

Using Social Robots to Teach Language Skills to Immigrant Children in an Oslo City District

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ABSTRACT

Social robots have been shown to help in language education for children. This can be good aid for immigrant children that need additional help to learn a second language their parents do not understand to attend school. We present the setup for a long-term study that is being carried out in blinded to aid immigrant children with poor skills in the Norwegian language to improve their vocabulary. This includes additional tools to help parents follow along and provide additional help at home.

CCS CONCEPTS

• **Human-centered computing** → **Natural language interfaces**; *User studies*; • **Computer systems organization** → **Robotics**.

KEYWORDS

social robots; language education; children; teaching

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1 INTRODUCTION

Children with an immigrant background, including refugees, may have difficulties learning and speaking the local language. This can be a real issue when the children begin in school and are expected to have a certain language proficiency. The situation can put a strain on the school system and teachers to provide the necessary basic language skills while also teaching the rest of the children. The problem is faced by several city districts in Oslo where up to 40% of the children who enter primary school need additional teaching in the Norwegian language. Children face further difficulties to

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Figure 1: Nao interacting with a small group of children in a care center context with staff present. Pictures of the terms to be learned are projected on the wall behind the robot.

improve their Norwegian if it is not spoken at home. Children may lose their motivation to stay with the studies and fall further behind their peers. Using social robots to help in the language training may offload some of the teaching load and keep the children motivated.

We are designing a program to use a social robot to improve immigrant children's ability to learn Norwegian as part of the language education in daycare centers (kindergartens). The program is designed with the help of parents and employees from a city district in Oslo. This paper documents the work that has been done so far, and how the study will be carried out over the next year.

2 RELATED WORK

Social robots have been used for teaching language in a variety of situations. The L2TOR project introduced a possible design for using a robot and tablet to teach children a second language [2]. Experiences from this study and other have lead to guidelines for teaching second language to children [3]. These guidelines highlight factors to consider such as the modality and if the robot acts as a peer, a teacher, or provides no feedback.

A recent large scale study compared how well 194 Dutch primary school children could learn English with a Nao versus a tablet application [8]. The study showed that children could retain the language they had learned from the robot at the same level they could with a tablet and that iconic gestures from the robot did not seem

to effect on how well the children learned. Our work differs in that we are teaching slightly younger immigrant children Norwegian so they can better participate in schools and their education.

Beyond language education, robots were programmed to show empathy to see how it affected children playing a game to learn about sustainability issues [1]. Others have also used robots and language to explore children’s trust of a robot [5].

This study draws inspiration from our earlier pilot study using social robots and tablets to teach Norwegian to children in daycare centers [4]. The pilot consisted of the robot together with a teacher, a group of children, and a tablet. The pilot showed that the children needed personalized one-on-one attention that could be provided by the robot, and that the speech recognition for Norwegian (especially for children, a general speech recognition problem [6]) must be improved. In addition, we are using guidelines from [3].

3 SMALL-SCALE STUDY AND INTERVIEWS

To help children before they enter primary school, we targeted day care centers in the Grorud district of Oslo. Most children in the district attend daycare centers from ages one to five. The pedagogic staff of the centers have developed a language program, *språkduj* (language shower), to aid children in expanding their Norwegian vocabulary. Currently, the program is implemented as printed pictures of things for which the proper term is to be learned. The basic principle has children presented with a corresponding visual and the question “What do you see here?” The children have to recall the correct term from their memory and its pronunciation by saying the word aloud. To reduce issues with the robot recognizing children’s speech, the pedagogic staff would assist the children in the process and determine if the answer was correct.

A small-scale study was conducted in Autumn 2018 in selected daycare centers. The trial involved a prototype using the Nao robot [7] that stood in front of approximately 15 children (Figure 1). The Nao was linked to a web application that was projected on the wall and showed pictures of the terms to be learned (e.g., trousers, chair, fork, showers) one at a time. The robot asked what the children saw, processed the children’s answer in its speech recognition engine, and determined the answer’s correctness.

The study showed promising results in children’s motivation as compared to the language program without a robot. From the study, the robot’s main advantages appeared to be its attractive, human-like appearance; its not-threatening size for children; speech synthesis and recognition; and the ability to move, gesture, and dance, including support for light, as well as sound and audio effects.

We conducted several interviews and workshops with pedagogues and other daycare center staff to find out how a robot could be part of their language program. We also interviewed some of the children’s parents to understand the parents’ Norwegian abilities and if children spoke (and learned) Norwegian or other languages at home. Overall, twelve people were interviewed. Suggestions included having the children in dialog with a robot and including game elements that would track each child’s progress to help motivate the children. The interviews also revealed it was necessary to include parents in the language teaching since they can help maintain the children’s motivation at home, and they may also benefit from learning Norwegian themselves.

4 LARGE-SCALE STUDY DESIGN

We used the suggestions from the interviews and workshops to build on the previous study by developing a digitalized version of the language program, and expanded it to include adults. The program includes a Nao, a tablet app, and a mobile app. The tablet app is a prompt and starting point for lessons with Nao. For instance, in one interaction, the app shows a picture with three socks. Nao asks the children what is the pattern of the sock in the middle? Without Nao, the app shows four answer alternatives in a multiple-choice manner. To maintain motivation, Nao will provide varied supporting feedback and give rewards in form of oral acknowledgments, dances, and suitable light and sound effects. The program also adds a mobile application that targets the children’s parents at home. The mobile app helps to keep track of a single child’s or group of children’s progress and can be used to have discussions about language at home. Currently, the app contains the entire language program and all instructions for the robot. The robot instructions is an add-on available only in the daycare centers. If the Nao is available, it connects to the app and coordinates the walk-through of the language program in a joint manner.

The study will begin in Spring 2020. The main objectives are (1) verify the technology, pedagogical, and gamification concepts; (2) measure gains in children’s permanent vocabulary using Nao and the accompanying apps compared to the traditional language program. The goal is the children will be better prepared to meet the language vocabulary requirements of the primary school, with a further positive impact on work life and social life as well.

The study will be longitudinal and use a between-subjects design. Some district daycare centers will have access to the digitalized solution, others not. The study will start at one daycare center to control for problems and added to other centers as the system stabilizes. Ideally, the centers’ employees will control the pace.

We will compare the language development of the children that use the program versus those that do not. We plan to test the children’s language skills at the beginning of the study, during the study, when it terminates, and 6 months after the trials’ termination. This involves testing the words that have been taught in the robot sessions to measure language skills.

5 DISCUSSION AND CONCLUSION

Involving parents and daycare employees has helped create a novel system for language training of immigrant children and maintaining their motivation. There are potential issues, particularly in speech synthesis and speech recognition for children, that may cause the system to fail. We are continually investigating these issues and hope to have them addressed before or during its use in the first daycare center. It will also be interesting to see how the robot becomes part of each daycare center’s education program. Our study design should provide good evidence to whether a social robot can be an important tool for immigrant children to learn the Norwegian language before entering primary school.

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