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Humanoid Robots Supporting Children's Intellectual and Social Dispositions in an Early Childhood Setting

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This study explores the affordances provided by the use of the NAO robot in an early childhood classroom. Using the Head Start Early Learning Outcomes Framework as a guide, the researchers analyzed the interactions and relationships between teachers, students, and learning, and the unique curricular opportunities and outcomes provided by the NAO robot.

Introduction

Humanoid robots, robots with an anthropomorphic body plan and human-like senses, are becoming increasingly prevalent as a technology that can be used in school classrooms, and early childhood classrooms are no exception. The researchers of this study explore the affordances of the NAO robot in an early childhood (EC) setting. Norman (1988) defines affordances as "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing can possibly be used." (p. 9). For Barnes (2000), a teacher's use of new technology is based on their belief that this technology will afford learning in a new way. This research is a direct response to NAEYC's call for more research to better understand how young children use and learn with technology (NAEYC, 2012).

Literature Review

The use of technology in classrooms with preschool children is a growing area of interest in the field of early childhood education. Adopted in 2012, the National Association for the Education of Young Children's (NAEYC) position statement on the use of technology in the preschool classroom recognizes the ubiquitous nature of technology, including both digital and analog materials, in the everyday lives of young children in contemporary contexts. The NAEYC position statement on technology and interactive media, like all NAEYC position statements, attempts to provide guidance for practitioners on developmentally appropriate use of technology with young children. NAEYC refuses a firm either/or position regarding the inclusion of young children's classroom engagement with technology, noting that evidence reporting on the benefits, or harm, remain conflicted (NAEYC, 2012). More importantly, argues NAECY, the selection and use of technology, by practitioners, is the key to maintaining pedagogically rich, inclusive, and developmentally appropriate experiences. In keeping with the NAEYC position statement, this study seeks to build a clear understanding of how the humanoid robot can serve classroom learning within and across various domains of children's development and how practitioners can prepare and integrate developmentally appropriate technology curriculum in their classrooms.

As the use of robots in classrooms is a recent technology development, the research base is nascent. Those researchers investigating the use of robotics in early childhood classrooms include Ioannou, Andreou and Christofi (2015), Kazakoof and Bers (2014) and Ros, Baroni and Demiris (2014). Research by Ioannou et al. (2015) involved an exploratory case study using the humanoid robot, NAO, with pre-school aged children. Their research investigated young children's interactions with the robot. According to these researchers, "Humanoid robots might be able to assist the education of young children. The easy interaction with NAO… provides initial evidence that humanoid robots can be smoothly introduced to educational activities" (p. 26). The researchers state that more work is needed to support their findings. Kazakoff and Bers (2014) examined the impact of programming robots on sequencing ability in early childhood. Their results supported the premise that young children may improve sequencing skills by learning to program robots. Ros, et.al. (2014) explored the potential for humanoid robots to interact with children in a dance activity. An analysis of their results revealed high levels of engagement on the part of young children; however, they stated the need for further research. This continual call for further research regarding the use of humanoid robots in early childhood classrooms provides relevancy and currency to this study.

Methods

This mixed methods study seeks to investigate the interactions and relationships between teachers, students, and learning, and the unique curricular opportunities and outcomes provided by the NAO robot. The researchers are currently investigating how teachers can use, and what students learn from, the NAO robot as it relates to supporting early childhood intellectual and social dispositions, as well as competencies within and across physical, cognitive, and social-emotional domains of development. Data collection methods for this research, involves focus groups, questionnaires, and observations, conducted at an early childhood center. The use of multiple methods will allow the researchers to address four questions guiding the study and reflecting its broad investigative goals:

1. How are teachers integrating the robot into the curriculum?
2. How do children's interaction with the robot, and corresponding curricula, support children's intellectual and social dispositions?
3. How do children's interaction with the robot, and corresponding curricula, support children's learning within and across physical, cognitive, and social-emotional domains of development?
4. What were the successes and challenges faced by teachers and students as they used the robot as part of everyday schooling?

Participants: This study includes a total of 40 children, aged three to five years that attend an early childhood center in the southeastern United States. Three teachers and five assistant teachers who work with the students will also be involved.

Procedure: This is a qualitative study and the data analysis. During this study teachers will receive a minimum of one hour training on how to use the NAO robot. An initial focus group will be held to allow the educators consider how the robot can be used to facilitate student learning and development. The NAO robot will be used in lessons and researchers will observe and video tape the interactions between the NAO robot and the educators and students. After using the NAO robot for at least four lessons, the educators will complete a questionnaire about how they used the robot in relation to the Head Start Learning Outcomes Framework. A concluding focus group will be held at the end of the study to evaluate how the use of the NAO robot facilitated student learning and development.

Data Collection Methods:

Focus groups: Self-selected teachers and teacher assistants will participate in responding to questions about the use and potential use of the robot in the EC classroom. Audio recordings will be made of the focus groups.

Questionnaires: Self-selected teachers and teacher assistants will participate in responding to questions about the use and potential use of the robot in the EC classroom. Specifically, in the questionnaires the participants will respond independently to the Head Start Learning Outcomes Framework in relation to use of the robot.

Observations: As a means to consider children's interactions with and outcomes from learning associated with the NAO robot, the researchers will follow an ethnographic approach to observation. As such, this project will use standard visual ethnographic methods including video and audio recordings, field notes, and still photography to capture the performative and narrative qualities that make up children's classroom learning events, related to information generated in connection with the NAO robot, in the early childhood classroom. Thus, collected data will include: photographs, audio and video clips of classroom learning, as well as artifacts created by teachers and children. Additionally, written notes will be collected to describe adult and children's movement, conversations, or statements made in the context of their activities related to the NAO robot. Digital cameras, iPads, and video cameras will be used as unobtrusive means of data collection.

Results and Analysis

Data collected will be analyzed in relation to the four research questions guiding this study. Sharing the results and analysis from this study at the Site Conference will allow educators to better understand the affordances provided by robots in early childhood settings and allow practitioners to better understand how to prepare and integrate developmentally appropriate technology curriculum in their classrooms.

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