Social Robots Introduced and Matured into Daily Education

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Abstract. In this paper, we present a methodology that Blue Ocean Robotics, as a leading provider of emerging robotic solutions, has compiled based on experiences collected from the execution of implementating robots in Danish municipalities. Furthermore, we report on the results from our latest project where three social robots were successfully implemented into Danish education institutions, increasing the children's concentration and learning efficiency.

Keywords: Child Robot Interaction, Daily Education, Social Robots

1 Introduction

Introducing and maturing robots into educational institutions comes with many challenges with regards to the involved pedagogues, their available time and lack of technological skills as well as general technical issues such as poor internet connection. So far, no evaluation model has been established based on real world experiences.

2 Method

The social robots used for the project presented in this study are Romibo, Milo and Nao. Romibo is a social robot by Origami Robotics that is controlled from an iPad and used to train social and academic skills, including social interaction and social communication. Milo is a 56cm tall humanoid robot by RoboKind for children with special needs. Its face has seven degrees of freedom, which allows it to express various emotions. Milo is used to teach children to express empathy, acceptable behavior in social situations, self motivation and to understand feelings. Nao is a 58cm tall humanoid robot by Aldebaran that is very rich in its movements. It is used to increase social interaction in the class room by encouraging children to move and play games.

Participants in our Innovation Projects are municipalities that are interested in implementing innovative robotic solutions. The robots are introduced to the organizations during 14-16 weeks including two to three workshops, weekly interviews and inquiry

forms. In addition, teaching personnel are offered training sessions. For this study, five Romibos were used at a primary school with 29 five to seven-year-old children. One Milo was used at a kindergarten that is practicing inclusion with a seven-year-old boy with special needs. One Nao was used at a kindergarten with a group of 12 three to four-year-old children. The pedagogues working with the children and the robot were the class teachers of the respective groups.

3 Analysis

Based on our experiences from around 20 executed Innovation Projects with different municipalities, we developed an analysis that comprises seven factors: 1) User experience 2) Work processes in the Organization 3) Competences of the personnel 4) Service/ Support/ Training 5) Infrastructure of the respective building 6) Business-Case 7) Technical adaptation of software and hardware. Factors 1-5 and 7 are evaluated with the help of qualitative data. Factor 6 is evaluated quantitatively. Business case calculations for social robots are focusing on situations in which the robot can optimize concentration time and learning efficiency for children. The calculations are done in cooperation with the respective pedagogues.

4 Results

The results show an increase in concentration time and learning efficiency. Children working with Romibo could in average concentrate 8 min longer than without the robotic solution and their learning efficiency increased by 18%. Teachers estimated that the children working with Nao could concentrate 14 min longer and their learning efficiency increased by 2,3%. The child playing with Milo could concentrate 23 min longer with an increased learning efficiency from 70% to 100%.

5 Challenges

Challenges that we face are to identify the right user type for the robot, the time pedagogues have available to prepare and conduct the sessions, their lack of technological skills, their willingness to contribute to business-case calculations and issues with the building's infrastructure, especially poor internet connection. We are currently trying to find particular solutions with all involved for these challenges.

6 Conclusion

In this paper, based on longitudinal data, we have described a 7-factor evaluation model for maturing robotic solutions in organizations. In addition, we have presented quantitative results for one of these factors, the business case, for three social robots. The results show that long-term usage of these robots in the classroom can increase children's concentration and learning efficiency for certain exercises.