

# Social Robots' use (Social Assistive Robot- SAR) in developing symbolic play and imitation skills in students with Autism Spectrum Disorder (ASD)

Konstantina Marathaki<sup>1</sup>; Christina Charitou<sup>2</sup>; Maria Polychronaki<sup>2</sup>

<sup>1</sup>Special Elementary School for Children with ASD, Piraeus, <sup>2</sup>University of West Attica

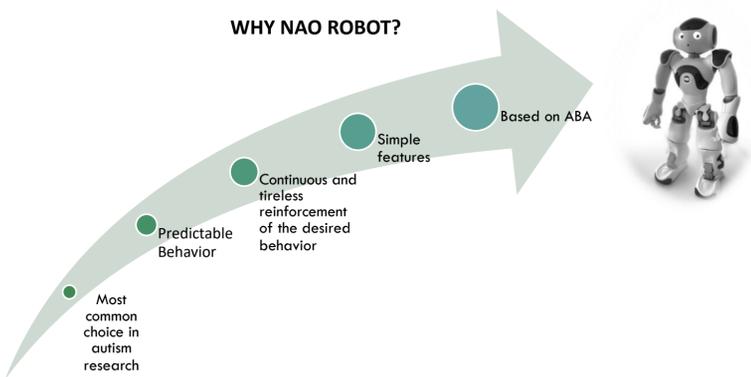
## Abstract

The research area of the presented study was “Education of Children with Autism Spectrum Disorder (ASD) using Humanoid Robots” and it took place under the ICTE Master Program [1]. Purpose of this research was to improve the skills of symbolic play and imitation of children with ASD through robot-based intervention sessions. Eye contact, attention and imitation skills of the children presented improvement after the sessions.

## Introduction

It was in 1976 when robots were used for the first time as an educational and therapeutic tool, by Emanuel and Weir, who used a turtle-shaped robot [2]. Saleh et al. [4] in their literature review related to ASD and the use of a robot, found that the most frequently used robot was NAO. Robaczewski et al. [5] in their literature review (2012 to 2019) report all surveys that concern only the ASD and the use of NAO. Based on those, researchers mostly used NAO robot to examine the improvement of social skills (imitation, eye contact, interaction, attention), and emotional skills (recognition of emotions, empathy). However, So et al. [6] examined how to develop role-playing skills in students with autism aged 4 to 6 years through dramatization using social robots.

### WHY NAO ROBOT?



## Methods and Materials

In this research which, a robot based intervention took place in order to improve function and pretend play skills of children with ASD.

Five students (2 girls and 3 boys) aged between seven and ten years old participated in this study. All students were diagnosed with ASD and they were attending the Special Elementary School for Children with Autism of Piraeus. All students were low functioning and non-verbal.

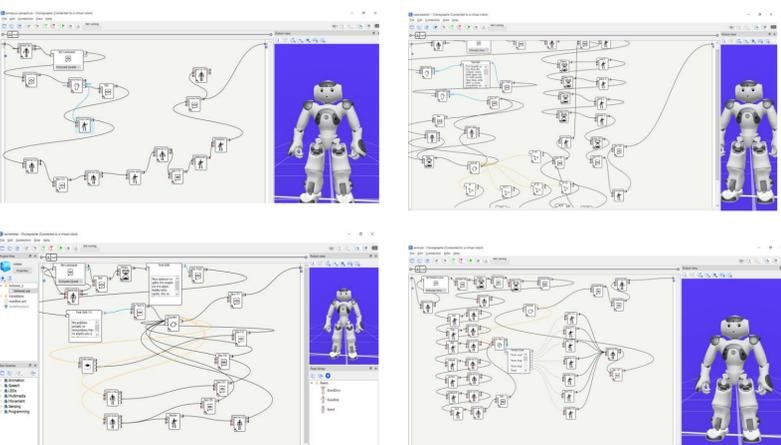
Four variables were measured: (a) Eye contact (>2”) [3], (b) Attention (>3”) [4], (c) Imitation (Frequency) [4], (d) Engagement (Likert) [3].

Data regarding the aforementioned variables were collected with a camera and two observation grids were used listing the four variables.

For the robot based interventions, six activities with NAO robot were planned, designed using Choregraphe 2.8.6.23 [6] and implemented : (a) NAO presents itself, (b) Touch me, (c) NAO-NAO are you there?, (d) Let’s cook, (e) Lets behave like the animals and (e) Song and dance (closing)

**Table 1.** Activities in Choregraphe 2.8.6.23

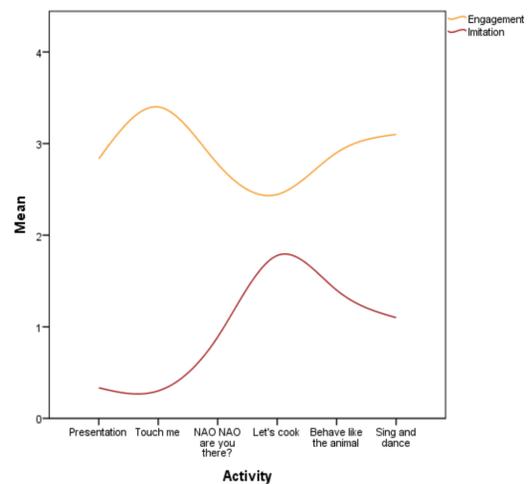
Presentation	Touch me	NAO NAO are you there?	Let’s cook	Behave like the animal	Sing and dance



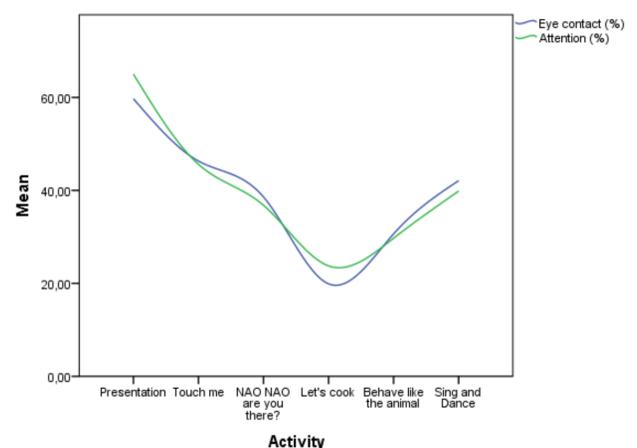
**Figure 1.** Flow diagram panels

## Results

- NAO robot increased the frequency of eye contact, attention, imitation and engagement of the students with ASD
- NAO robot promoted children to functional play behavior and enriched their pretend play behavior
- Activities in which there was interaction increased the engagement
- Activities with audio-motion combination increased eye contact and attention
- Activities with familiar subject increased imitation behavior
- Low functioning children with ASD need physical guidance



**Chart 1.** Engagement and imitation in activities.



**Chart 2.** Eye contact and attention in activities.

## Limitation & Future Work

This study had a few limitations. First of all, the sample of students was small and the duration of the study was short. In addition, technical problems of the software and the connection between computer and the robot restricted the intervention process.

Further work needs to be done with more children with ASD and the interventions to have longer duration. Delays and connection interruptions need to be tackled in order for the research to be more precise.

A follow-up study is needed to establish the right characteristics of the activities that a robot based intervention should contain.

Lastly, the independency of adults with ASD can be further be examined using adapted intervention process.



**Figure 2:** Let’s cook



**Figure 3:** Presentation



**Figure 4:** Behave like an animal

## Conclusions

To sum up, our work was to examine whether Social Robots were effective in fine-tuning play skills of children with low function ASD. Five children with ASD called to interact with NAO robot.

While physical guidance was necessary at first time to become familiar with the NAO robot, during post-test the childrens’ pretend play behavior enhanced. Final, results suggest that the intervention increased children’s play skills during and after the experiments.

## References

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