Toy, Tutor, Peer, or Pet?: Preliminary Findings from Child-Robot Interactions in a Community School

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ABSTRACT

Research focused upon Child-Robot Interaction shows that robots in the classroom can support diverse learning goals amongst preschool children. However, studies with children and robots in the Global South are currently limited. To address this gap, we conducted a study with children aged 4-8 years at a community school in New Delhi, India, to understand their interaction and experiences with a social robot. The children were asked to teach the English alphabet to a Cozmo robot using flash cards. Preliminary findings suggest that the children orient to the robot in a variety of ways including as a toy or pet. These orientations need to be explored further within the context of the Global South.

CCS CONCEPTS

• **Social and professional topics** → **Children**; • **Computer systems organization** → *Robotics.*

KEYWORDS

Child-Robot Interaction; Robot Assisted Learning; User Study

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1 INTRODUCTION

Tremendous strides have been made in technology for learning and education, from collaborative online courses, to novel interactive experiences, to social robots [8, 10]. Social robots take on many different roles to support learning: as a peer and learning companion, as a tutor for one-on-one instructional learning, as a novice to support learning by teaching [2]; and sometimes as a pet for young children [1, 22]. Learning by teaching has been shown to improve motivation, self-confidence, and commitment to a task [18]. In Child-Robot Interaction (CRI) learning goals are also diverse, from language learning [14], to fine and gross motor skills such as handwriting [9], to dancing [1], to learning about nutrition [20]. Studies suggest that children orient towards anthropomorphic robots as informants and that they retain the information they provide for longer [5]. In addition, children develop a relationship with the robot *as close as a friend or a pet* over the long-term [22].

However, most CRI research is conducted in the Global North which may provide incomplete accounts of interaction. Social robots mimic human social interactions, which are inherently situated within diverse socio-cultural contexts, making it significant to explore CRI with children in the Global South [19]. In a cross-cultural study with over one hundred Pakistani and Dutch children, aged 8-12 years who played a card game with a social robot, the authors found that cultural background affected children's subjective experiences [19]. For instance, Pakistani children reported having more fun with the robot than Dutch children and they were also more interested in playing again. With regards to India, previous CRI research includes only one study with a robot parrot and children with autism aged 6-16 years [4] and 7-11 years [3] in Chennai.

In this paper, we contribute to the scant literature on CRI research in the Global South. We discuss a study where we introduced the Cozmo robot to children at a community school in New Delhi, India who live in a urban low-resource environment. Our aim is to understand children's experiences in a learning-by-teaching scenario. Based upon our initial review of CRI research in the Global South, this is the first study of its kind with young children and social robots in India.

2 METHODOLOGY

After receiving approval for the study from our institutional review board, we began a two-phase exploratory user study with 12 participants in a kindergarten class (age M=5 years; SD=1 year). First, participants were informally interviewed to understand their attitudes, opinions, and perceptions of robots. They were given a short demo of the Cozmo, introduced as *Raju* (a common Hindi name). Second, participants interacted with *Raju* to complete weekly learning tasks over a three week period to learn the English alphabet, including lowercase (week 1) and uppercase (week 2) letters, and association with objects (week 3) such as H for HAT. The tasks were designed together with their teacher. Participants worked in pairs to teach *Raju* ten letters in each session using flashcards with printed letter or objects. In some cases, the children paired with different partners each week. We conducted two sessions per participant per week, with each session lasting 10-15 minutes. Because the lighting in the classroom was inadequate for image recognition, *Raju* was controlled using a Wizard-of-Oz technique. All sessions were video recorded and consent was obtained from the children's parents. The schools' principal and HR head were also involved in preparation of the study.

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Figure 1: (left) Learning by teaching, (center) Bolo Raju, and (right) learning by teaching

3 RESULTS AND DISCUSSION

Results from the first phase indicate that the children were familiar with robots although they may have not interacted personally with one. For instance, they characterised robots as being able to "talk, sit, eat food, and work" (*"kaam bhi karta hai"* in Hindi). From the second phase we studied their interaction and conversations with the robot [12, 13, 15, 16] as discussed in the following three sub-sections.

3.1 The changing group dynamics

We found that the learning by teaching approach engaged the children in each task similar to previous research that discusses how children who adopt the role of an instructor, also known as the *protégé effect* [6], build confidence [11] and have improved learning outcomes [2]. However, challenges arose when children were unable to recognize a letter. The moderator would need to intervene to facilitate rudimentary knowledge acquisition of the letter itself. In the example shown in Figure 1 left, the children were unable to recognize the letter 't'. The moderator first asks the children "what comes after 's'"? The children guess saying the letter 'y'. The moderator then asks them to recite the ABC's together using this approach as a strategy for letter recognition. After some time the children identify the letter correctly as 't'. The moderator says - *"now tell Raju"*. The children then say *"Raju, this is letter 't'"*. Interestingly, during these instances the children looked to the moderator for confirmation rather than interact directly with *Raju*. The moderator appeared to be the more significant interaction partner for the children. From the children's perspective a teacher "by definition, knows" [11] and they internalize this even when given the opportunity to become a teacher if an adult is present.

3.2 Bolo Raju!

In the next example shown in Figure 1 center, the children were asked to teach the letter 'o' to *Raju*. They ask *Raju* if he knows the letter and *Raju* replies *no*. The children then says to *Raju* - *'o'*. However, the child in this case, looks at the moderator for confirmation and not at *Raju*. The moderator says - *bolo Raju*, which means tell Raju. The child then looks at *Raju* and says *Raju this is 'o'*, and Raju replies with *'o'*. The moderator asks *what did Raju say?* Both children respond looking directly at the moderator saying *'o'*. In this instance, letter learning was accomplished primarily through the moderator-student interaction where they confirmed with each other *Raju*'s responses. Further, the children ended up talking *at* rather than *with Raju*. Both moderator and student interacted with *Raju* as a device rather than a similarly embodied partner. Previous research has focused on making social robots more user-friendly and socially acceptable by designing empathetic characteristics [17] such as an expressive voice [21]. In this study, the children primarily interacted with the moderator in the initial sessions, possibly due to Cozmo's limited anthropomorphic attributes.

3.3 Pet or Toy?

We found that as children spent more time with the robot they began to develop a familiarity that could be conceived of as developing a relationship with *Raju*. For instance, in week two they were given more time to play (Figure 1 right) with the robot. This playtime was a useful way for them to understand the limitations and constraints for interacting with *Raju*. As the children became more comfortable with the robot some would hold *Raju* in their palms, talk to and pet him treating it as a pet. Overall, given the complex social dynamics of the people present during the study - the pair of children, the moderator, *Raju*, and the Wizard-of-Oz assistant - the Cozmo robot was oriented to more as a toy or pet rather than a tutor or peer. Even so, we found that it can be used as a novel tool for learning although perhaps not as a tutor or peer. Similarly, previous research has also shown that young children form connections with social robots as peers, friends, and in some cases, as pets [1]. For instance, a study with pre-school children, between 4-7 years old, showed that they enjoyed interacting with social robots that display emotion and movement over that of a conversational agent like Alexa [7].

4 CONCLUSION

While the field of CRI has made extensive progress in developing an understanding of how children learn and interact with social robots for a variety of educational goals, studies in the Global South are limited. Our aim in further research will be to examine the role social robots play as a tutor, teacher, peer or friend, a novice, or even a pet in the classroom. Specifically to understand the multiplicity of relationships that are instantiated to suit the particular needs of each child during a sustained interaction with a social robot and to understand whether and what differences appear within the context of the Global South.

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