Socially Aware, Expressive, and Personalized Mobile Remote Presence: Co-Robots as Gateways to Access to K-12 In-School Education

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Interaction Lab

Objective

To improve access to in-school learning for K-12 students by developing socially aware, expressive, and personalizable remote mobile presence (MRP) co-robot systems and understanding their usability.

Background and Motivation

- Each year, more than 6.5 million Americans miss significant amounts of school, causing educational and social issues.
- Online learning and personal tutoring can address missed educational experiences but fail to address the lack of peer-mediated social experiences that can have ***serious effects on social and cognitive development***.
- ***MRP systems in classrooms*** could fill this gap. Important research problems in this area include communicative signaling (i.e., expressiveness) to co-located students, social integration, training, and personalization.

Overview of Past Work on This Grant

1. An **MRP Case Study** identified use cases and current shortcomings of MRP systems in the classroom.
2. Additional modalities for MRP **Expressiveness** were explored, and a **Simulated Game Environment** was created for user testing.
3. MRP **Personalization** and **Interpersonal Closeness** was studied between users from convenience populations.

Classroom Deployments for Homebound Students

The final year of funding focused mainly on analyzing survey, interview, and video data from classroom deployments.

Methods

Four homebound students attended class via the MRP system for multiple (2-7) weeks. Participants' experiences with the MRP system and their classmates were measured via surveys, interviews, and video recordings.

Evidence for High Variance Between Homebound Students

Recruitment efforts yielded four participants with **varying reasons why they were homebound** (see table below). Also, annotation of video recordings revealed a large **variance in student engagement levels** as measured by both speaking (below) and moving the MRP.

ID	Medical Context	Avg. Engagement
P1	Speech and motor challenges	Spoke in **32%** of 5min windows
P2	Mental health challenges	Spoke in **89%** of 5min windows
P3	Speech and motor challenges	Spoke in **96%** of 5min windows
P4	Mental health and motor challenges	Spoke in **38%** of 5min windows

Interviews with participants and their caretakers revealed **variance in how the MRP was beneficial** to participants' educational experiences:

- P1, usually confined to bed, enjoyed the system's mobility
- The limited field of view helped P2 focus
- The flexibility to attend school for only 1 hour per day and log out at any time fit P3's medical needs
- P4's parents felt the MRP brought greater visibility among school administrators to her unique needs

Conclusion

MRP systems were observed to provide life-changing benefits to homebound students during these deployments. Future MRP systems should accommodate their very different needs and engagement levels. The latest results with homebound students are being submitted to journals and conferences in 2021.

Other Recent Results

Operator Personalization of Telepresence Robots: two of our studies showed that operators' presence and individuation may be increased when they personalize the MRP, but three other studies we conducted showed that these personalizations may not be well-received by interlocutors [1].

Comparing Remote Learning Technologies in the Classroom: a study we conducted in four university courses found that students felt more present, self-aware, and expressive using an MRP than other distance learning tools [2].

Recent Outreach

This work was described to local inner city high school students at the virtual Robotics Open House in April 2020.

Recent Publications

[1] Naomi T. Fitter, Megan Strait, Eloise Bisbee, Maja J. Matarić and Leila Takayama. "You're Wigging Me Out! Is Personalization of Telepresence Robots Strictly Positive?", In *ACM/IEEE International Conference on Human-Robot Interaction (HRI '21)*, Mar 2021.

[2] Naomi T. Fitter, Nisha Raghunath, Elizabeth Cha, Christopher A. Sanchez, Leila Takayama and Maja J. Matarić. "Are We There Yet? Comparing Remote Learning Technologies in the University Classroom", In *IEEE Robotics and Automation Letters*, 5(2):2706-2713, Apr 2020.