Proposal Research Traineeships 2019

1. Title of the Project

Implementing social robots in educational practice: developing linguistic skills of preschool children by storytelling with a social robot

2. Coordinators

Dr. Paul Vogt (DCA)

Dr. Rian Aarts (DCU)

3. Project Summary

In recent years, there has been an increased effort in developing robot tutors to educate both children and adults (Belpaeme et al., 2018). One application domain for robot tutors is second language tutoring to preschool children (Belpaeme et al., 2015; Vogt et al., 2019). This could either be tutoring a popular second language such as English to native speakers of, for instance, Dutch or tutoring the official school language to children from immigrant families. One of the advantages of using a robot is that it may converse with the child in both her first language (L1) and second language (L2).

In our earlier research, we have focused on the engagement of preschool children while interacting with a social robot (Baxter et al., 2017). In a next step, we have investigated the effect of L1 use in teaching L2 vocabulary of 4-6 year old Turkish children (Leeuwestein et al., submitted). Recently, we have focused on the implementation of social robots in L2 educational environments by investigating the needs and possibilities for their use by conducting interviews with 9 preschool teachers. We also conducted an experiment in which a social robot conducted a storytelling task with 38 preschool children from two schools (Goossens et al., 2019).

In the current proposal, we aim at investigating the implementation of social robots in educational practice by investigating the implementation process of using robots in the classroom in a detailed way. To this aim, we propose to use a storytelling task in this process, as teachers suggested this as a meaningful task to stimulate productive linguistic skills, which are of great importance for the school success of children. A social robot may provide a non-threatening and safe environment in which they can practice these skills. Children tend to consider interacting with robots being less stressful (Alemi et al, 2015), as a result of which children engage more readily with robots about things they think are boring when interacting with humans (Leyzberg et al., 2014).

In interviews with preschool teachers, we found they had a positive attitude towards the implementation of social robots in educational practice. They indicated the robot could be employed in teaching vocabulary, concepts and sentence construction, as these skills need much support and the teacher could use some help in these areas. A storytelling experiment was conducted in the earlier project (Goossens et al., 2019) on a small scale as a pilot, and lead to recommendations for improvement (e.g. set up, materials used). While in most studies, the robots were used at schools, the studies were held in a separate room to which children were invited to engage with the robot in a one-to-one experimental setting. To move forward, it is essential to bring the robots into the classroom as part of the teachers' daily program.

In the current project, we intend to develop and evaluate such a program for stimulating storytelling for preschool children using a social robot in close relation with educational practice.

Research questions

1. How can social robots be implemented in classroom with the aim of stimulating productive linguistic abilities of preschool children?
2. How do teachers evaluate the implementation of a social robot in their daily educational practice?
3. What are the effects of the implementation of social robots in storytelling on the productive linguistic abilities of preschool children?

Methods

The research questions will be answered in close collaboration with educational practice. Two primary schools will be asked to cooperate in the project. The set up of the materials of the storytelling program will be done in a close cooperation with the practitioners in these schools. The project entails both a qualitative process study in which materials are developed and implemented, and an evaluative study in which the acceptance of the program by teachers and its effects on children's abilities will be measured.

In the first phase of the project, on the basis of the foregoing study (Goossens et al., 2019), a storytelling program for preschool children will be developed. Each part of the program will be presented to the teachers of the two school and they will be asked for advice. Moreover, each part will be tried out with a small number of children. In this way, a program of 3 to 5 sessions with storytelling activities using a social robot will be developed.

In the second phase of the project, the program will be evaluated on its acceptance by teachers and on its effect on productive linguistic abilities of preschool children. The program will be implemented in the schools. The interactions between robot and children will be recorded on video. The videos will be analyzed qualitatively concerning the levels of engagement between child and robot. Next to that, the productions of children will be transcribed and analyzed on different linguistic levels, using the construct of academic language based on features that have been shown to be related to school success of children consist of lexical richness, syntactical complexity and abstractness (Demir-Vegter et al., 2014; Aarts, et al., 2016; Leseman et al., 2007). Furthermore, teachers will be interviewed on their perceptions on the usability of the social robot in their classroom and the perceived outcomes for their teaching practice.

Collaboration and project results

The research trainees will closely collaborate in data collection and analysis, but each with their own focus. One trainee will focus on the qualitative part of the study and will put most effort in the set up of the program. The other student will focus on the HRI aspects of this project and will put most effort in implementing the findings from the first part by programming the social robot. This collaboration also nicely integrates research approaches from the two departments involved. The project incorporates language acquisition research of both departments: educational aspects and academic language from DCU, and the research on second language learning using social robots from DCA.

The project will result in an initial draft for a publication to be submitted to a journal on child language development or educational robotics.

4. Project timeline

Month	Trainee DCU	Trainee DCA	Milestone
Sept 2019	Literature study		
Oct 2019	Setting up the storytelling program	Implementation in robot	
Nov 2019	Piloting in schools		Answer RQ1
Dec 2019-Jan 2020	Adjusting the program	Implementation in robot	Design of implementation
Feb-March 2020	Experiment		Data collected
April-May 2020	Data analysis		Answer RQ 2+3
June 2020	Drafting the paper		

5. Research Trainee Profile

Both trainees will be involved in the literature study, design, data collection and analysis. One trainee will focus primarily on the qualitative part of developing the program, while the other is more concerned with the task of incorporating the findings into the robot tutor. However, the trainees will be working together and sharing responsibility for both parts of the project.

We are seeking two enthusiastic students, preferably at the Research Master or Master levels (though excellent Bachelor students are also considered), who have excellent communication skills and preferably some background in language acquisition and -at least- affinity with human-robot interaction. For at least one of the trainees, basic programming skills (or the willingness to acquire these) are required.

Applications, including a motivation letter and a resume, should be sent to both Rian Aarts (A.M.L.Aarts@uvt.nl) and Paul Vogt (P.A.Vogt@uvt.nl).

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