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Supporting Early-childhood Teachers with Integrating a Humanoid Robot to Enhance Learning

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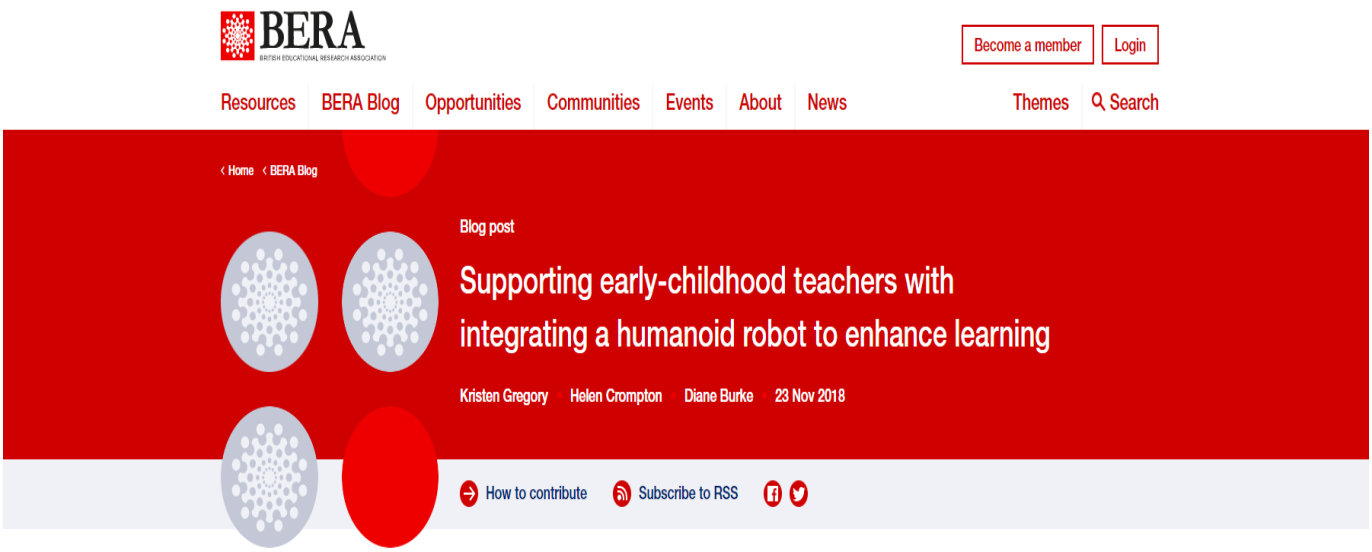

Anthropomorphic robots are increasingly being used as a technology in early childhood settings, and they have been found to enhance social interaction (Tanaka, Cicourel & Movellan, 2007), support foreign language development (Mazzoni & Benvenuti, 2015), and gain student attention and interest (Ioannou, Andreou & Christofi, 2015). Furthermore, integrating a humanoid robot can provide affordances across all domains of the Head Start Learning Outcomes Framework: approaches to learning; social and emotional development; language and communication; cognition; and perceptual, motor and physical development.

Supporting early childhood teachers with professional development and opportunities to collaborate is important as they develop their knowledge base and experience with integrating new technologies. In our research project, described in a new article in the *British Journal of Educational Technology* (Crompton, Gregory & Burke, 2018), we worked with six early childhood teachers and assistants in an urban early childhood center as they explored using a NAO humanoid robot in their instruction. They participated in training sessions to learn the

basic functions of the robot, and they engaged in collaborative brainstorming sessions with their peers focussed on how to integrate the robot into their instruction to align with the Head Start framework.
When planning for the integration of the NAO robot into learning activities, the teachers held high expectations and were open minded about the process and outcome. They initially planned to use the robot as a tool to supplement learning in a pre-planned activity. They planned to use the robot in their lessons in whole-group, small-group, and one-on-one activities. They anticipated using the robot during daily activities in which the robot could take on the role of the teacher and prompt students with directions and encouragement.

In their classrooms, the teachers implemented lessons integrating the NAO robot across all five of the learning domains represented in the Head Start framework. For example, lessons included opportunities for students to:

- ask questions about what they were curious about regarding the robot (approaches to learning)
- care for the robot (social and emotional development)
- ask questions of and talk with the robot (language and communication)
- count and compare the robot's number of fingers with their own (cognition)
- dance and walk with the robot (perceptual, motor and physical development).

Despite addressing these domains, the teachers often allowed the robot and children to guide the activity, causing the lesson to go off course and impeding the predetermined learning outcomes.

> ‘Teachers used the robot as a tool for classroom management and guiding student behavior – for example, the robot provided opportunities for the students to practice taking turns, share, and develop patience.’

The teachers and students exhibited excitement regarding the presence of the robot, and students repeatedly exhibited enthusiasm and curiosity about the robot and the corresponding lesson. Even when it was not present, the students often initiated speech and play focussed on the robot. In many instances, the teachers used the robot as a tool for classroom management and guiding student behavior. For example, integrating the robot provided opportunities for the students to practice taking turns, share, and develop patience.

Upon reflecting on their lessons, the teachers agreed the children enjoyed their experiences with the robot. The teachers expressed interest in learning learn how to program the robot and teach the students how to program. Further, they were able to identify many other curricular areas where the integration of the robot could provide positive learning experiences.

The main challenge the teachers faced was their lack of knowledge and experience working with a humanoid robot. They were uncertain how to operate the robot and troubleshoot when issues occurred, but

more importantly there was a lack of knowledge of how to effectively integrate the robot into instructional experiences. This lack of background knowledge and experience impeded their ability to effectively develop and implement their original lesson ideas, which led to frustration. They expressed a desire for more professional development to overcome these challenges.

In summary, using the robot during instructional activities promoted student learning in all five of the Head Start learning domains, and students were actively engaged in each of those learning opportunities. Providing more professional development and opportunities to collaborate would be beneficial for early childhood teachers to strengthen their abilities to integrate the NAO humanoid robot into positive and effective learning experiences for children.

This blog post is based on the article, 'Humanoid Robots Supporting Children's Learning in an Early Childhood Setting', by Helen Crompton, Kristen Gregory, and Diane Burke, which is published in the *British Journal of Educational Technology*. It is free-to-view for a time-limited period, courtesy of the journal's publisher, Wiley.

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