., Doeer, C.: Changing Attitudes and Performance with Computer-Generated Models. In: Proceedings of the 2007 Artificial Intelligence In Education Conference, Los Angeles, California, pp. 51-58 (2007)
[2] Fatahi, S., Ghasem-Aghaee, N.: Design and Implementation of an Intelligent Educational Model Based on Personality and Learner's Emotion. International Journal of Computer Science and Information Society. **7 (**3), 423-434 (2010)
[3] Kim, Y., Baylor, A.: Pedagogical Agents as Learning Companions: The Role of Agent Competency and Type of Interaction. Educational Technology Research and Development, 54 (3), 223-243 (2006)
[4] Bower, G. H., Forgas J. P.: Mood and Social Memory, Handbook on Affect and Social Cognition. J. P. Forgas Publishers, Lawrence Erlbaum Associates, Inc, Mahwah, NJ (2004)
[5] Kim, Y., Baylor, A.: 2006. A Social-Cognitive Framework for Pedagogical Agents as Learning Companions. Educational Technology Research and Development. 54 (6), 569-596 (2006)
[6] Kim, Y., Baylor, A.: Pedagogical Agents as Social Models to Influence Learner Attitudes. Educational Technology. 47 (1), 23-38 (2007)
[7] Bates, J.: The Role of Emotion in Believable Agents. Communications of the ACM. 3 (7), 122-125 (1994)
[8] Lee, J., Nass, C., Brave, S., Morisima, Y., Nakajima, H., Yamada., R.: The Case for Caring Colearners: The Effects of a Computer-Mediated Colearner Agent on Trust and Learning. Journal of Communication. 57, 183-204 (2007)
[9] Lepper, M. R., Chabay, R. W.: Socializing the Intelligent Tutor: Bringing Empathy to Computer Tutors. In: A. Lesgold (ed.) Learning Issues for Intelligent Tutoring Systems, pp. 242-257. Springer-Verlag, New York, NY, (1987)
[10] Creed, C., Beale, R.: Simulated Emotion in Affective Embodied Agents. In: Peter, C., Beale, R. (eds.) Affect and Emotion in Human-Computer Interaction. LNCS, vol 4858, pp. 163-174. Springer, Heidelberg (2008)
[11] Creed, C. Social Emotional Relationships with Computers. In: Proceedings of the 19th British HCI Group Annual Conference, Edinburgh, UK, pp.191-193 (2005)
[12] Compeau, D.R., Higgins, C.A. Computer Self-Efficacy: Development of a Measure and Initial Test. MIS Quarterly. 19(2), 189-212 (1995)