Agentic Engagement with a Programmable Dialog System

Amanda Buddemeyer
amb467@pitt.edu
Learning Research & Development
Center and School of Computing and
Information, University of Pittsburgh
Pittsburgh, Pennsylvania, USA

Leshell Hatley
lhatley@coppin.edu
Department of Mathematics &
Computer Science, Coppin State
University
Baltimore, Maryland, USA

Angela Stewart
angelast@andrew.cmu.edu
Human-Computer Interaction
Institute, Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Jaemarie Solyst
jsolyst@andrew.cmu.edu
Human-Computer Interaction
Institute, Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Amy Ogan
aeo@andrew.cmu.edu
Human-Computer Interaction
Institute, Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Erin Walker
eawalker@pitt.edu
Learning Research & Development
Center and School of Computing and
Information, University of Pittsburgh
Pittsburgh, Pennsylvania, USA

ABSTRACT

Dialog with a social pedagogical robot or agent is a powerful way for kids to learn [1, 5] but may limit the formation of an *agentic relationship with the technology* [9]. One main purpose of conversational agents is to allow the user to have a natural interaction that reduces the need to learn artificial conventions [6], but dialog systems fall short with respect to failure recovery, vocabulary diversity, remembering conversational history, and other measures [2, 3]. Further, Hill et. al. [4] found that people adapt their model of communication to match a chatbot's in the same way they do with a child or non-native speaker. Thus, users conversing with a pedagogical agent are implicitly trained to shape their behavior to suit the technology rather than shaping the technology. For young learners, particularly among populations that have been historically excluded from technology fields, this limits agency and reinforces marginalizing power structures [9].

This project combines a conversational agent with ideas of *agentic engagement* to help middle-school-aged children learn computational thinking. Agentic engagement is defined as students' constructive contribution into the flow of instruction and includes behaviors such as expressing interests, preferences, and opinions. It has been positively correlated to learning performance and motivation [7, 8]. Combined with a culturally responsive curriculum (CRC), agentic engagement may help to foster an agentic relationship with technology. Our system encourages learners to engage agentically by using programming constructs to change the agent's *vocabulary*, recognizing the intent behind a user utterance (an *invocation*), and defining the *action* the agent will take to respond to an invocation. Students use computational thinking concepts such as pattern recognition, abstraction, and decomposition to convert ideas into commands for the dialog system and to understand

which of their ideas can't be programmed with the technology as presented. They learn both to personalize the system today and to see the agent as a technosocial construct that they can shape in the future.
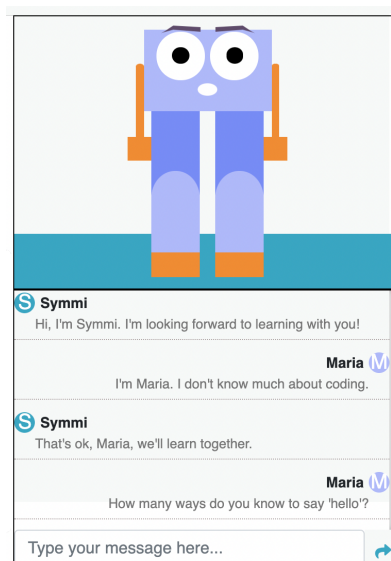

Figure 1: A screen shot showing the robot character and with its chat box below

Programming can be accomplished either using Google's Blockly visual programming tool (https://developers.google.com/blockly) or through conversation with the agent itself. The agent is embodied as a robot character, so agent actions can be verbal, physical, or both. Through social dialog with the agent, learners reflect on how computational thinking is relevant to themselves and their communities as part of a CRC, building on the work of Stewart et. al. [10]. For example, learners may be asked to reflect on the relationship between greeting behaviors and identity. After designing a greeting interaction, learners program the dialog system to achieve the greeting. Then learners may be asked to imagine how

they might hypothetically enhance the dialog system to make it even more capable of implementing their preferences.

In parallel to the development of the dialog system and curriculum, we will also adapt Reeve's agentic engagement instrument [7] for CRC. Our contributions will include this instrument, insights into the relationship between agentic engagement and an agentic relationship with technology, and insights into how a programmable dialog system impacts agentic engagement and learning computational thinking.

CCS CONCEPTS

• **Human-centered computing → HCI theory, concepts and models**; • **Social and professional topics → Computational thinking**.

KEYWORDS

agency, agentic engagement, dialog systems, culturally responsive curriculum

ACKNOWLEDGMENTS

REFERENCES

[1] Tony Belpaeme, James Kennedy, Aditi Ramachandran, Brian Scassellati, and Fumihide Tanaka. 2018. Social robots for education: A review. *Science robotics* 3, 21 (2018).

[2] Ana Paula Chaves and Marco Aurelio Gerosa. 2020. How Should My Chatbot Interact? A Survey on Social Characteristics in Human–Chatbot Interaction Design. *International Journal of Human-Computer Interaction* (2020). https://doi.org/10.1080/10447318.2020.1841438

[3] Ulrich Gnewuch, Stefan Morana, and Alexander Maedche. 2017. Towards Designing Cooperative and Social Conversational Agents for Customer Service.. In *ICIS.*

[4] Jennifer Hill, W Randolph Ford, and Ingrid G Farreras. 2015. Real conversations with artificial intelligence: A comparison between human–human online conversations and human–chatbot conversations. *Computers in human behavior* 49 (2015), 245–250.

[5] Nichola Lubold, Erin Walker, Heather Pon-Barry, and Amy Ogan. 2019. Comfort with Robots Influences Rapport with a Social, Entraining Teachable Robot. In *International Conference on Artificial Intelligence in Education.* 231–243. https://doi.org/10.1007/978-3-030-23204-7_20

[6] Kellie Morrissey and Jurek Kirakowski. 2013. 'Realness' in chatbots: establishing quantifiable criteria. In *International conference on human-computer interaction.* Springer, 87–96.

[7] Johnmarshall Reeve. 2013. How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of educational psychology* 105, 3 (2013), 579.

[8] Johnmarshall Reeve and Ching-Mei Tseng. 2011. Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology* 36, 4 (2011), 257–267.

[9] Kimberly A Scott, Kimberly M Sheridan, and Kevin Clark. 2015. Culturally responsive computing: A theory revisited. *Learning, Media and Technology* 40, 4 (2015), 412–436.

[10] Angela Stewart, Jaemarie Solyst, Amanda Buddemeyer, Leshell Hatley, Sharon Henderson-Singer, Kimberly Scott, Erin Walker, and Amy Ogan. 2021. Explaining Engagement: Underrepresented Learner Behaviors in a Virtual Coding Camp. In *The 22nd International Conference on Artificial Intelligence in Education.*