A Design Strategy for Meaningful HRI Discussions in Elementary School

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Abstract

This position paper describes the experimental behavior design of the adaptable humanoid social robot Pepper in four different roles in class. In 2018 and 2019, we held English classes in seven Finnish elementary schools with a twofold mission. Our aim was both to showcase these four different social roles in an English class of 5th graders and to discuss future robot-assisted education and collaborative learning with the children. As a design strategy, we developed pedagogical robot applications and adopted the content to the curriculum of the 5th grade and to cultural phenomena that Finnish children aged 10-12 were well familiar with.

However, although one thoroughly designs for a meaningful experience of - and interaction with - a robot, other factors are at play that affect the perception of the robot and interaction with it. All things considered, we conclude that co-created robot applications, corresponding to the curriculum and contemporary youth culture that the children interact with co-present in class, offer an interesting and accessible opportunity for children to reflect on the use and design of socially assistive robots.

Author Keywords
Human-robot interaction; Design methods; Socially Assistive Robots in Education; Co-creation.

CSS Concepts
• Human-centered computing -> Interaction design -> Interaction design process and methods -> Contextual design

1. Introduction

Socially Assistive Robots (SARs) support students and teachers in educational contexts through social interaction in various roles. They serve as tutors, companions or peers, and teachers with the aim of supporting and enhancing learning outcomes [1]. We set out to discuss robot-assisted education and work life with children and chose to design trustworthy scenarios of how robot-assisted education may be shaped as a basis for reflection in class. Our background lies in exploratory design research, using in particular Research through Design methods, in human-computer interaction. Therefore, we wanted to explore whether designing curriculum aligned applications for a co-located, socially present robot could be the right design choice to make for our purposes of a meaningful and critical discussion of future robot-assisted education together with 10-12-year-old Finnish pupils.

This position paper is not to be considered as a formal content analysis of the discussion following the children-robot interaction but rather as a subjective, selective interpretation of the children's perceptions of the experience design, and how well it served our purposes of a group discussion on robot-assisted education. We found that the robot applications worked rather well as a foundation for a lively, fruitful and open-minded discussion on robot-assisted education with the children. Hence, we argue that a design strategy that involves the teachers prior to visit in class, which supports co-creation of robot applications with teachers and students, aligning them with curriculum and youth culture, is well worth considering as a valuable path towards a rich discussion with children on SAR's potential, use cases and implications. By sharing our experience of child-robot interaction in class as a basis for reflection on use of SARs, we hope to contribute to the discussion on how children may be given opportunities to discuss the topic and how to design for a relevant and accessible experience.

2. Experience Design Strategy

Within a national project on future technology and co-learning in education, we set out to discuss socially assistive robots together with children aged 10-12. We ascribed the robot Pepper four roles in the class, that of a study buddy/friend, a pupil that the child will teach, a collaborative agent in a team with human beings, and as a solitary teacher.

In order to meet the goals of the set design strategy, we decided to use a blend of proof-of-concept demonstration and speed dating [2] as a basis for the classroom discussion with the children. They were – voluntarily - interacting with six adaptable robot programs where the robot assumes three different roles, those of a peer, a teacher and a pupil. The fourth role of the robot was being an adaptive part of a team, together with two humans. Although the children didn't explore any of the content and scenarios in depth, our hypothesis was that the likelihood of them forming an opinion on the topic would be increased after

the opportunity to watch and/or try out interacting with the robot in these contexts.

The educational robot applications derive from two contexts. Firstly, the current curriculum of the 5th grade English subject in Finnish elementary school was at the core of the robot application content. As an example, we created a scenario where Pepper was acting out the nouns and verbs – in essence the homework of the English subject – much like in the game *Charades* with the children. The idea here was to explore the robot in a peer role, mimicking a fellow pupil practicing the homework with another child. For instance, Pepper pretended to fly like an airplane and asked the children, in English, *"What am I doing now?"* The robot adopted its answer to whether the response of the child was correct or incorrect.

Another example is the adapted Basic channel application, where the children were posing questions to Pepper, ranging from social and cognitive life of the robot to its personality. These discussion topics had been practiced in class together with the teacher prior to our visit as examples of how to greet and to make conversation in English.

Secondly, several schools had active daily life, dancing and motion in everyday life as a special theme. We chose to highlight this theme as well, and included scenarios where dancing was taught in class with the children and the robot, working together. At the time of the group discussions held with the children, the floss dance was immensely popular within this age segment. Most had heard of it, and many knew how to do the dance, popularized by digital games and popular culture. Thus, we designed a scenario where Pepper asked the children to teach it how to do the dance and for feedback as the robot did the floss dance. This work was co-created with students prior to discussions in class.

We always started each school session with a presentation of Pepper, its abilities and pre-programmed platform. We outlined together the framework of the lecture, in terms of transparency and trialability [3], voluntary interaction and the elements of the lesson, i.e. introduction, interaction and then finally, discussion.

Subsequent to the applications, an unstructured group discussion with teachers, assistive teachers, and the children took place. We tried to re-orient the discussion to social robots, in case the topic resided too much on automation of say vehicles or space crafts. The main focus was always to open a window to future possibilities and to keep an open discussion on what was on the children's mind.

We conclude that the choice of showcasing many shallow modes of interacting with a robot in various roles, instead of going into depth in one single use case, was pursuing our goal of having a lively discussion on SARs with the children.

The robot content seemed to be appreciated and our experience design managed well in most cases to maintain the children engaged throughout 45-50 minutes. However, in several classes, the oldest children were at times dissociating themselves, perhaps because they thought it was too childish, particularly the storytelling application. Also, the whole continuum of emotions and perceptions of the robot was present in

almost each class, where some of the children were enthusiastic and excited, others were calmly curious, and some were reluctant and hesitant to interact. A few children were very suspicious. Both positive and negative emotions were discussed and shared throughout the session and in the group discussion afterwards as well.

Naturally, we identified many factors influencing the children's attitudes towards the robot's performance, abilities and possible adoptions, reflecting the group discussion afterwards. We note that factors on a subjective, environmental, technical, and cultural level all affect the outcome of the child-robot interaction. These include prior work in class; context based issues such as lighting, buzz and sound in the surroundings; the children's prior experience of social robotics; children's and teachers' attitudes towards technology and robots in general; group dynamics in the class and the more or less supportive role of the teacher in the group interaction; the message, feeling and sense of security of the researchers working together with Pepper and holding the sessions; technical challenges and so forth.

3. Conclusion

The chosen design strategy served our goal rather well. It's our experience that it was the right thing to design several educational, adaptable applications to be interacted with a co-located, socially present robot in a group setting in class, in order to have a lively and insightful discussion on robot-assisted education in the future with 10-12-year-old pupils.

We support co-designing the applications serving as basis for discussion with children on the one hand, for relevant and meaningful topics and teachers on the other, who can point to meaningful content in current curriculum as well as introduce the topic prior to collaborative learning scenarios in class and assist in the discussion afterwards.

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