

Assignment 4:
Mixed Methods Research Study
Stephanie Talalai
New Jersey City University

Introduction

Studies involving the use of robot assistants in the treatment of children with Autism Spectrum Disorder (ASD) has gradually increased since 1999 due to their simplistic interactions, predictable behavior, and controlled social situations (Aresti-Bartolome & Garcia-Zapirain, 2014). “The engaging, predictable and safe nature of robots suggests that robots could be a useful tool for teachers in special education especially when working with children with profound and multiple disabilities” (Hedgecock, Standen, Beer, Brown, & S. Stewart, 2014, p. 112). The use of robotics to aid persons with disabilities “holds promising and effective possibilities as it is motivating, accurate, objective and adaptive to the needs of individuals” (Shamsuddin et al., 2012, p. 1449). In a study conducted by Fridin (2014), results showed that through storytelling, a robot can assist the teacher in “facilitating a process of constructive learning” and “teaching of new concepts and motor skills” (p. 60).

According to the NAEYC and the Fred Rogers Center, the deliberate and developmentally appropriate use of technology and interactive media by teachers of preschool students are pathways to learning and development when they are used intentionally (NAEYC, 2009). In a 2014 survey on technology trends, usage and professional development in early childhood programs, most of the technology use reported covered computers, tablets, TV/DVDs, digital cameras, and interactive whiteboards (Blackwell, Wartella, Lauricella, & Robb, 2015). Teacher perception and usage of robotics are not included in the survey.

While the use of robotics in STEM education is has shown an increase in creativity, critical thinking and collaboration in primary and secondary students (Khanlari, 2013), few studies have been conducted on their implementation into preschool classrooms. Additionally,

the researcher is unaware of any existing research on humanoid robot assistants and the preschool disabled population.

With the lack of teacher training on the use of robotics in early childhood classrooms and the absence of research on their use in preschool disabled classrooms, this study will examine their effects of humanoid robot assistants on skill acquisition, student engagement and teacher perceptions of developmentally appropriate implementation.

Statement of the Problem

The literature reviewed showed that there is a growing number of studies on the use of humanoid robots and students classified as ASD in increase socially acceptable behavior and increase eye contact. However, the researcher found few studies which focus on using robots to increase engagement in students with other cognitive disabilities, especially in preschool-aged children. While many of these studies have taken place outside of the United States, the researcher feels that there is a significant lack of research pertaining to teacher perceptions of the use of humanoid robots with student classified as preschool disabled. This mixed-method explanatory sequential study will contribute to the body of knowledge needed to address the use of humanoid robots to increase engagement and skill acquisition in students classified as preschool disabled.

Purpose of the Study

The purpose of this sequential explanatory mixed methods study will be to evaluate the impact of a humanoid robot assistant to increase color identification in students classified as preschool disabled in self-contained classrooms. The study will also address teacher perceptions

of the use of a humanoid robot assistant with children classified preschool disabled to increase color identification and student engagement. The results of this study should contribute to the understanding of how humanoid robots can be incorporated into preschool disabled classrooms to increase color identification and student engagement.

Research Questions

Quantitative Research Question:

- Will the use of a humanoid robot assistant increase color identification in students classified as preschool disabled and placed in a self-contained setting?

Null Hypothesis

Ho: There is no significant difference in color identification between the students that are exposed to a humanoid robot assistant during instruction as compared to the students that are not exposed to the humanoid robot assistant during instruction.

Research Hypothesis

Ha: There is a significant difference in color identification between the students that are exposed to a humanoid robot assistant during instruction as compared to the students that are not exposed to a humanoid robot assistant during instruction.

Independent and Dependent Variables

Independent Variables: Humanoid robot assistant.

Dependent Variable: Color identification.

Qualitative Research Question:

- What are teacher's perceptions of the ways humanoid robot assistants support or do not support color identification in students classified as preschool disabled in self-contained classrooms?

Qualitative Research sub-questions:

- Do teachers find value in the use of humanoid robot assistants in classrooms?
- Do teachers feel that the use of humanoid robot assistants increased student engagement?
- Do teachers feel they have enough support and training for successful implementation of humanoid robot assistants?

Theoretical Framework

The use of humanoid robot assistants with students classified as preschool disabled incorporates various learning approaches:

The cognitive dimension

The educational theories of constructionism and constructivism, which are based on student-centered discovery utilizing prior knowledge and focuses on the belief that students need to be immersed in hands-on, real-world learning activities are the underlying theoretical frameworks of this study (Educational Robotics and Constructionism, 2016). Based on these frameworks, the researcher will examine the acquisition of color identification in students classified as preschool disabled when accompanied by a humanoid robot assistant.

The social dimension

The use of socially assistive robots is grounded in Marie Montessori's belief that learning is for the whole child and must include social and intellectual components. Both the social and

the intellectual components are taught through social groups and hands-on learning environments (Montessori Method, 2016).

Significance of the Study

Through an extensive literature review, the researcher has found several studies which have been conducted on the use of humanoid robots with children classified as Autistic. However, there has been no research on the use of the humanoid robots and the preschool disabled population. With the focus on both technology and early childhood, this study will help teachers of young children with disabilities develop activities and projects that will involve children in active learning and encourages them to use higher-level thinking skills. This study is significant in that it will add to the literature concerning the use of humanoid robots, skill acquisition and student engagement in children classified as preschool disabled. It will also attempt to explain the relationship between robotics use and teachers perception of robotics within the preschool disabled classroom.

Develop a Statement of Resources

The primary sources used in this research project will be the data collected during the pre and post tests conducted during the quantitative phase of the study in addition to the interviews and surveys given to classroom teachers that will be used in the qualitative phase of the study. Secondary sources will be identified in reviewing the literature for this study. The researcher will focus on three key topics which will attempt to synthesize previous research and contribute to the overall structure of the study. Previous studies involving the use of humanoid robots with Autistic children will focus on Human-robot interaction, an increase in communication and the

use of robotics in therapy sessions. The literature review will also attempt to look at how robotics have been used to support children with multiple disabilities. Finally, the researcher will investigate how technology has been previously used with preschool aged children. Keywords will include: technology and preschool, disabilities, robotics, skill acquisition, humanoid robots and NAO.

Methodology

Philosophical Framework

The worldview a researcher adopts influences the research method used in a study (Creswell, 2014). For this mixed methods study, a Pragmatic philosophical framework will be used. Through this philosophical lens, the researcher can independently choose the “methods, techniques and procedures of research that best meets their needs” (Creswell, 2014, p. 11). Pragmatism helps to clarify how research approaches can be mixed successfully in ways that provide the best possibilities for explaining important research questions (Johnson & Onwuegbuzie, 2004). Through quantitative pre and posts tests and qualitative open-ended survey questions and teacher interviews, the researcher will attempt to make sense of the historical and cultural climate of preschool disabled classrooms and seek to find significance in the views and experiences of the participants.

Research Approach and Design

For this mixed methods study, the researcher will use a sequential explanatory design. As defined by Creswell (2014), mixed method research combines the strengths of both qualitative and quantitative studies “to develop a better understanding of the research problem or questions” (p. 215). Through quantitative pre and posttests, the researcher will attempt to discover if the use

of a humanoid robot assistant will increase color identification in students classified as preschool disabled and placed in self-contained classroom settings in New Jersey. Through qualitative open-ended surveys and interviews, the researcher will attempt to explain and interpret teacher perception and student engagement with the use of humanoid robot assistants in preschool disabled classrooms.

Research Method

For the quantitative phase of this study, the researcher will randomly assign classrooms of students classified preschool disabled aged 3 to 5 years old to two groups. Group one (the control group) will be introduced a color identification lesson during regular classroom instruction by their teacher. Group two (the experimental group) will be introduced to the same color identification lesson using the Nao Humanoid Robot. Pre and Post tests will be conducted as well as data that is collected through the NAO software will provide the quantitative data.

For the qualitative phase of this study, the researcher will provide an open-ended survey as well as interview teachers after the quantitative phase to discover their perception of robotics use and student engagement in a preschool disabled setting.

Quantitative data will be analyzed using a statistical software that will test the theory which has been presented. Implications and limitations of the research as well as recommendations for further study will be discussed.

Qualitative computer data analysis programs or hand coding will be used to interpret the meaning of the data collected through interviews and surveys. Implications and limitations of the research as well as recommendations for further study will be discussed.

References

- Aresti-Bartolome, N., & Garcia-Zapirain, B. (2014). Technologies as support tools for persons with autistic spectrum disorder: A systematic review. *International Journal of Environmental Research and Public Health*, *11*(8), 7767-802.
- Blackwell, C. K., Wartella, E., Lauricella, A. R., & Robb, M. B. (2015). *Technology in the lives of educators and early childhood programs; trends in access, use, and professional development from 2012 to 2014*. Latrobe, PA: The Fred Rogers Center for Early Learning and Media at Saint Vincent College.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th. ed.). Thousand Oaks, CA: Sage.
- Educational Robotics and Constructionism (Papert). (2016, April 11). Retrieved from: <http://www.learning-theories.com/educational-robotics-and-constructionism.html>
- Fridin, M. (2014). Storytelling by a kindergarten social assistive robot: A tool for constructive learning in preschool education. *Computers & Education*, *70*, 53-64.
doi:10.1016/j.compedu.2013.07.043
- Hedgecock, J., Standen, P. J., Beer, C., Brown, D., & S. Stewart, D. (2014). Evaluating the role of a humanoid robot to support learning in children with profound and multiple disabilities. *Journal of Assistive Technologies*, *8*(3), 111.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14-26.
- Khanlari, A. (2013). Effects of robotics on 21st century skills. *European Scientific Journal*, *9*(27), 26.

Montessori Method (Montessori). (2016, April 30). Retrieved from: <http://www.learning-theories.com/montessori-method-montessori.html>

National Association for the Education of Young Children (2009). Developmentally appropriate Practice in early childhood programs serving children from birth through Age 8. Retrieved from the NAEYC March 16, 2016 from <http://www.naeyc.org/files/naeyc/file/positions/PSDAP.pdf>

Shamsuddin, S., Yussof, H., Ismail, L. I., Mohamed, S., Hanapiah, F. A., & Zahari, N. I. (2012). Initial response in HRI- a case study on evaluation of child with autism spectrum disorders interacting with a humanoid robot NAO. *Procedia Engineering*, *41*, 1448-1455.
doi:10.1016/j.proeng.2012.07.334