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Bricks for Building Empathy: An Action Research Study Assessing the Impact of Robotics on Elementary Students' Empathy Towards Individuals With Disabilities

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BRICKS FOR BUILDING EMPATHY: AN ACTION RESEARCH STUDY ASSESSING THE IMPACT OF ROBOTICS ON ELEMENTARY STUDENTS' EMPATHY TOWARDS INDIVIDUALS WITH DISABILITIES

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DEDICATION

This body of work is dedicated to all my friends and family who encouraged me each day until I crossed the finish line. To my students along the way and to those in this study, thank you for being a part of the journey. To my parents, Phil and Teresa, and brothers, Ethan and Cooper, thank you for your constant love and support throughout my life. All that I am and all that I hope to be, I owe to you.

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ABSTRACT

Empathy helps us understand and respond appropriately to how others feel. It allows us to establish meaningful connections to those around us at home, school, work, and in society. The education system has realized the importance of social-emotional skills and have started implementing programs to help students develop these skills. Businesses have also started developing principles and practices that center around empathy and perspective-taking. The purpose of this action research was to assess the impact of robotics on fifth grade students' empathy towards people with disabilities. This study aimed to answer the following research questions: (1) How does using robotics effect students' empathy? and (2) How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

Fifth grade students at Burton Academy within the researcher's classroom participated in a disability scenario in which they programmed a Lego Boost Robot to assist a person with a disability achieve a given task. In order to assess the impact of this innovation, quantitative data was collected through the use of a 20-item pre- and post-survey. In addition, qualitative data was collected through individual interviews and student response journals. Participants' names and the name of the school were replaced with pseudonyms. Using descriptive statistics and inductive analysis, each data source was analyzed separately and the findings were merged in order to draw conclusions. The innovation had no statistically significant impacts on overall empathy, cognitive empathy,

and affective empathy as measured by the Basic Empathy Scale. The qualitative findings of this study revealed four themes. These themes include: (a) the innovation increased students' understanding of people with disabilities and realization that they aren't treated well, (b) students perceive disabilities to severely limit participation in everyday life and impact families, (c) the innovation increased empathy and improved manner of treating others, and (d) the participants value empathy. Implications include the implementation of robotics in the classroom as a tool to teach empathy and other skills and increasing disability awareness in children and adults.

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CHAPTER 1

INTRODUCTION

This action research study focused on the use of robotics as an innovation to increase students' empathy towards individuals with disabilities. To lay the foundation of this study, an introduction with the following components is provided: (a) national context, (b) local context, (c) statement of the problem, (d) explanation of researcher subjectivity and positionality, and (e) definition of key terms.

National Context

Empathy is at the core of everything that makes a child caring, an employee responsive, and a world civilized (Borba, 2018). Empathy is the "sharing and understanding of another's emotional state or context resulting from experiencing the emotive state and understanding another's emotions" (Cohen & Strayer, 1996, p. 990). Without empathy, bullying, distrust, narcissism, and hate rise, while people suffer. As schools realize that students need more than rigor and high-stakes testing to be successful in life, attention has turned to social-emotional skills, such as empathy (Borba, 2018; Goleman, 1995). The realization of the importance of empathy and other social-emotional skills has also occurred in the professional world. Forbes encourages companies to implement principles that center around empathy and perspective-taking, and the Harvard Business Review named empathy as one of the "essential ingredients for leadership success and excellent performance" (Borba, 2018).

Unfortunately, there is an evident deficiency of empathy across the United States. Results from a 2016 study, which measured and ranked 63 countries on their abilities regarding empathetic concern and the ability to imagine another person's perspective, reported the United States placed 7th (Chopik, O'Brien, & Konrath, 2016). Even though the United States was in the top 10, researchers warn that people are struggling now more than ever to create meaningful relationships (Chopik, O'Brien, & Konrath, 2016). The study also found that younger generations seem to focus more on one's own needs and less on someone else's individual needs or the collective needs of society (Chopik, O'Brien, & Konrath, 2016). Konrath (2010) reports that American teens are now 40 percent less empathetic than they were thirty years ago. With the education system, workplace, and society benefiting from inclusion, including those with disabilities, it is important that students develop empathic and perspective-taking skills towards people with differences (Hausmann, Chi, & Roy, 2004; Herro et al., 2017; World Health Organization, & World Bank, 2011).

Real-world applications of artificial intelligence machines involve scientific, mathematical, and engineering problems with practical, theoretical, and economic interest (NSF, 2000). These benefits extend into classrooms across the nation, as robots are being recognized as an effective tool in education (NSF, 2000). Through the use of robotics, students can experience a hands-on and highly interactive way of learning while being able to visualize challenging, real-world applications (Gomoll et al., 2016; Zhong, 2020).

Local Context

Johnson County School District recognizes the importance of social skills, such as empathy, and the role it plays for students in school and in their futures. One of the six

priority areas stated in Johnson County School District's Strategic Education Plan is to expand whole child supports. This goal aims to promote the well-being in the learning process through the teaching of social, emotional, and life skills. The Strategic Education Plan lists two actions in order to develop and foster these skills in students: (1) implement a strong social and emotional component into existing character education plans, and (2) provide professional development to classroom teachers on strategies for teaching and promoting social and emotional skills in students. Technology is widely-used throughout the district by both students and staff. All K-12 students within the district have access to a personalized learning device, which can be used at school and at home throughout the school year.

In order to better understand fifth graders' perspectives on their abilities with social skills, including empathy, a social-emotional survey was administered to 290 fifth graders at Burton Academy by the school guidance counselor in November of 2019. The survey results revealed a deficit in empathy towards others, including individuals with a disability. When asked to respond to the statement, "I take time to understand how other people feel by listening and watching their body language" 49% of participants answered "sometimes" or "almost never." Teachers have participated in multiple social and emotional skills professional development sessions based on the data collected from the survey. The school's guidance counselors and administrators have conducted classroom observations, including inclusion classrooms where students with disabilities and students from the self-contained classrooms are mixed with general education students throughout the day. Administrators, counselors, and teachers continue to report a lack of empathy,

along with ongoing aggression and bullying, as witnessed through observations of students working together and social situations.

Statement of Problem

Fifth grade students in an inclusion setting at Burton Academy lack empathy towards students with disabilities. This inclusion setting consists of students who don't receive any special education services and students who do receive special education services.

Purpose Statement

The purpose of this action research was to assess the impact of robotics on fifth grade students' empathy towards individuals with disabilities.

Research Questions:

1. How does using robotics effect students' empathy?
2. How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

Researcher Subjectivities & Positionality

I am a white, heterosexual female who was born and raised in the United States. I attended public school from kindergarten through twelfth grade. I have worked as a teacher in South Carolina for seven years. I obtained my Master's Degree in Educational Administration at the university where this research was conducted. I am of the belief that technology improves the teaching experience for educators, as well as the learning experience for students. Teachers perceive technology to increase student engagement, student understanding, and instructional differentiation (Carver, 2016). I am biased

towards technology in education because I believe it positively influences student achievement and engagement.

I hold a postpositivist perspective and hold a deterministic philosophy in which causes determine outcomes (Creswell, 2014). “The problems studied by post-positivists reflect the need to identify and assess the causes that influence outcomes, such as found in experiments” (Creswell, 2014). I believe that claims about knowledge are based directly on one’s own experiences, and rely on facts to explain outcomes (Bogdan & Biklen, 2003).

In order to maintain the validity of this research, I was honest in my positionality and biases. Since I was the classroom teacher in which the research took place, my positionality was as an insider. I was the sole teacher of the classroom in which I taught all content areas to my students. Since I spent a considerate amount of time with my students (seven hours each school day), I built relationships with my students. I knew them academically, as well as on a personal level.

My insider perspective allowed me to enhance my research. Since I am a classroom teacher who creates lessons that are developmentally appropriate for fifth grades, I was able to appropriately design the task for this action research. In addition, the relationships I had with my students allowed them to comfortably participate in the research. To maintain the credibility of the research, I inhibited my insider perspective from interfering. Since my students may have viewed me as an outsider, I removed my position of authority as best as I could. I wanted to prevent changes, such as teacher-pleasing behavior, a lack of care or respect, or other shifts in behavior due to my presence. I also designed the study to remove subjective bias. In addition, reporting my

findings to an outside party throughout the study held me accountable to being unbiased in my reporting.

I am fully aware that strong values can insert themselves into research methods. As a lifelong learner, education is of high value for me. I am also biased in thinking that those who work hard will reap the benefits of their efforts. I was cautious not to force these beliefs and values into the actions of the students.

Definition of Terms

Many definitions of empathy exist and tend to contain overlapping components. For the purpose of this study, *empathy* was operationalized based on the definition by Cohen and Strayer in 1996. The Basic Empathy Scale, which was used in this study as a quantitative data collection method, was based on Cohen & Strayer's definition of empathy, which is why this definition was chosen. According to Cohen and Strayer, empathy is the "sharing and understanding of another's emotional state or context resulting from experiencing the emotive state and understanding another's emotions" (Cohen & Strayer, 1996, p. 990).

As the application of robotics continues to change and expand, so does its definition. Many earlier definitions contain the word 'mechanical,' and are now outdated with the development of software robots, which aren't mechanical (Trevelyan, 1999). Merriam-Webster's definition of robotics takes into consideration the different types and uses or robotics, so as not to exclude any robotics from being included. Merriam-Webster defines robotics as "technology dealing with the design, construction, and operation of robots in automation" (Robotics, n.d.).

As stated in the World Health Organization's *International Classification of Functioning, Disability and Health*, 'disability' is "an umbrella term for impairments, activity limitations and participation restrictions" (World Health Organization, 2002, p. 2). Within the context of this research, *disability* was identified as a physical or mental impairment that limits one or more of life's activities (Americans with Disabilities Act of 1990).

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this action research was to assess the impact of robotics on fifth grade students' empathy towards individuals with disabilities. This literature review will examine research related to the constructs in the following research questions: (a) How does using robotics effect students' empathy? and (b) How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

Literature Review Method

Multiple research databases were utilized in order to gather literature about the constructs and their backgrounds. These databases include *Education Source, ERIC, ResearchGate, ScienceDirect,* and *PsycINFO*, with additional information gathered from *SAGE*. While using these databases, Boolean searches were conducted using various combinations of keywords. Samples of these keywords include: collaboration, constructivism, cooperative learning, disability, empathy, mixed methods, perception, programming, robots, simulation, technology integration, and video games. Roughly 155 articles have been reviewed, and 106 of them were selected for use. Several texts were obtained through the use of the local public library. In addition, numerous pieces of literature were ones I came across while reading articles found through the databases. I used the citations in these articles to locate the literature they were referencing.

Organization of Literature Review

This comprehensive literature review is organized by the following sections: (a) the importance of working with students with disabilities, (b) an overview of empathy and its importance, (c) theoretical framework, (d) the benefits of using technology to teach empathy and the use of technology-based simulations, and (e) the connection between robotics and programming to empathy.

Working with Children with Disabilities

In order to work with children with disabilities, one must understand what a disability is. According to the *International Classification of Functioning, Disability and Health*, written to create a standard language for health, 'disability' is "an umbrella term for impairments, activity limitations and participation restrictions" (World Health Organization, 2002, p. 2). The Americans with Disabilities Act of 1990 describes a person with a disability as having a physical or mental impairment that limits one or more of life's activities (Americans with Disabilities Act of 1990). According to a 2010 global estimate, about 15%, or more than 1 billion people, live with a disability (World Health Organization, & World Bank, 2011, p. 29).

Importance of working with children with disabilities

Inclusion for students with disabilities in mainstream schools promotes completion of a primary-level education, contributes to the eradication of discrimination, and is cost-effective (World Health Organization, & World Bank, 2011). Creating an inclusive learning environment results in improved communication skills, greater social competence, stronger relationships with their peers (Bennett, DeLuca, & Bruns, 1997; Fryxell & Kennedy, 1995). For able-bodied children, interaction with children with a

disability in an inclusive setting can increase familiarity and self-esteem while reducing prejudice (Garrick-Duhaney & Salend, 2000; Rafferty, Boettcher & Griffin, 2001; Sasso & Rude, 1988; Voeltz, 1982). Inclusive education provides learners with the opportunity to recognize and accept differences in people, and is therefore central in promoting an inclusive and equitable world (Lohmann et al., 2019). With the rise of 21st Century Skills and their use in the workforce, school, and the military, collaboration is a desired and necessary skill (Hausmann, Chi, & Roy, 2004; Herro et al., 2017). Individuals with disabilities often have a unique perspective to share ideas from and should be included in decision-making, including the formulating and implementation of policies, services, and activities (United Nations, 2006).

Barriers of working with children with disabilities

The World Health Organization recognizes that many disadvantages affecting individuals with disabilities are due to the barriers they face, and emphasize the importance of a global understanding and responsibility towards breaking down disabling barriers (World Health Organization, & World Bank, 2011). Policies often fail to account for the needs of individuals with disabilities (World Health Organization, & World Bank, 2011). Other barriers include a lack of accessibility, consultation, and involvement (Lid & Solvang, 2016; Mudrick et al., 2012; Rimmer et al., 2017). These disabling barriers contribute to the disadvantages that individuals with disabilities experience. These disadvantages include poorer health outcomes, fewer educational achievements, less economic participation, higher rates of poverty, increased dependency, and restricted participation (Braveman, 2006; Whitehead, 1992). Negative attitudes and misconceptions held are a major barrier and can affect the inclusion of individuals with disabilities into

mainstream society (Fisher & Purcal, 2017). Children with disabilities are at a higher risk for being ridiculed or picked on, and staff members in an inclusive setting often lack the knowledge on how to appropriately prompt and encourage learners with disabilities (Rafferty & Griffin, 2005; Seery, Davis, & Johnson, 2000). Parents of children without disabilities worry that their children will be negatively impacted in an inclusive setting by learning negative behaviors, being frightened by unusual behaviors, or being disrupted by children with disabilities (Lohmann et al., 2019; Rafferty & Griffin, 2005). Respect and understanding are vital to an inclusive society. By collecting information on knowledge, perceptions, and attitudes towards individuals with disabilities, we can help improve the public's understanding of disability, address negative perceptions, and fairly represent disability (Lid & Solvang, 2016; World Health Organization, & World Bank, 2011).

Empathy

Empathy is the sharing and understanding of another's emotional state or context resulting from experiencing the emotive state and understanding another's emotions (Cohen & Strayer, 1996). It is an "other-oriented vicariously induced emotion" that supports positive social behaviors and limits aggressive social behaviors (Laible, Carlo, & Roesch, 2004, p. 706). Empathy helps us understand people whose values, views, and behaviors are different from our own (Calloway-Thomas, 2010).

Characteristics of empathy

The empathic person will display communication skills and be a "polished social actor" (Riggio, Tucker, & Coffaro, 1989). They take on the other person's perspective and communicate a cognitive understanding of that person's situation (Borba, 2018; Riggio, Tucker, & Coffaro, 1989). Individuals who can express their emotions and

thoughts appropriately and have high social adaptation and social sensitivity also possess the ability to emphasize (Utkur, 2019). Those who experience empathy are motivated by it to help others and reduce their distress (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Laible, Carlo, & Roesch, 2004).

Methods that have been used to study empathy

In an attempt to measure empathy, psychologists have examined different measurements of empathy, including self-report questionnaires, asking questions after a planned exposure to a specific experience, studying facial cues and body language, and measuring heart rate (Galán, Choe, Forbes, & Shaw, 2017; Kelly, Svrcek, King, Scherpbier, & Dornan, 2020; Stueber, 2019). While self-reporting measures have their own limitations, they are the most commonly-used and accepted tool for measuring empathy (Stueber, 2019). A multitude of self-report tools to measure empathy exist. Aside from the Basic Empathy Scale (BES), other measures that are widely-used include the Questionnaire Measure of Emotional Empathy (QMEE) (Mehrabian & Epstein, 1972), the Hogan Empathy Scale (HES) (Hogan, 1969), and the Interpersonal Reactivity Index (IRI) (Davis, 1980).

Cognitive empathy

According to Jolliffe and Farrington (2006), cognitive empathy is the degree to which a perceiver understands the emotional state of the target. In other words, cognitive empathy refers to the ability one has in understanding the emotions of others (Blake & Gannon, 2008; Jolliffe, Farrington, 2006). According to Blair (2005), a person must experience cognitive empathy before being able to experience affective empathy. Evidence also suggests that cognitive empathy can exist in a person, even if affective

empathy does not (Blair, 2005). For both males and females, a higher cognitive empathy ability correlates to lower behavioral and emotional issues, and higher prosocial behavior (Dadds, et al., 2007). Cognitive empathy increases as children get older and correlates with their verbal IQ (Dadds, et al., 2007; Eisenberg & Fabes, 1990). Sample items from the Basic Empathy Scale (2006) that are scored on the cognitive scale include *I find it hard to know when my friends with disabilities are frightened, I can often understand how people with disabilities are feeling even before they tell me,* and *I can usually realize quickly when a friend with a disability is angry*.

Affective empathy

According to Jolliffe and Farrington (2006), affective empathy is the degree to which a perceiver shares the emotional state of the target. In other words, affective empathy is described as the ability one has in being able to experience the emotions of others. Unlike cognitive empathy, higher affective empathy abilities in females only correlated to lower behavioral and emotional issues, while higher affective empathy abilities in males are only associated with higher prosocial behavior (Dadds, et al., 2007). Affective is unrelated to the age and verbal IQ of the child (Dadds, et al., 2007; Eisenberg & Fabes, 1990). Research has also revealed that impaired affective empathy correlates to antisocial behavior (Anastassiou-Hadjicharalambous, & Warden, 2008). Sample items from the Basic Empathy Scale (2006) that are scored on the affective scale include *after being with a friend that has a disability and is sad about something I usually feel sad, I don't become sad when I see people with disabilities crying*, and *I often become sad when watching sad things on TV or in films*.

Importance of empathy in children

A child's ability to experience and demonstrate empathy is directly related to their ability to take on the emotional experiences or perspective of another (Wilson & Ray, 2018). A child's ability to empathize has a direct impact on academic achievement; a child with empathy can understand the perspective of a person or character in fictional and historical texts in reading, literature, and social studies curriculums (Utkur, 2019). Children with higher empathy levels were also reported as having higher self-regulatory abilities, low negative behaviors, and constructive social behaviors (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Murphy et al., 1999).

Importance of empathy in adults

Empathy in adults is positively related to self-expression, socialization, social sensitivity and social adaptation (Utkur, 2019). There is empirical evidence linking empathy to moral recognition of ethical situations, greater understanding of stakeholder impact, and improved financial success (Calloway-Thomas, 2010). In human relations, the ability to empathize is critical since it helps individuals communicate with others, understand their emotions and thoughts, anticipate their future behaviors, and respond in appropriate ways (Peck, Maude, & Brotherson, 2015). Professionals in the health field need to be able to empathize with patients. Patients desire health care professionals who can empathize with their pain or situation (Crumpei, & Dafinoiu, 2012; Peck, Maude, & Brotherson, 2015). Professionals in the social work field also need to be able to empathize. This ability helps them to become more effective and helps in avoiding "compassion burnout or fatigue" (Clark & Butler, 2020; Peck, Maude, & Brotherson, 2015). Empathy in adults also plays a role in policies pertaining to education, taxation,

and health as these areas impact the well-being of others (Eisenberg, Eggum, & DiGiunta, 2010).

Empathy towards individuals with disabilities

It's important to understand the way our empathy, or lack of, influences our attitudes towards different groups of people, including our tendencies to create stereotypes, distance, and even isolate ourselves from these groups (Parchomiuk, 2019). Less empathetic individuals are not as concerned with social justice because they cannot easily identify or relate to others' perspectives or situations (Cartabuke et al., 2019). More time spent with individuals with disabilities correlates to higher empathy levels (Perenc & Peczkowski, 2018). Observing and cooperating with someone with a disability on a regular basis helps adolescents develop other prosocial skills, such as a respect for diversity (Perenc & Peczkowski, 2018). Siblings who help care for their disabled siblings admit to having a better overall understanding of people than children without disabled siblings admit to, and tend to be better adjusted in relations with others (Dew, Balandin, & Llewellyn, 2008; Perenc & Peczkowski, 2018; Seligman & Darling, 1997). Siblings that identify as caregivers expressed feelings of concern and empathy for disabled adult siblings. Siblings respond to these feelings by making efforts to talk to and spend time with their disabled siblings (Seltzer et al., 2005). Children and adolescents who live with a sibling with a disability seek friends who share their empathetic nature and even test friendships to see if potential and current friends possess empathy, stating that it's an important quality in understanding their life and being around their family (Dew, Balandin, & Llewellyn, 2018).

Theoretical Framework

Constructivism, a learning theory with contributions from Piaget, Bruner, Goodman, and Vygotsky, has been applied to many studies (Botha & Kourkoutas, 2016; Chizega & Sorin, 2016; Goodhall & Atkinson, 2019; Gray & Winter, 2011; Holbert & Wilensky, 2019). Understanding that learners' understanding and knowledge are based on their own experiences was the foundation of this study, where participants constructed their own meaning from the simulation-based innovation (Botha & Kourkoutas, 2016; Chizega & Sorin, 2016; Goodhall & Atkinson, 2019; Vygotsky, 1978).

Social constructivism theory

Vygotsky's social constructivist theory is grounded in the idea that children develop various skills through play and interaction (Vygotsky, 1978). Playing engages children and enables them to become active participants in their own learning (Vygotsky, 1978). Play is linked to socialization in which children develop speech skills, which organizes and unifies perception, memory, and problem solving (Chizega & Sorin, 2016; Vygotsky, 1978). A constructivist approach also positions children as active participants and decision-makers who actively contribute to others' learning (Chizega & Sorin, 2016). Teaching methods rooted in social constructivism are highly effective because they involve collaboration and social interaction between students as they work through authentic tasks (Nanjappa & Grant, 2003; Powell & Kalina, 2009; Wang et al., 2012). In education, social constructivists believe that ideas are developed through interaction with the teacher and other students as opposed to cognitive constructivism where ideas are developed through a personal process (Powell & Kalina, 2009). Within a constructivist environment, dialogue between children and their peers or children with their teachers is

used to resolve natural occurring problems as they arise (Cooney, Gupton, & O'Laughlin, 2000).

Role of Technology in Teaching Empathy

Technology enables teachers to make learning more innovative and interactive (Pulman et al., 2012). Technology is used with online communities that connect children from various backgrounds and guides them through stories and activities that help them with perspective-taking (Zuiderveid, 2020). Technology is used to immerse learners in a learning environment where they can engage with others, build connections and relationships with others, and increase motivation (Paiva, Dias, & Sobral, 2005).

Benefits of incorporating technology

Technology integration is useful in developing the higher-order skills of critical thinking, analysis, and scientific inquiry (Roschelle et al., 2000). Tasks that utilize technology have problem-solving embedded in the process (Chen et al., 2004; Land, 2013). The use of technology in an activity raises student engagement and interest levels, enhances understanding, and increases memorability (Carver, 2016; Jansen, 2006; Pegrum, Oakley, & Faulkner, 2013; Poirier, & Feldman, 2012; Whatley, & Ahmad, 2007). It also provides ways to heighten student learning by exposing the students to new content and technology, real-world experiences, and community resources (Chen et al., 2004). Technology projects allow for a more effective division of labor, the incorporation of solutions from group members with differing perspectives, knowledge, and experience, and enhanced solution quality by the ideas of other group members (Graesser, Forsyth, & Foltz, 2017; Roschelle et al., 2000).

Simulation

Scenario-based learning. Learning occurs when students are engaged in critical thinking by a task that involves immersion (Vygotsky, 1978). Through immersion, students actively create their own meaning of the material by experiencing the application of the skill in a realistic setting (Golden, 2018). Simulations focus on a problem or situation that learners explore and resolve (Golden, 2018). Realistic scenarios encourage transferability, as well as increase critical thinking, analytic reasoning, and problem-solving abilities (Friesen & Scott, 2013; Hmelo-Silver, 2004; Khan et al, 2015).

Disability simulation. Disability simulations are frequently used in programs that aim to bring more awareness to disabilities (Kim, 2014; Kim, 2015). They were developed to impact the attitudes, behaviors, and perceptions of the participants by increasing empathy through the realization of every day limitations (Kiger,1992). Disability simulations are used to create real-world environments that make the learning more relevant (Chen et al., 2004). Technology-based simulations allow for choice, challenge, and authenticity of situation and task which support the development of collaboration and motivation (Marinak, 2013). In disability simulations, students focus on realistic approaches to solving real-world problems (Chen et al., 2004). Researchers reported that the disability simulations helped able-bodied participants to better understand the frustrations and obstacles that their peers with disabilities frequently encounter (Bang & Lim, 2007; Kang, Kim, Kim, Park, & Lee, 2004; Seo & Kim, 2009, Yu & Cho, 2008). Simulated disability experiences result in a positive attitudes and higher empathy towards people with disabilities (Yu & Cho, 2008, Yuker, Block, & Campbell, 1970). Providing children with an environment in which they are able to

experience empathic understanding may enable them with the ability to convey empathy toward others (Wilson & Ray, 2018).

Robotics in Teaching Empathy

As robotics evolve and their use continues to expand into various fields, the definition of robotics changes to include newly-developed robots. Merriam-Webster's definition of robotics these changes into consideration and defines robotics in a way that does not exclude any robotics. Merriam-Webster defines robotics as "technology dealing with the design, construction, and operation of robots in automation" (Robotics, n.d.).

Advantages to using robotics

Using robotics in the classroom has many benefits, including learning of other disciplines, applying knowledge to real world situations, and developing a deeper knowledge of mathematics (Shankar et al., 2013). They also establish connections between different areas of knowledge that are otherwise difficult to connect with only paper and pencil mediums (Sanchez, Martinez, & Gonzalez, 2019). Teaching-learning activities are being supported with the help of robotics in project-based classes, which challenge students to be creative, while improving their cognitive skills and motivating them to take an active role in their learning (Sanchez, Martinez, & Gonzalez, 2019). In addition, robotics provide students with a highly interactive and hands-on learning experience (Gomoll et al., 2016; Zhong, 2020). They help students visualize challenging real-world applications and supports multiple representations of a problem (Shankar et al., 2013).

Students using robotics

Robots are increasingly being used in the classrooms of younger students as their capabilities and applications are expanded (Hansen et al., 2016; Shankar et al., 2013; Zhong, 2020). The number of U.S. schools integrating computer science into their instruction continues to increase each year (Hansen et al., 2016). Initiatives, such as Hour of Code, combined with kid-friendly programming platforms, have allowed younger children to be exposed to computer science (Du, Wimmer, & Rada, 2018; Hansen et al., 2016). These websites and applications use guided practice and highly motivating tasks to teach block-coding to younger learners (Du, Wimmer, & Rada, 2018; Hansen et al., 2016). Robots are most commonly used for math lessons, such as teaching algebraic concepts in a way that is concrete, authentic, accessible, and motivation (Zhong, 2020, p. 89). Using robotics in mathematical domains provides learners with opportunities to explore special reasoning and problem solving, while externalizing ideas and reflecting on the learning process (Zhong, 2020). There is also a positive correlation between students' use of robotics their motivation regarding STEM careers (Shankar et al., 2013).

Programming as a tool to foster empathy

Empathy is a skill that is used to develop user-centered design (Kouprie & Visser, 2009; Sanders & Dandavate, 1999; Visser et al., 2005). User-centered design "is a broad term to describe design processes in which end-users influence how a design takes shape" (Hansen et al., 2016, p. 2). With user-centered design, the programmer is tasked with making sure the user is able to use the product with minimum effort in learning how to use it (Hansen et al., 2016). Cognitive empathy, taking the intellectual role or perspective of someone else, aligns with the goals of computer science developers (Kouprie &

Visser, 2009). Programmers and designers use empathic design in an attempt to understand the lives and experiences of potential users, in order to create a product that meets the user's needs (Koskinen, Battarbee, & Mattelmäki, 2003; Kouprie & Visser, 2009). For example, sociable androids must be programmed by programmers who understand and possess empathic abilities in order for the android communicate empathy through a responsive face (Lee, 2006). Programmers are encouraged to participate in role-playing in order to better understand the user's experience before they begin programming (Kouprie & Visser, 2009). Empathy allows designers to make appropriate design choices for users who are unlike the designers themselves by 'stepping into the user's shoes' and 'walking the user's walk' (Koskinen, Battarbee, & Mattelmäki, 2003, p. 438).

Chapter Summary

Working with students with disabilities in an inclusive setting significantly impacts their cognitive abilities and social skills of all students, disabled and abled (World Health Organization, & World Bank, 2011). These abilities contribute to their success in school, and later as citizens and members of the workforce (Hausmann, Chi, & Roy, 2004; Herro et al., 2017). Disabling barriers, such as misconceptions and a lack of accurate information, limit individuals with disabilities from being included, consulted, and represented (World Health Organization, & World Bank, 2011). In order to change the attitudes and misconceptions held by others, we must educate the public and improve their understanding of disability (World Health Organization, & World Bank, 2011).

Empathy allows us to understand people whose lives and views are different than ours (Calloway-Thomas, 2010; Feshbach & Feshbach, 2009). With empathy, we can

better understand the lives of individuals with disabilities, while also motivating us to help and improve their situation (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Laible, Carlo, & Roesch, 2004). Empathy in children leads to higher academic achievement, higher self-regulatory abilities, and more developed social behaviors (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Murphy et al., 1999; Utkur, 2019). Empathy is also important in adults as it positively impacts their social sensitivity, ability to communicate, financial success, and decisions regarding the well-being of others (Eisenberg, Eggum, & DiGiunta, 2010; Peck, Maude, & Brotherson, 2015; Utkur, 2019). An increased amount of time spent with individuals with disabilities leads to higher levels of concern and empathy (Seltzer et al., 2005).

By immersing in a simulation, we are able to imagine how someone in that situation would think and feel (Decety & Ickes, 2009). Empathy simulations are used to increase one's empathic understanding (Barak et al., 1987). Simulations connect with Vygotsky's social constructivist theory, as simulations allow the participants to interact with the situation and other participants (Powell & Kalina, 2009; Vygotsky, 1978). Through the use of simulations, learners become active participants in their own learning and collaborate with others, while also developing communication skills and problem-solving abilities (Powell & Kalina, 2009; Vygotsky, 1978).

Using technology to immerse students in a real-world experience allows learning to be more innovative and interactive, while developing critical thinking and problem-solving abilities (Chen et al., 2004; Land, 2013; Pulman et al., 2012; Roschelle et al., 2000). Technology also increases student engagement, increases memorability, and encourages learners to shared different ideas and perspectives (Carver, 2016; Graesser,

Forsyth, & Foltz, 2017; Jansen, 2006; Pegrum, Oakley, & Faulkner, 2013; Poirier, & Feldman, 2012; Roschelle et al., 2000; Whatley, & Ahmad, 2007). Scenario-based learning through the use of simulations allows students to create their own meaning of the material by immersing themselves and actively participating in the scenario (Golden, 2018; Vygotsky, 1978). Learning through the use of realistic scenarios, such as disability simulations, makes the learning more relevant, while fostering critical thinking and problem-solving abilities (Chen et al., 2004; Friesen & Scott, 2013; Hmelo-Silver, 2004; Khan et al, 2015).

Through the use of robotics, learners are more motivated and are provided a hands-on learning experience (Gomoll et al., 2016; Zhong, 2020). Robotics give learners the opportunity to apply their knowledge to real world situations, develop a deeper understanding of the material, problem solve, and visualize the application of the material in an authentic way (Gomoll et al., 2016; Shankar et al., 2013; Zhong, 2020). The learners, acting as programmers, must use empathy to effectively program the robots, as empathy is at the core of user-friendly design (Sanders & Dandavate, 1999; Kouprie & Visser, 2009; Visser et al., 2005). Programmers who understand the perspectives and needs of others are able to make the appropriate design choices that will positively impact the user (Koskinen, Battarbee, & Mattelmäki, 2003; Kouprie & Visser, 2009).

CHAPTER 3

METHOD

The purpose of this action research was to assess the impact of robotics on fifth grade students' empathy towards individuals with disabilities. This study seeks to answer the following research questions: (a) How does using robotics effect students' empathy? and (b) How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

The following sections within this chapter will describe the study's (a) research design, (b) setting and participants, (c) innovation, (d) data collection, (e) data analysis (f) rigor and trustworthiness, and (g) plan for sharing and communicating findings.

Research Design

The purpose of this action research was to assess the impact of robotics on fifth-grade students' empathy towards individuals with disabilities. Action research was the most appropriate approach for this study because it involved systematic inquiry into the researcher's own practice (Mertler, 2017, p.4). Through action research, researchers can make improvements to their effectiveness by studying their own classrooms and by collaborating with others (Johnson, 2008; Mills, 2011).

Action research attempts to solve a problem within one's sphere of influence (Creswell & Creswell, 2018). Action research is cyclic in nature, as it begins with identifying the problem and ends with implementing changes based on results before identifying a new or remaining problem and continues through the cycle (Mertler &

Charles, 2011). It is less formal than traditional research and aims to improve an educational practice. This allowed the research to take place in a setting where the participants, the researcher's students, felt comfortable. The participants in an action research study are ones that work directly with the researcher and the results have limited generalizability (McLean, 1995).

This study was conducted within the researcher's classroom over a single school year, during which time both qualitative and quantitative data were collected. After exploring the different mixed methods designs, it was determined that this research would work best using the convergent parallel mixed methods design. When using a convergent parallel mixed methods design, the qualitative and quantitative data are collected simultaneously, analyzed separately, and then merged (Mertler, 2017). Since the quantitative and qualitative data provided different types of information, a convergent parallel design enabled the researcher to gain a better understanding of the results and gave the study greater credibility (Mertler, 2017, p.107).

Setting

The setting for the research was Burton Academy, which is part of the Johnson County School District in South Carolina. Burton Academy is a neighborhood school with a 30% free and reduced lunch rate. The population of the school was diverse and included students who are Caucasian (60%), African American (22%), Hispanic (10%), Asian (4%), and multi-racial (4%). The student-teacher ratio was 19:1 (18-19 Profile, 2019). Burton Academy services students with special needs through inclusion classes, resource pull out groups, and self-contained classes. There were 40 students who receive inclusion and/or resource services. Inclusion students were in a general education

classroom with one general education teacher and a special education teacher that comes into the classroom and co-teaches for part of the day. Resource students were pulled out of their general education classroom to receive support services in a small group setting. In addition, Burton Academy serviced 14 self-contained students, meaning their environment was a special education classroom taught by certified special education teachers and aides. I am in the third year of teaching fifth grade at Burton Academy when the study took place.

The study took place in my general education classroom. I taught all core subjects to the same group of students each day. Due to COVID-19 guidelines, students were seated in pods. The pods were constructed of two trapezoid-shaped tables, allowing four students to sit at each pod. Plexiglass dividers were in place on top of the tables to separate student work spaces. All students had their own Chromebook which was used daily for engaging in lessons and activities. The students also attended a STEAM Lab elective once a week for 45 minutes and an Innovation Lab elective once a week for 45 minutes. The students learned coding techniques for various robotics in both STEAM Lab and Innovation Lab. Students received empathy-based lessons through their guidance counselors. These 45-minute lessons took place once a month.

Participants

The participants were a purposeful sample, since all participants in the study were students in my fifth-grade class. I was the only teacher for the participants since I taught all core subjects to my group of students. The participants were all between the ages of 10 and 11. Of my 23 students, 12 (52%) were female and 11 (48%) were male. There were 17 (74%) Caucasian participants, four (18%) Hispanic participants, one (4%)

African American participant, and one (4%) Asian participant. The opportunity to participate in the study was offered to all 23 students in my class. I had 18 students volunteer to be participants by completing assent forms, then their parents completed consent forms. The 18 participants completed all parts of the study, including the pre- and post-survey, interaction with the innovation, student response journal, and individual interview. Of the 18 fifth-grade participants, 4 of them self-reported a disability. Of the 4 that self-reported a disability, none of them self-reported autism spectrum disorder.

Table 3.1

Participant Demographics

Pseudonym	Age	Gender	Ethnicity	Self-reported disability
Miller	10	M	W	Yes
Bella	11	F	W	No
Oliver	11	M	W	No
Graham	11	M	W	Yes
Austin	10	M	W	No
Della	10	F	H	No
Finley	11	F	H	No
Sadie	11	F	W	No
Grace	11	F	H	No
Lily	10	F	A	Yes
Brooks	11	M	B	Yes
Harrison	10	M	W	No
Avery	11	F	H	No

Piper	10	F	W	No
Hayes	11	M	W	No
Noah	10	M	W	No
Kelsey	11	F	W	No
Elliot	11	M	W	No

Note: A = Asian; *B* = Black; *F* = female; *H* = Hispanic; *M* = male; *W* = White

Through their interactions with robotics in the STEAM Lab elective and Innovation Lab elective, students were very knowledgeable in regards to programming robotics. The same coding techniques used to program robotics in STEAM Lab and Innovation Lab were utilized when working with the innovation.

Innovation

The innovation for my action research was the implementation of a Lego Boost robot which students programmed in order to help an individual with autism spectrum disorder achieve a specific task. The implementation period for the innovation was six weeks long. During those six weeks, students were pulled individually to work with the innovation. Due to the classroom and school schedules, between two and four students were pulled each week during the six-week implementation period.

Justification for the innovation. The innovation for my action research study was the use of a Lego Boost robot in a disability scenario. Several studies have shown that the use of robotics can be a highly effective tool to enhance learning (Gomoll et al., 2016; Shankar et al., 2013; Zhong, 2020). In addition, robotics provide students with a highly interactive and hands-on learning experience (Gomoll et al., 2016; Zhong, 2020). In addition, the use of technology in the learning process increases student engagement,

enhances understanding, and increases memorability (Carver, 2016; Jansen, 2006; Pegrum, Oakley, & Faulkner, 2013; Poirier, & Feldman, 2012; Whatley, & Ahmad, 2007). Empathy is a skill that is commonly used by programmers and designers (Kouprie & Visser, 2009). In order to create a product that meets the end-users' needs, they use empathic design to guide their decision-making (Koskinen, Battarbee, & Mattelmäki, 2003; Kouprie & Visser, 2009). This empathic design requires cognitive empathy, or taking on the perspective of someone else (Kouprie & Visser, 2009). Participants used this same user-centered design when coding the Lego Boost robot to assist a person with autism spectrum disorder in learning how to greet someone.

Participants were provided with a scenario which described the person, the disability, and the task the participants were assigned. Through the use of a simulation, a real-world environment was created to make the learning more relevant, while also allowing for choice, challenge, collaboration, and authenticity of the task (Chen et al., 2004; Marinak, 2013). Robotics provide an interactive and hands-on learning experience that help students visualize real-world situations (Gomoll et al., 2016; Shankar et al., 2013; Zhong, 2020). In addition, creating a scenario where learners are able to experience empathic understanding enables them to be empathic towards others (Wilson & Ray, 2018). In working to achieve the task, participants had to consider the limitations of the user, meaning the person with the disability who would be using the robot to learn how to greet someone. Taking time to understand the perspective and needs of someone with a disability leads to an increase in empathy for others (Dew, Balandin, & Llewellyn, 2008; Perenc & Peczkowski, 2018; Seligman & Darling, 1997).

Lego Boost robot. Prior to students using the innovation, I downloaded the Lego Boost app onto the iPad and followed the step-by-step directions provided by the app to build the robot. I selected the Lego Boost robot over other robots because of its features. The Lego Boost robot could be coded to move in all directions, use its arms, and make difference facial expressions. It came with sound and voice recordings already in a block of code. Participants could also record their own voice recordings and use the recordings in the code.

Figure 4.1. Lego Boost Robot

I began each session by explaining to students that they would be participating in a programming activity utilizing the Lego Boost robot. While the participants all possessed a lot of experience with coding and robotics, the Lego Boost robot was not a robot that any of them had previously worked with. I provided each student with an explanation of how to use the iPad app, where to find certain commands (clear all codes, run program, and repeat code), and how to reconnect the iPad to the robot in case it

disconnected. The codes were categorized on the app, so I also gave a brief overview of each category and what types of codes would be in each.

Once each student was comfortable using the app, I read the scenario (Appendix C). The scenario I created was modeled after scenarios in other studies (Bang & Lim, 2007; Evans, 1976; Pfeiffer, 1989; Wilson & Alcorn, 1969). The scenario described the disability in student-friendly terms, along with limitations associated with the disability.

When Laura was born, she seemed perfectly healthy. As Laura grew older, her parents began to notice that Laura didn't seem to behave like the other at children her age. After many doctor's appointments and evaluations, Laura was diagnosed with autism spectrum disorder. People who have autism spectrum disorder often struggle to understand and appropriately behave in social situations.

You are a programmer who has been asked to program the robot to help people like Laura overcome obstacles. The Lego robot you are working with today is a prototype. Your task is to program the robot to greet Laura, so that she can learn how to appropriately greet someone. Program the robot to greet and interact with Laura. You can incorporate any actions you feel are important into the greeting to help Laura.

Students were given a copy of the scenario to refer back to during their session and could request it to be reread at any time. I reviewed the rules for working with the materials, along with additional safety and behavioral expectations.

Each student was then given 30 minutes to program the Lego Boost robot to greet someone. Examples of the codes most frequently used by participants in this study included *move forward, turn 90 degrees to the left/right, smile, extend arm, shake hand, nod,* and *wave.*

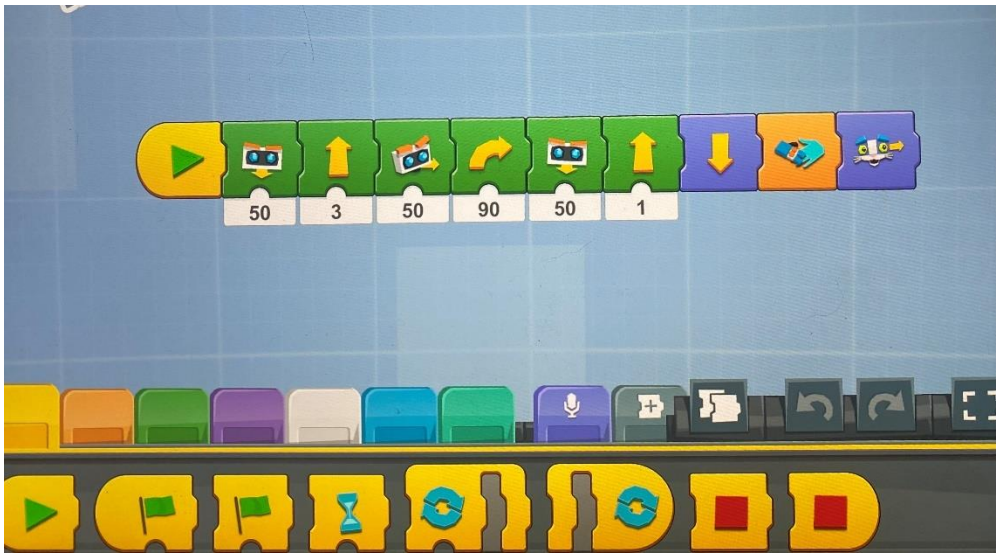

Figure 4.2. Student artifact from Lego Boost Robot App on iPad

Students worked independently on the task, without assistance from their peers or teacher. Since the task was open-ended, no feedback was provided on whether the task was completed correctly or not. While there were variations in the participants' final results, all 18 participants used similar codes. These similarities included moving forward to approach an imaginary person, use commonly accepted greetings (e.g., hello, what is your name, etc.), and use friendly body language (e.g., wave, smile). Of the 18 participants, 13 included a voice recording that invited the imaginary person to play with them. All 18 participants programmed the robot appropriately, according to how children of the participants' ages interact with their peers based on the researcher's observations and experiences in teaching 10- and 11-year-olds. When the participants had questions about a certain code or needed help reconnecting the iPad to the Lego Boost robot, I provided support. For example, some students needed help locating and using the voice recorder code, while others asked for help with duplicating a block of codes.

Data Collection

The purpose of this action research was to assess the impact of robotics on fifth-grade students' empathy towards individuals with disabilities. To complete this research, multiple data sources were utilized. The first section presents the quantitative data collection methods. This is followed by the methods for qualitative data collection. These sources were triangulated to provide the study greater reliability and validity, and the researcher with a comprehensive understanding of the results (Mertler, 2017, p.107). Table 3.2 shows each research question and the data sources that relate to it.

Table 3.2

Research Questions and Data Sources

Research Question	Data Source
RQ1: How does using robotics effect students' empathy?	• Pre- and post-survey • Individual interviews • Student response journals
RQ3: How does the innovation impact fifth grade students' perceptions of individuals with disabilities?	• Individual interviews • Student response journals

Pre- and Post-survey

Each student completed the adapted survey (Appendix E) based off the Basic Empathy Scale (Appendix D) that was originally developed by Jolliffe and Farrington in 2006. The BES is a twenty-item scale that measures five basic emotions where the measurements relate more generally to cognitive and affective empathy. This data allowed the researcher to understand the participants' empathy levels prior to the implementation of the innovation. The data from this pre-survey was later compared with

the post-survey data to assess the level of impact the innovation had on student empathy levels.

This study utilized an adapted version (Appendix E) of the Basic Empathy Scale (Appendix D) as a pre- and post-survey to collect quantitative data regarding the effects of robotics on student empathy levels, students' perceptions of the innovation on their empathy levels, and the impact of the innovation on students' perceptions of individuals with disabilities. As shown in Table 3.2, this data was used in response to the first and second research questions. The Basic Empathy Scale was developed by Jolliffe and Farrington in 2006. It measures both affective and cognitive empathy in adolescents. According to Jolliffe and Farrington (2006), affective empathy is the degree to which a perceiver shares the emotional state of the target and cognitive empathy is the degree to which a perceiver understands the emotional state of the target. The Basic Empathy Scale is a self-report measure where respondents rate their level of agreement with empathy-related statements using a five-point Likert scale. The scale will range from a 1 for 'strongly disagree' to a 5 for 'strongly agree,' with 'neutral' being the midpoint at 3. The use of a Likert-scale provided me, the researcher, an effective means of gathering data concerning students' attitudes, perceptions, and opinions (Mertler, 2017).

The twenty statements are divided into two subscales: 11 items belong to the affective empathy subscale and 9 items belong to the cognitive empathy subscale. Sample statements from the affective empathy subscale include "Other people's feelings don't bother me at all" and "I get caught up in other people's feelings easily." Sample statements from the cognitive empathy subscale include "When someone is feeling

‘down’ I can usually understand how they feel” and “I am not usually aware of my friend’s feelings.”

Jolliffe and Farrington's (2006) reported strong internal consistency for both the affective empathy subscale (α = .85) and the cognitive empathy subscale (α = .79), and an overall Cronbach alpha coefficient of .87.

The Basic Empathy Scale was administered via Google Forms. Students completed the pre- and post-survey in class. This allowed me to read questions aloud to students as needed. This prevented students with lower reading levels from misreading the questions. This also provided the opportunity for students to ask clarifying questions regarding the survey questions. The same questions were used for both the pre- and post-survey. The same students who participate in the pre-survey participated in the post-survey.

Semi-structured Individual Interviews

The study utilized semi-structured individual interviews to collect qualitative information regarding participants’ perceptions of individuals with disabilities and the role that empathy plays in their ability to program the robot. Each participant took part in a 20-minute interview with the researcher after the implementation of the innovation. These interviews were conducted face-to-face. Interviews took place an administrator’s office on the same hall as the students’ classroom. Students were pulled for their interview in the same order they were pulled to work with the innovation. All interviews were audio recorded and transcribed. The researcher collected real-time field notes during the interviews. Participants and their parents were given access to their transcripts and field notes.

Using an interview was beneficial because the findings from open-ended questions often reveal unexpected thoughts and feelings from students (Schmuck, 1997). A semi-structured design utilizes pre-determined, open-ended questions to guide the interview, while also allowing the interviewees to expound on their responses (DiCicco-Bloom & Crabtree, 2006; Whiting, 2007). The findings from these interviews contributed to the responses of both research questions, as shown in Table 3.2. The interview protocol (Appendix F) aligned with the research questions as shown in Table 3.3.

Student Response Journals

The study utilized student response journals to collect qualitative information regarding the effect of robotics on participants' empathy towards individuals with disabilities and participants' perceptions of individuals with disabilities. In the response journals, students were provided with questions and typed their responses.

Table 3.3

Interview Protocol Research Question Alignment

Research Question	Interview Question
RQ1: How does using robotics effect students' empathy?	How would you describe your empathy level towards individuals with disabilities? How might your life be different if you had a disability? How might your life be different if someone you care about had a disability? How has the innovation impacted the way you feel about others' emotions? How has the innovation impacted the way you treat others? How has the innovation impacted the way you react to others' emotions?
RQ2: How does the innovation impact fifth	What did the innovation help you to understand that you may not have understood before?

grade students' perceptions of individuals with disabilities?	Describe your thoughts when you see someone with a disability. How do you feel about individuals with disabilities? How has the innovation impacted your thoughts about individuals with disabilities? How has the innovation helped you to understand individuals with disabilities?

Student response journals were digital through the use of Google Docs. The document contained open-ended questions, as shown in Appendix G. Participants typed their responses into the journals following their experience with the innovation. Student response journals were collected at the end of Phase II, the innovation implementation and data collection period.

Student response journals strengthened the data by allowing the researcher to obtain the language and words of the participants (Creswell, 2014; Dunlap, 2006). Unlike the individual interviews, the response journals allowed students the opportunity to reflect and consider their responses, which provided more in-depth information. Through reflection, students become aware of their thoughts, positions, and feelings (Farabaugh, 2007, p.2). According to Phelps (2005), data from journals can provide significant insights that are not always obtained through other data collection methods. The journals were easily accessed at a time convenient for the researcher and provided data that the participants had given attention to (Creswell, 2014).

Data Analysis

Research Question Alignment

Since this study included both quantitative and qualitative data collection, multiple data analysis methods were utilized. The pre- and post-survey were analyzed

using quantitative data analysis methods, while the semi-structured interviews and student response journals were analyzed using a qualitative data analysis method. Table 3.4 provides an outline and alignment of the research questions, data sources, and analysis methods.

Quantitative data analysis. Descriptive statistics allowed the large amount of numerical data to be simplified, summarized, and organized (Mertler, 2017). As shown in Table 3.4, the mean, standard deviation, and range were identified through analysis and used to summarize the data from the pre- and post-survey. While analyzing the data, a Wilcoxon signed-rank test was conducted after the Shapiro-Wilk test indicated non-normally distributed data for the affective subscale. The use of inferential statistics analysis enabled the researcher to determine how likely the result from the study is to be repeated with a larger population (Guetterman, 2019).

Specifically, a paired samples *t*-test will be utilized to compare the pre- and post-survey results. A paired samples *t*-test is most valuable to this study because the same group of students will be pre-surveyed, exposed to the innovation, and then post-surveyed (Guetterman, 2019). The alpha level will be set at 0.05, which is typical in educational research studies (Mertler, 2017).

Qualitative data analysis. Inductive thematic analysis was used in analyzing the data collected from the individual interviews and student response journals, as shown in Table 3.4. Parsons and Brown (2002) describe a three-step process for conducting inductive analysis of qualitative data: organization, description, and interpretation. The organizational step focuses on reducing large amounts of data from interview transcripts, observational field notes, documents, and records (Creswell, 2014; Mertler, 2017). This is

accomplished using coding, which groups data with similar information (Parsons & Brown, 2002).

Table 3.4

Alignment of Research Questions, Data Sources, and Analysis Methods

Research questions	Data sources	Analysis method
RQ1: How does using robotics effect students' empathy?	• Pre- and post-survey • Individual interviews • Student response journals	• Descriptive statistics (*M, SD*) • Inferential statistics (paired samples *t*-test) • Inductive/thematic analysis
RQ2: How does the innovation impact fifth grade students' perceptions of individuals with disabilities?	• Individual interviews • Student response journals	• Inductive/thematic analysis

Note: M = mean; *Med* = median; *RQ* = research question; *SD* = standard deviation

Data were analyzed through inductive analysis (Corbin & Strauss, 1990; Glaser & Strauss, 1967). As an incident is found, it was compared with other instances to identify similarities and differences (Corbin & Strauss, 1990). As concepts are discovered, they were labeled and compared to others (Corbin & Strauss, 1990). Open coding was used to code the responses phrase-by-phrase. In open coding, events or interactions are compared with others for similarities and differences, and then given conceptual labels (Corbin & Strauss, 1990). The use of these labels was beneficial to the researcher because it allowed for events and interactions that are conceptually similar to be grouped together for analysis. Open coding, being heuristic in nature, allowed the researcher to explore the

study's data without assumptions (Bailey & Bailey, 2017). The combination of open coding and constant comparisons allowed the researcher to avoid subjectivity and bias (Corbin & Strauss, 1990).

Findings from the qualitative analysis were presented in narrative form through themes and thick, rich description. The use of inductive thematic analysis in studying perceptions has been used in multiple studies (Jansen, 2006; Marinak, 2013; Morrisey, 1981). The inductive process was documented and presented through graphic representations.

The qualitative findings were used in tandem with the quantitative findings to provide a more comprehensive understanding. Triangulating the data is central to the effectiveness of a mixed methods study and produces greater insight than a single method approach would (Lingard, Albert & Levinson, 2008).

Procedures & Timeline

This study consists of three phases. The timeline for the procedures of this action research is as follows: Phase I: Participant Identification, Phase II: Data Collection, and Phase III: Data Analysis. Each phase is described in detail below. Table 3.5 is included to detail the timeline of all of the procedures.

Phase I: Participant Identification

I obtained permission from my school district's Department of Accountability and Quality Assurance in order to conduct my research. Once permission was granted, I informed my school administration of my research and its purpose. I also informed my students and their parents about the research, and sent home consent forms for parents to sign, with an opt-out option.

Table 3.5

Timeline of Participant Identification, Data Collection & Data Analysis

Phase	Participant Role	Researcher Role
Phase I (2 weeks)	Complete consent/assent forms	Obtain permission from district Distribute empathy pre- survey
Phase II (6 weeks)	Complete pre-survey Engage in innovation scenario Complete response journals Participate in interview Complete post- survey	Distribute pre- survey Facilitate innovation scenario Record field notes Conduct interviews Distribute post- survey Collect response journals
Phase III (12 weeks)	Participate in member checking	Transcribe interviews Complete external audit Complete statistical summary and narrative report Conduct member checking Share findings

I sent home email reminders to my students' parents until all forms were returned, so that I could identify who was a participant and who had opted out. There were no consequences for those who chose to opt-out. Consent from parents and assent from students were required in order for students to become participants. Upon obtaining consent and assent, the participant group was identified. Participant identification took about two weeks to complete and occurred in early Spring of 2021 using purposeful sampling.

Phase II: Data Collection

Phase II began with students completing the pre-survey. Prior to administering the survey, a review of unfamiliar vocabulary was conducted with the students. This

survey, the Basic Empathy Scale, was initially developed by Jolliffe and Farrington in 2006.

The researcher provided students with an overview of the six-week implementation phase.

Throughout these six weeks, in-depth, qualitative data was collected. First, detailed field notes were recorded during observations. Second, students responded to prompts in their response journals. Lastly, semi-structured interviews were conducted. In week six, student response journals were collected. Then, students completed the post-survey. Using student-friendly language, I briefly described these data collection methods to students and when each would be conducted.

Phase III: Data Analysis

After data was collected from field notes and interviews, it was be analyzed for developing themes. These themes guided the researcher in developing codes to analyze the emerging data. Upon completion of the innovation and data collection, the interviews were transcribed. Using a Word Document, open coding was used by entering inserting codes in a column along the right side of the transcripts (Creswell, 2017). These codes were refined and organized into categories from which themes were determined (Creswell, 2017). The data and codes were shared with an external auditor. After the external audit was complete, the data from the empathy pre- and post-survey was analyzed using a paired-samples *t*-test. Following this analysis, a statistical summary and narrative report were developed and shared with participants.

The researcher then reached out to students via email to present the interview transcripts and the completed inductive analysis. The researcher led a discussion and took

written notes of the feedback from participants regarding the accuracy of the transcripts and conclusions drawn. When member checking was completed, necessary revisions were made and a final report was developed and shared with stakeholders.

Rigor & Trustworthiness

It is imperative that measures were taken to ensure rigor and trustworthiness within the research. In action research, rigor is achieved through procedures that are implemented to ensure unbiased results (Stringer, 2007). Trustworthiness is established through accurate and believable data (Mertler, 2017). The study used triangulation, member checking, thick, rich descriptions, referential adequacy, an audit trail, and peer debriefing to ensure rigor and trustworthiness.

Triangulation. Triangulation involves the careful reviewing of data collected through different methods in order to achieve a more accurate and valid estimate of the results (Allen & Oliver-Hoyo, 2006). Triangulation assisted me by cross-examining the integrity of the participants' responses and reducing bias (Anney, 2014). If researchers can substantiate multiple data sets with each other, the findings drawn from them are likely to be trustworthy (Carlson, 2010). Both quantitative and qualitative data collection methods were used in this study. These included the semi-structured interviews, the student response journals, and the pre- and post-survey. The use of multiple methods and sources of data collection enhanced the validity of the findings (Mertler, 2017).

Member checking. Through member checking, participants were given the opportunity to verify the accuracy of the conclusions from the research in which they shared their experiences (Doyle, 2007). Creswell (2009) strongly suggests using polished interpreted pieces from surveys or interviews. Participants were provided the opportunity

to review both the interview transcripts and the completed inductive analysis. This allowed them the chance to confirm accuracy, and contribute additional thoughts they had. Since the participants are elementary students, I contacted participants via email and engaged in discussion regarding the accuracy of the conclusions drawn from the data. This allowed me to ensure I interpreted their responses in the way they intended for them to be interpreted.

Thick, rich descriptions. I provided detailed descriptions of settings, participants, data collection, and analysis procedures to ensure credibility of the research (Anfara, Brow, & Mangione, 2002). Creswell and Miller (2000) describe an additional purpose of thick, rich description as helping to draw the reader closer to the narrative in order to evoke a sense of connection with the study's participants. The use of thick, rich descriptions allowed the reader to determine if the overall findings "ring true" (Shenton, 2004, p. 69).

Audit trail. An audit trail accounted for all decisions and research activities to show how the data was collected, recorded and analyzed, and how codes, categories, and themes were determined (Bowen, 2009; Li, 2004). All raw data, observation notes, interview notes, documents, and collected student work were kept as part of the audit trail (Guba & Lincoln, 1982).

Peer debriefing. Seeking support and feedback from other professionals improved the quality of the research findings (Anney, 2014). My dissertation committee and colleagues within the program reviewed and critiqued my processes of data collection, analysis, and interpretation (Mertler, 2017). In addition, the survey and interview questions were reviewed by another fifth-grade teacher, the school's

instructional coach, guidance counselor, and the technology specialist. Peer debriefing allowed me to gain insight from professionals with backgrounds and experiences that differ from my own. Since their feedback was used to improve the findings of the research, I sought their support both before and during the determination of my own conclusions.

Sharing and Communicating Data

The purpose of this action research was to assess the impact of robotics on fifth grade students' empathy towards individuals with disabilities. The findings of this research were communicated with all stakeholders in various presentations. Since the purpose of action research was to positively impact the researcher's local context and close the gap between research and practice, the findings were also be shared with colleagues and administration (Mertler, 2017, p. 259). Sharing and communicating the findings and limitations of my research allowed others to implement future studies and expand the knowledge base of this field (Mertler, 2017, p. 259). In order to maintain reciprocity, the findings were shared with the participants and their parents (Creswell, 2017, p. 137).

Since the participants were minors, the participants' parents were invited to attend this presentation as well. In order to keep the participants' anonymous, participants' names and the name of the school were replaced with pseudonyms (Mertler, 2017).

The findings were shared with the participants of this study through a Google Slides presentation via Google Meet. All students in the class, both participants and non-participants, were invited to be in the audience for the presentation. The presentation was presented in student-friendly language and provided an overview of the purpose, process,

and findings. Quotes from students were included to better understand the students' experience with the innovation. Parents and administration were invited to attend as well. In order to include these stakeholders' thoughts and recommendations, a Survey Monkey survey was used to collect their feedback. The survey for participants was age-level appropriate for fifth graders. There was a different survey for the adults in attendance. The parents and administrators received their own survey, which contained questions specific to their role (parent v. school staff member).

In addition, the findings of this research were communicated with teachers at Burton Academy. The findings were shared through a Google Slides presentation, but differed from the presentation shared with participants. Unlike the presentation for students and parents, the presentation for teachers at Burton Academy included the theoretical framework, specific data presented through graphs and tables, and details on the implications of the study's findings. This presentation took place at a faculty meeting, where administration was also in attendance. A Survey Monkey survey was used to collect the thoughts and recommendations of colleagues who attended this presentation. The same survey used for administrators who attended the presentation with participants was the one utilized during the staff's presentation.

After the thoughts and recommendations from these two presentations were recorded, organized, and summarized, the findings of the research with the summarized feedback were presented specifically to administration. This presentation took place at an administration team meeting. This presentation was followed by a discussion on the implications the findings have on our teachers, parents, and students.

The surveys utilized give weight to the stakeholders' opinions (The Belmont Report, 1978). By sharing and communicating the findings of this research with all stakeholders, potential unethical issues with data sharing were avoided (Creswell, 2014, p. 132).

CHAPTER 4

ANALYSIS AND FINDINGS

The purpose of this action research was to describe the impact of robotics on fifth grade students' empathy towards individuals with disabilities. The following two research questions guided the proposed study: (1) How does using robotics effect students' empathy? and (2) How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

This chapter presents an overview and analysis of the data collected during a mixed methods action research study. The participants were administered (a) pre- and post- surveys, completed (b) student response journals, and participated in (c) individual interviews. This chapter includes both my quantitative findings and qualitative findings. Included in the quantitative findings is a breakdown of the surveys. In the qualitative findings, student response journals and interviews can be found. The chapter concludes with a report of the themes that emerged from the student response journals and individual student interviews, along with interpretations and a chapter summary.

Quantitative Data Analysis and Findings

Quantitative data was gathered through participant responses to the Basic Empathy Scale (BES). The Basic Empathy Scale was used as a pre- and post-survey, which was completed by all participants prior to the innovation and a second time following the innovation. The following sections include (a) participant demographics and (b) a presentation of findings.

Participant Demographics

All participants were fifth grade students in a public elementary school in South Carolina. The participants were all students in the researcher's class and were taught all subjects each day by the researcher. Participants responded to demographic questions that were included in the pre- and post-survey. Of the 18 participants, 9 were male and 9 were female. In addition, 7 were 10-years-old and 11 were 11-years-old.

As part of the pre- and post-survey, participants self-reported if they had a disability. If a participant responded to this question and reported a disability, the following question asked them to expound. Of the eighteen participants, four of them reported having a disability. Five of the participants reported having an ADHD diagnosis and two students reported vision disabilities. One of the students that reported having a vision disability also reported an epilepsy diagnosis and a hearing disability. In addition, five participants reported someone in their immediate family having a disability.

Presentation of Findings

Prior to participating in the Lego robot innovation, all participants completed a pre-survey, which included demographic questions and the Basic Empathy Scale. After their time with the innovation, all participants completed a post-survey, which was

identical to the pre-survey. All items were scored on a Likert-style scale containing values from 1 to 5. Each participant's response values were added together for a total score each time (Jolliffe & Farrington, 2006). Therefore, the highest possible score on the Basic Empathy Scale is a 100.

Cronbach's alpha showed the post-survey to reach acceptable reliability, $\alpha = 0.87$. In addition, I conducted reliability analysis on each subscale post-survey values. Cronbach's alpha showed the cognitive empathy subscale results to be less consistent and should be taken tentatively, $\alpha = 0.57$. Cronbach's alpha showed the affective empathy subscale results to reach acceptable reliability, $\alpha = 0.85$.

Descriptive Statistics. The descriptive statistics for the participants ($n = 18$) for the survey items were derived from the two subscales on both the pre-survey and post-survey. The mean response of each survey subscale and its standard deviation were calculated using JASP software and are displayed in Table 4.1.

Table 4.1

Descriptive Statistics for Pre- and Post-Survey (n = 18).

	Pre-survey *M*	**Pre-survey *SD***	**Post-survey *M***	**Post-survey *SD***
Overall total	68.89	10.82	70.61	11.83
Cognitive total	34.94	4.14	36.0	5.85
Affective total	33.94	8.43	34.61	8.39

Pre-survey and post-survey data indicated the mean pre-survey scores for the cognitive subscale were 34.94 with a standard deviation of 4.14 while the post-survey

data indicated a mean of 36.0 with a standard deviation of 5.85. The affective subscale indicated a pre-survey mean of 33.94 with a standard deviation of 8.43 while the post-survey data indicated a mean of 34.61 with a standard deviation of 8.39.

Inferential Statistics. Paired samples t-tests were planned to compare pre-survey means to post-survey means. To determine if the survey responses for the overall total and for each subscale were distributed into the range of normality, post-survey data were tested for normality using Shapiro-Wilk tests. Because multiple inferential tests were being conducted, a Bonferroni adjustment was made to the significance level, $\alpha = 0.017$ ($\alpha = 0.05/3 = 0.017$).

For the overall total, the Shapiro-Wilk test indicated the data were normally distributed ($p = .47$). So, a t-test was conducted, $t(17) = 0.79$, $p = .44$; there was no significant difference between pre-survey ($M = 68.89$, $SD = 10.82$) and post-survey ($M = 70.61$, $SD = 11.83$) mean scores.

For the cognitive subscale, the Shapiro-Wilk test indicated the post-survey data were normally distributed ($p = .63$). So, a t-test was conducted, $t(17) = 0.75$, $p = 0.46$; there was no significant difference between pre-survey ($M = 34.94$, $SD = 4.14$) and post-survey ($M = 36.0$, $SD = 5.85$) mean scores.

For the affective subscale, the Shapiro-Wilk test indicated post-survey data were non-normally distributed ($p = .02$). Therefore, a Wilcoxon signed-rank test was conducted, $W = 89.00$, $p = .29$. No significant difference was found between pre-survey scores (Med. = 35.00, $SD = 8.43$) and post-survey scores (Med. = 36.00, $SD = 8.39$).

The innovation had no statistically significant impacts on overall empathy, cognitive empathy, and affective empathy as measured by the Basic Empathy Scale. As

part of the peer review process, analysis of the quantitative data was reviewed and confirmed by my dissertation chair.

Qualitative Data Analysis and Findings

This study collected qualitative data from student response journals and individual student interviews conducted following students' interaction with the innovation. A total of 18 student response journals were collected for review. A total of 18 individual interviews were conducted. This section includes a description of the qualitative data, followed by the methods of analysis, themes, and interpretations.

Student Response Journals

The purpose of collecting qualitative data from the student response journals was to gain insight on the students' empathy towards individuals with disabilities and perceptions of individuals with disabilities prior to and following their interaction with the innovation. Student response journals allow the researcher to obtain the language and words of the participants (Creswell, 2014; Dunlap, 2006). The response journals provided students with an opportunity to reflect and consider their responses, which provided more detailed information (Farabaugh, 2007). Students responded to all seven questions in the journals immediately following their interaction with the innovation. Student responses ranged from a single word or short phrase to multiple paragraphs.

Individual Interviews

Following the completion of the student response journal, all students participated in an individual, semi-structured interview with the researcher (Appendix F). A semi-structured design uses pre-determined, open-ended questions to guide the discussion, while allowing new questions to emerge in order to clarify ideas or have the interviewee

expound on their meaning (DiCicco-Bloom & Crabtree, 2006; Whiting, 2007). All interviews were conducted individually and at different times throughout the school day based on the day's schedule and instruction. Each interview lasted approximately 5 to 11 minutes. Interviews were conducted with all 18 fifth-grade participants. Since I teach ten- and eleven-year-olds, I wanted the interview experience to be welcoming so they felt comfortable in sharing their thoughts and ideas. The interviews took place in the hallway outside my classroom, where students felt comfortable to speak without being worried of what others might think if they listened in on the conversation. I took hand-written notes in a spiral notebook (Figure 4.3) throughout the interview. All of the interviews were recorded by myself using a voice memo app on my iPhone and then transcribed verbatim. Prior to analyzing, I prepared the interview data by uploading the audio recordings from my iPhone onto an online transcription service called Rev. Once I received the transcriptions from Rev, I compared them to the audio recordings to ensure accuracy (Mertler, 2017). All transcripts were emailed to participants for review. As a form of member checking, participants were asked to review the transcripts for accuracy within three weeks of receiving them. All participants approved their transcript. No changes were made by the participants.

After the transcripts were approved by the participants, I created a separate Word Document file for each interview transcript and placed the transcript into a table. The table was formatted so that each speaker's new response was in a new cell. I then added a column to both the left and right side of the transcript. The left column was for analytic memos and the right column was for codes. Examples of analytic memos used include

repeated question, probing, clarifying, and *student says "sincerely" in place of "especially."*

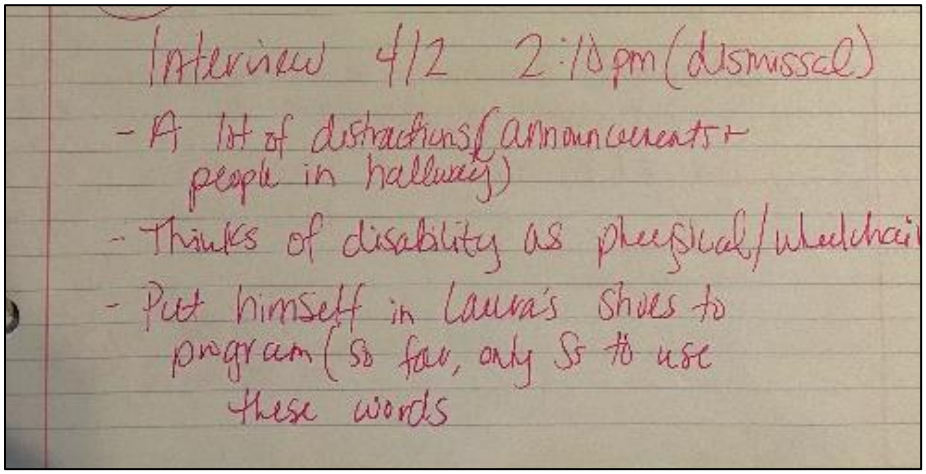

Figure 4.3. Notes from observation of innovation and interview

Examples of codes include *impact on life, understand others, given same treatment,* and *treat all with kindness.*

Repeated question	Emily:	How might your life be different if someone you cared about has a disability?	
	Hampton:	It would be a lot different. say one of my family members has autism, we would have to be watching them all the time so that they don't do anything that could hurt themselves or something like that.	Provide care Family Need watching Self-harm
	Emily:	What did the Lego robot help you understand that you may not have understood before?	
	Hampton:	It helped me understand that people with disabilities like someone with autism, they can't like understand big	Understand disabilities Autism Lack understanding

Figure 4.4. Sample of three-column coding document

Analysis of Qualitative Data

I began the coding process using open coding techniques. As I read through each phrase of speaker text, I analyzed what the speaker was trying to say and compared

actions and events with others for similarities and differences and then typed codes into the right-hand column of the transcript (Corbin & Strauss, 1990; Mills, 2011, Parsons & Brown, 2002). This resulted in 1,159 codes.

After open coding the data, two categories of codes were identified: (a) descriptive and (b) in vivo. Descriptive coding summarizes topics into words or phrases (Saldaña, 2016). Descriptive coding helped to create a foundation (Wolcott, 1994). In vivo coding uses a word or phrase from the actual language in the data (Charmaz, 2014; Saldaña, 2016). An example of this was the *Try and Help Them* code. This code appeared across several students' transcripts from the individual interviews. For example, this code was used in Elliot's transcript when the participant said, "It's not their fault that they have it and I would try and help them and if they need help." This code allowed me to preserve the participants' actual language, which allows for a deeper understanding of their perspectives and experiences (Saldaña, 2016).

Next, I merged any repeating codes and refined the wording of others (see Figure 4.5) in order to combine similar codes and better understand the data (Creswell, 2014; Saldaña, 2016). One example of this was the *Voice Commands* code. This code served as a place to note when a student programmed a command for the robot. This code was later revised to the *Robot Command* code to incorporate all commands given to the robot, as not all of them were voice commands. Another example of refined wording is with the codes *Care about Others*, *Care for Others* and *Care for Them* were merged into the same code of *Care for Others*. The code *Care about Others* came from Finley's interview when the participant stated, "I think I care about others more than before now," and the code *Care for Others* came from the same participant saying, "I think we should care for

them more." Kelsey responded, "I would probably spend a lot more time with them and care for them," which provided the code *Care for Them.* All three of these statements revolved around providing care for other people. Since these statements had similar meanings, the codes were merged into one. After this step, 309 codes remained.

Couldn't participate	Disabilities limit opportunities
Couldn't play with others	Disabilities limit opportunities
Courteous	Courteous
Create big idea	Create big idea
Curious	Curious
Daily life difficulties	Disabilities limit physical abilities
Deal with disabilities	Deal with disabilities
Deep and personal connection	Value in relationships and community
Dependent	People with disabilities rely on others
Dependent on mom	People with disabilities rely on others
Depends on emotion	Depends on emotion
Dialogue	Robot command
Didn't learn anything new	Didn't learn anything new
Difference in learning	Difference in learning
Differences don't matter	Differences don't matter
Differences in people	Differences in people

Figure 4.5. Merged and refined codes

I then transitioned into the next step through code mapping. Code mapping allows for the strategic organization of information while also building credibility and trustworthiness (Corbin & Strauss, 2008; Saldaña, 2016). I analyzed the codes to determine which types of codes were prevalent in my data. I sorted codes based on the type and discovered that the 309 codes could be organized into five code types: descriptive, concept, structural, values, and emotion codes. Table 4.2 shows how many codes were in each of the code types. As I identified each code's type, I used a color-coding system to organize the types. Figure 4.6 is an example of the codes with their cells filled with the color of their code type.

Table 4.2

Distribution of Codes in Categories

Categories	Number of Codes Per Category
Descriptive	34
Concept	5
Structural	150
Values	97
Emotion	23
Neutral perceptions of individuals with disabilities	25
Positive perceptions of individuals with disabilities	14
Negative perceptions of individuals with disabilities	29
Differences in people	22
Perceived needs and feelings of individuals with disabilities	18
Disabilities impact and limit life	13
Perceived desires of individuals with disabilities	11
Positive impact of intervention	13
No impact of intervention	8
Interactions with robot/intervention	34
Self-awareness of own empathy	23
Social norms and expectations	46
Interactions with others and individuals with disabilities	53
Increased understanding of individuals with disabilities and realization that they aren't treated well	5
Disabilities severely limit participation in everyday life and impact families	2
Increased empathy and improved manner of treating others	4
Value empathy	2

After that, I began to sort the codes into categories using open coding. Open coding helped me to identify similarities and differences among the data which allowed

patterns to emerge (Corbin & Strauss, 1990). In order to do this, the codes were printed, cut apart, and arranged randomly on a table (see Figure 4.7).

Descriptive	Concept	Structural
Ask for help	Better than nothing	A little different
Attempt to do things	Create big idea	Able to participate
Be aware of your reactions	Curious about people with differences	Act differently
Be with family/friends	Disabilities are unbiased	Act like robot
Believable	Find common ground	Act towards others
Can control own actions		Affirmative
Can't go to school		Already am empathetic
Changed small daily tasks		Already treat everyone equally
Coping mechanism		Attempt to empathize
Desire to participate		Attempt to feel
Do things together		Attention

Figure 4.6. Color-coding system used to sort code by type

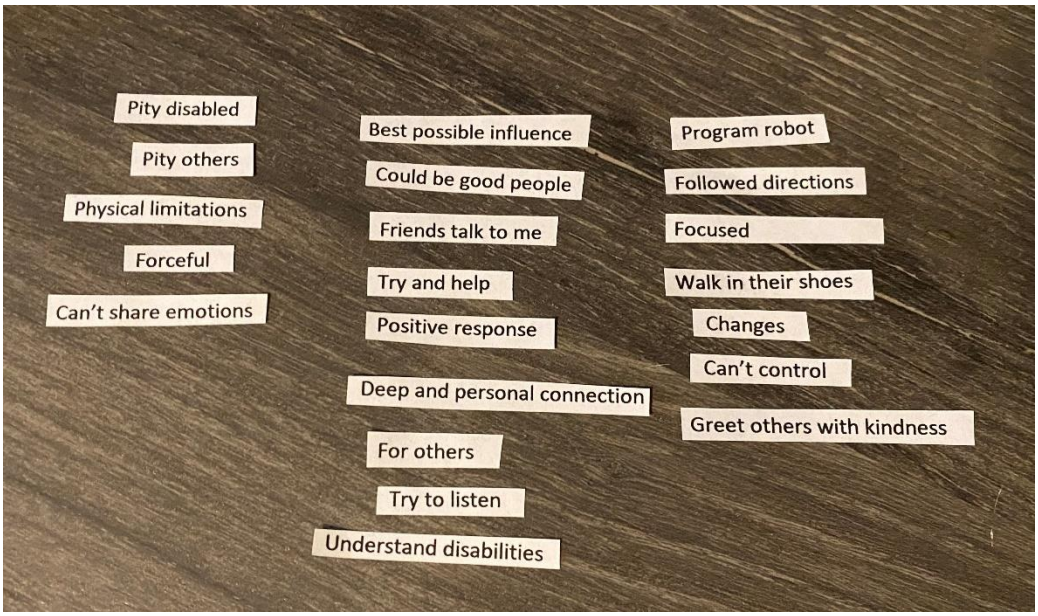

Figure 4.7. Sample of codes prior to being sorted

I began moving the printed codes around to create categories. One of the first relationships I noticed was positive versus negative. There were many codes that involved this pattern, including perceptions of individuals with disabilities, feelings towards the innovation and its effectiveness, and disabilities themselves. There were also

several codes regarding the impact and limitations of disabilities. After the initial sorting, some of the categories had a large number of codes and I began to look for more specific relationships that the larger categories could be broken down by. An example of this was the category that began as *Human Interaction.* At this point, the *Human Interaction* category had 91 codes in it. I broke this category down into three separate categories: *Human Connection*, which focused on relationships and their value, *Communication*, which involved verbal communication and listening skills, and *Social Norms/Expectations*, whose codes reflected participants' expectations of how people should interact with each other. As new patterns emerged, the codes were rearranged until all of the codes were logically grouped into 24 categories. The 24 categories and their corresponding codes were recorded in the Excel spreadsheet (see Figure 4.8).

Views of own empathy	Human connection	Communication
Difficult to empathize	Feelings of lonliness	Speak to others
Difficult to relate to people with disabilities	Share life events	Misunderstanding
Difficult to understand people with disabilities	Empathy in real life	Inner dialogue
Self-aware of empathy	Long-time friends	Not listening
Affirmative	Others' emotions	Hard to explain
Attempt to empathize	Others' feelings	Two-way conversation
Attempt to feel	Everyone has personal hardships	Something to say
Can empathize	Spend more time with people with disabilities	Ways to communicate
Can't empathize	Family and friends with disabilities	Being talked to
Know different emotions	Be with family/friends	Learn to communicate
Struggle sometimes to understand others	Got along well	More options to talk

Figure 4.8. A sample of categories and codes

I then wanted to explore the possibility of other relationships that would explain the data. Therefore, I sorted the codes again and logically consolidated the categories based on similarities (Charmaz, 2014; Corbin & Strauss, 2008; Saldaña, 2016). There were several categories whose codes seemed to overlap. For example, the categories *Limitations of Disabilities* and *Disabilities Impact Life* both involved ways in which disabilities impact families, as well as limit opportunities and participation. These

limitations involved codes, such as *Impact on Home Life* and *Disabilities Limit Physical Abilities*. The categories of *Limitations of Disabilities* and *Disabilities Impact Life* were combined to form the category of *Disabilities Impact and Limit Life*. While reorganizing, some codes revealed other relationships than the ones I had previously identified. In these instances, I got rid of the category and relocated the codes to other categories. For example, the code *Normal Thing* originally existed within the category *Disabilities are Normal.* I relocated the code to the category *Neutral Thoughts About Disabilities* because it fit with other codes within the category, such as *Disabilities are Unbiased* and *Unusual Movements*. After reorganizing codes and consolidating the original 24 categories within the Excel sheet, 13 categories resulted. Figure 4.9 shows the 13 categories.

Cycle 3 Round 2 Categories	Cycle 3 Round 1 Categories	Cycle 1 Codes w/ Cycle 2 Code Mapping
	Neutral thoughts about disabilities	Person with disability
	Physical disabilities	Unusual movements
	Disabilities are normal	Disabilities are normal
	Similarities	Witnessed similar behaviors
Neutral perceptions of people with disabilities	Curious about disabilities	Wonder
Positive perceptions of people with disabilities	Positive perceptions of people with disabilities	Can do good
Negative perceptions of people with disabilities	Negative perceptions of people with disabilities	Make assumptions about people with disabilities
	Differences	Act differently
Differences in people	Different disabilities	Autism
	Perceived needs of people with disabilities	More quality time
	Positive perceived feelings of people with disabilities	Well-loved
	Negative perceived feelings of people with disabilities	Blameless
Perceived needs and feelings of people with disabilities	Cope with/cure for disabilities	Coping mechanism

Figure 4.9: A sample of final categories with subcategories and codes

By comparing categories with each other and consolidating the data, I moved away from particulars and move towards themes and concepts (Charmaz, 2014; Corbin & Strauss, 2008; Saldaña, 2016). From these 13 categories, I was able to identify four themes. As part of the peer review process, I submitted my categories and resulting themes to my dissertation chair for feedback. My dissertation chair commented that two of my themes seemed to overlap because they both mentioned how individuals with disabilities have a perceived desire to fit in while battling negative self-esteem. I then rearranged a few of my categories to be more cohesive and reworded the two themes. For

example, the category *Perceived Needs and Feelings of Individuals with disabilities* was relocated from second theme to the first theme. I then resubmitted my categories and themes to my dissertation chair for input and received approval. For one of the themes, the categories *Positive Impact of Innovation, No Impact of Innovation, Interactions with Robot/Innovation,* and *Self-Awareness of Own Empathy* fit together to create the theme "While some students view the innovation as having little or no impact on their empathy, most believed that they gained a better understanding of individuals with disabilities, increased their empathy, and would treat individuals with disabilities better in the future." Figure 4.10 shows the connection from the 13 categories to the final 4 themes.

Cycle 4 Themes	Cycle 3 Round 2 Categories
Increased understanding of people with disabilities and realization that they aren't treated well	Neutral perceptions of people with disabilities
	Positive perceptions of people with disabilities
	Negative perceptions of people with disabilities
	Differences in people
	Perceived needs and feelings of people with disabilities
Disabilities severely limit participation and impact families	Disabilities impact and limit life
	Perceived desires of people with disabilities

Figure 4.10. A sample of final themes and categories

Member checking and peer debriefing were also conducted throughout the transcribing and coding process to ensure accurate analysis. Since data analysis took place after the end of the school year and the participants now attend various middle schools, communication was done through email and video conferencing. I presented the categories and themes that I identified from the data analysis. Participants reviewed the

themes and confirmed that the information was accurate and that it communicated what they learned about disabilities and robotic programming through the innovation.

Themes and Interpretations

Through observations, student response journals and individual interviews, four themes were identified from the data: (1) increased understanding of individuals with disabilities and realization that they aren't treated well, (2) Students perceive disabilities to severely limit participation in everyday life and impact families, (3) increased empathy and improved manner of treating others, and (4) value empathy. Table 4.3 shows each theme along with its assertion and categories.

In this section, each theme, with its assertion and categories, will be discussed in detail. Participants will be referred to using pseudonyms to protect their identities and ensure confidentiality (Mertler, 2017). Participant quotes from student response journals and interviews will be taken verbatim to most accurately describe participants' experiences and ideas (Maxwell, 2012).

Theme 1: Increased understanding of individuals with disabilities and realization that they aren't treated well. This theme was defined as being more considerate of individuals with disabilities, an increased awareness of what their daily lives are like, and a recognition of how they are often overlooked and excluded. For the participants, this meant understanding why individuals with disabilities have certain mannerisms and limitations, as well as recognizing that individuals with disabilities are often left out or made fun of. Overall, students walked away from this study with a better understanding of individuals with disabilities. In realizing that individuals with

disabilities are very similar to them, students also recognized that individuals with disabilities have a desire to fit in and be accepted, just like able-bodied people. The participants' ability to recognize and understand the emotions of others aligns' with the pre-existing higher cognitive empathy levels that they entered into this study with (Blake & Gannon, 2008; Jolliffe, Farrington, 2006). Through self-reflection and conversation within the interviews, students shared many instances where they witnessed the mistreatment of someone with a disability. Nine participants admitted to not having a lot of knowledge regarding disabilities prior to the innovation. Six even admitted to avoiding interactions with individuals with disabilities, which stemmed from a lack of understanding and believing misconceptions.

For able-bodied children, interaction with children with a disability in an inclusive setting can increase familiarity and self-esteem while reducing prejudice (Garrick-Duhaney & Salend, 2000; Rafferty, Boettcher & Griffin, 2001; Sasso & Rude, 1988; Voeltz, 1982). Inclusive education provides learners with the opportunity to recognize and accept differences in people, and is therefore central in promoting an inclusive and equitable world (Lohmann et al., 2019). The experiences of the students, in combination with existing literature, leads to the assertation that students perceive themselves to have an increased understanding of individuals with disabilities. They believe that individuals with disabilities aren't treated well, despite a perceived positive outlook on life and desire to fit in. Austin admitted, "It made me think that they are a lot like us. It helped me understand them better. That they can't help when things are harder for them." Kelsey agreed and stated, "It helped me understand how hard life can be for them sometimes. It helps me know why they don't necessarily act like other people might act."

Table 4.3

Themes, Assertions, and Categories from Qualitative Data

Theme	Assertion	Categories
1. Increased understanding of individuals with disabilities and realization that they aren't treated well	Students perceive themselves to have an increased understanding of individuals with disabilities. They believe that individuals with disabilities aren't treated well, despite a perceived positive outlook on life and desire to fit in.	Neutral perceptions of individuals with disabilities Positive perceptions of individuals with disabilities Negative perceptions of individuals with disabilities Differences in people Perceived needs and feelings of individuals with disabilities
2. Students perceive disabilities to severely limit participation in everyday life and impact families	Students view disabilities as severely limiting participation in school, sports and social events, while also greatly impacting families by requiring a lot of help and attention from family members.	Disabilities impact and limit life Perceived desires of individuals with disabilities
3. Increased empathy and awareness of the manner of treating others	While some students view the innovation as having little or no impact on their empathy, most believed that they gained a better understanding of individuals with disabilities, increased their empathy, and would treat individuals with disabilities better in the future.	Positive impact of innovation No impact of innovation Interactions with robot/innovation Self-awareness of own empathy
4. Value empathy	Students perceive empathy to be an important part of interacting with others, see value in human connection, and have consistent, high expectations for how people should treat others.	Social norms and expectations Interactions with others and individuals with disabilities

Of the 18 participants, 14 agreed that individuals with disabilities most likely want to fit in but are often picked on instead.

Neutral perceptions of individuals with disabilities. This category was defined as having neither positive nor negative perceptions of individuals with disabilities, but instead feeling indifferent or neutral towards them. Of the participants, six were indifferent in their perceptions of individuals with disabilities and don't feel a need to treat some people differently than how they treat others. These participants felt that they already possessed a positive perception of individuals with disabilities and didn't feel like they mistreated them. These participants who expressed neutral perceptions also shared that they have siblings and/or friends with disabilities and interact with them often. Siblings who help care for their disabled siblings admit to having a better overall understanding of people than children without disabled siblings admit to, and tend to be better adjusted in relations with others (Dew, Balandin, & Llewellyn, 2008; Perenc & Peczkowski, 2018; Seligman & Darling, 1997). Their neutral perception stems from being satisfied with their current perspective and treatment of others. Grace shared, "I think they're normal" and Piper wrote, "I'm kind of normal around them. I'm not like, "Oh, she has disability." These participants choose to look past disabilities and view everyone as "normal."

Positive perceptions of individuals with disabilities. This category wad defined as having positive opinions of and experiences with individuals with disabilities. Of the 18 participants, five expressed positive views of individuals with disabilities. These students were among the ones who revealed a lack of prior knowledge in regard to disabilities previous to participating in the study. For some students, the innovation was the first

hands-on experience involving disabilities they had engaged in. Observing and cooperating with someone with a disability helps adolescents develop other prosocial skills, such as a respect for diversity and a better understanding of others (Perenc & Peczkowski, 2018). Along with Harrison, two others expressed that a person's disability did not diminish his character. When asked, "How do you feel about individuals with disabilities?" Harrison said, "I feel like they could be good people." Sadie believes that disabilities don't necessary limit independence. She wrote, "Disabled people can still do their own things." Their experiences and newfound knowledge replaced their preexisting misconceptions and enabled them to view individuals with disabilities in a positive manner.

Negative perceptions of individuals with disabilities. This category wad defined as having negative opinions of and experiences with individuals with disabilities. Seven participants shared negative perceptions of individuals with disabilities and doubted their abilities. These students admitted that these beliefs stemmed from a lack of information. Negative attitudes and misconceptions held are a major barrier and can affect the inclusion of individuals with disabilities into mainstream society (Fisher & Purcal, 2017). In addition, these students shared that their friends and family are all able-bodied, so they don't feel like they can connect with or relate to people who have disabilities. Less empathetic individuals are not as concerned with equality because they struggle to identify or relate to others' perspectives or situations (Cartabuke et al., 2019). Grace felt that individuals with disabilities are looked down upon by others and wrote, "I think that they feel like they're a lost puppy." Piper said, "I kind of do feel a little bit bad for them because when you have a disability you can't really do everything that the other people

are able to do." After engaging with the innovation, these students do not believe that individuals with disabilities are as capable as able-bodied people and are disregarded.

Differences in people. This category was defined as an awareness and knowledge of differences between individuals with disabilities and people without disabilities. To understand students' perceptions, empathy levels, and experiences, it was important for me to gauge their awareness of differences between people and their prior knowledge of disabilities. The Americans with Disabilities Act of 1990 describes a person with a disability as having a physical or mental impairment that limits one or more of life's activities (Americans with Disabilities Act of 1990). Without being prompted, students referenced a range of disabilities when responding to interview questions. Physical disabilities were the most common disabilities noticed and discussed by participants. Graham wrote, "I see people not being able to walk, being in a wheelchair, or having a prosthetic leg." The participants struggle to know what to expect from individuals with disabilities, specifically in terms of their abilities. Kelsey said, "People act different, and they might do things you wouldn't think that they would do." The innovation also helped some participants to better understand autism spectrum disorder, which was the disability used in the innovation. Elliot shared, "People with autism spectrum disorder, it's hard for them to fit in because they don't act the same as people without autism spectrum disorder." It was evident that students were more aware of visible disabilities and less aware of disabilities that cannot be seen. This awareness was relevant in understanding their experiences, knowledge, and perceptions of individuals with disabilities along with their interaction with the innovation.

Perceived needs and feelings of individuals with disabilities. This category as defined as the physical, emotional, and mental needs of individuals with disabilities as perceived by participants without a disability. Participants who self-reported a disability were able to share their insight about the needs and feelings of individuals with disabilities. The 14 participants who did not have a disability themselves spoke to the perceived needs and feelings they felt individuals with disabilities have. Empathy is the sharing and understanding of another's emotional state or context, which results from experiencing the emotive state and understanding another's emotions (Cohen & Strayer, 1996). In gaining a deeper understanding, participants were also able to be more empathetic. Participants felt they were able to connect to individuals with disabilities, especially people their own age. Since students felt they could now relate with individuals with disabilities, they also believed they could identify the feelings and needs of individuals with disabilities. Sadie believed that individuals with disabilities would have needs but recognized that not everyone would necessarily have the same need. Sadie wrote, "Well depending on what the disability, they might need different things." While some students' responses reflected only cognitive empathy, others presented signs of affective empathy by sharing in the emotional state of others (Jolliffe & Farrington, 2006). Miller took on the perspective of a person with disabilities and wrote, "Because I can understand if they're watching a group of kids, they're playing a game that they physically can't. They must feel sad or left out or lonely and stuff like that." Participants believed individuals with disabilities are no different from able-bodied people in that they desire to fit in and be included.

Theme 2: Students perceive disabilities to severely limit participation in everyday life and impact families. This theme was defined as recognizing how disabilities often inhibit participation in everyday activities and how families are needed to provide care and assistance for family member with disabilities. For the participants, this meant disabilities limited participation in sports, school, and friendships. For participants, this also meant families are expected to provide care, companionship, and assistance, which often impacts able-bodied family members' abilities to live their lives. After participating in the study, the 12 of the participants expressed that individuals with disabilities are not able to participate as much as able-bodied people. These limitations impact their involvement in school, sports, jobs, relationships and other areas. Students perceived their inabilities to participate like able-bodied people to also inhibit their relationships, self-confidence and success in life. The World Health Organization (2011) recognizes individuals with disabilities encounter disadvantages due to the barriers they face, and have brought attention to the importance of a global understanding and responsibility towards breaking down disabling barriers. These barriers include policies, accessibility, consultation and involvement (Lid & Solvang, 2016; Mudrick et al., 2012; Rimmer et al., 2017). In addition, participants believed that individuals with disabilities require a lot of help and attention from those around them, particularly family members. Mothers and fathers of children with disabilities both spend a significantly greater amount of time on caretaking tasks than parents of typically-developing children (Luijkx, Van der Putten, & Vlaskamp, 2017; Tadema & Vlaskamp, 2010). Students perceived individuals with disabilities to need help with physical tasks as well as educational and emotional support. The word 'disability' is "an umbrella term for impairments, activity

limitations and participation restrictions" (World Health Organization, 2002, p. 2). When asked about how a disability might impact life, Noah said, "If you really wanted to play sports and you got paralyzed from the waist down, you wouldn't be able to play sports." In response to the question, "How might your life be different if someone you cared about had a disability?" Miller answered, "Say that one of my family members had autism spectrum disorder, we would have to be watching them all the time so that they don't do anything that could hurt themselves or something like that." Della shared that her sister has a learning disability, yet tries to be independent when doing her homework. She then added, "Sometimes she tries to do it on her own, but I know she's struggling, so I help her." Situating the participants' experiences within preexisting literature generates the assertion that students view disabilities as severely limiting participation in school, sports and social events, while also greatly impacting families by requiring a lot of help and attention from family members.

The categories in this theme include: (a) disabilities impact and limit life and (b) perceived desires of individuals with disabilities.

Disabilities impact and limit life. This category was defined as ways in which disabilities inhibit participation in everyday activities, such as work, school, hobbies, and relationships. Every participant remarked that disabilities impact the those who have them and the people in their lives. The students' experiences led them to the realization that many individuals with disabilities require more assistance than able-bodied people. Nine participants shared that disabilities require family members to become caregivers. Studies show that families are the primary caregivers for children with disabilities (Miller, Buys, & Woodbridge, 2011). Students' participation in the study led them to

understand that individuals with disabilities receive a range of care, from companionship to assistance with physical tasks. Family members are directly impacted through the time, effort and assistance that they provide. Additionally, disabilities restrict people with them from participating like able-bodied people do. Students shared that individuals with disabilities are not able to participate in school, sports and other activities due to physical, mental and emotional limitations. The Americans with Disabilities Act of 1990 describes a person with a disability as having a physical or mental impairment that limits one or more of life's activities (Americans with Disabilities Act of 1990). The participants commented often on how different their lives would be if they or someone in their family had a disability. Sadie agreed that individuals with disabilities require more from their family members. When asked, "How might your life be different if someone you care about had a disability?" Sadie responded, "Probably way different because we would have to do a lot of things for them and I guess pay more attention to them." Oliver remarked, "They might need a little help doing things." Three participants even made comments about not being able to attend the same school as they do now or have the same friends they do now if they had a disability. When asked how their lives might be different if they had a disability, Kelsey said, "I might not go to same school," while Elliot wrote, "I may not have as many friends as I have now." To the same question, Avery expressed, "It would be really different. My mom would have to work less to take care of me." An additional 5 participants worried that the responsibilities of caring for someone with disabilities would fall on their families and have negative effects. After interacting with the innovation, these students believe that disabilities limit people's

abilities to fully participate in life and everyday activities while also impacting families who help care for them.

Perceived desires of individuals with disabilities. This category was defined as the desires of individuals with disabilities to be accepted, be considered, and to not burden others, as perceived by participants without a disability. For participants, they reflected on their own desires and applied these beliefs to others. The participants perceived people with disabilities to desire being accepted, being considered, and not burdening others. Of the 14 students who did not self-identify with having a disability, 12 of them explained that they stepped into the shoes of individuals with disabilities throughout the innovation to try and determine what their lives are like. Simulation theorists believe that we imagine ourselves in others' situations and read their internal states from our own (Decety & Ickes, 2009). Since the study focuses on empathy, taking on someone else's perspective was an indication of empathy. An empathetic person will take on the other person's perspective and communicate a cognitive understanding of that person's situation (Borba, 2018; Riggio, Tucker, & Coffaro, 1989). The participants reported perceived desires of individuals with disabilities in order to better understand how disabilities impact families and limit participation in everyday life. When asked what life might be like if he or a family member had a disability, Avery said, "If my mom had a disability then I'd probably stay with her a lot and help her with things. If I had a disability then I might be a little different, but I wouldn't want my mom or anyone to have to do stuff for me all the time." Parents of children with disabilities have considerably less free time that parents unaffected by childhood disability (Luijkx, Van der Putten, & Vlaskamp, 2017; McCann, Bull, & Winzenberg, 2012). Even though

students were willing to take care of others, they didn't want their family members to be burdened with the responsibility of caring for them. Parents of children with disabilities experience higher levels of parenting stress than parents of typically-developing children (Fidler, Hodapp, & Dykens, 2000; Hauser-Cram, Warfield, Shonkoff, & Kraus, 2001; Smith, Oliver, & Innocenti, 2001; Trute, Hiebert-Murphy, & Levine, 2007).

When stepping into the role of someone with a disability, participants shared a desire to continue their lives like normal, in terms of playing sports, going to school, hanging out with friends, etc. When asked, "How might your life be different if you were in a wheelchair?" Hayes reported, "I'd probably want to play sports and there's some people that judge. So, I'd probably get judged." While a perceived desire to play sports like normal was expressed, it was attached to a perceived fear of receiving negative attention. When asked about what life might be like for a person with a disability, Elliot said, "I can understand if they're watching a group of kids, they're playing a game that they physically can't. They must feel sad or left out or lonely and stuff like that." Several other participants shared Elliot's thought on a perceived desire to fit in with able-bodied people. While working through the scenario, students gained an understanding of the perceived desires of individuals with disabilities to participate like able-bodied people and not require assistance from their families.

Theme 3: Increased empathy and awareness of the manner of treating others. This theme was defined as an increased ability to understand and relate to the perspective of someone with a disability and respond accordingly. This theme also included the decision to create positive interactions and relationships with individuals with disabilities in the future. For students, this theme meant an increased ability to

connect with people who have disabilities and ease their distress. It also included a determination to be inclusive of individuals with disabilities. Overall, students increased their empathy or maintained their preexisting high empathy level and made the determination to treat individuals with disabilities better in the future. Of all 18 participants, 12 commented on how the innovation helped them to see things from the perspective of someone with a disability. With an increased understanding, participants are also able to better empathize cognitively with them (Blake & Gannon, 2008; Jolliffe, Farrington, 2006). This understanding was vital, as cognitive empathy is developed prior to affective empathy (Blair, 2005). Empathy is vital skill that helps us understand people whose values, views, and behaviors are different from our own (Calloway-Thomas, 2010). Empathetic children are reported to have higher self-regulatory abilities, low negative behaviors, and constructive social behaviors (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Murphy et al., 1999). In adults, empathy is positively related to self-expression, socialization, social sensitivity and social adaptation (Utkur, 2019). Participants were asked, “How has the Lego robot helped you to understand individuals with disabilities?” Graham shared, “It makes me think about how they’re feeling and they’re not telling it because they don’t really want to talk,” in response to the same question. Six students commented on how they’ve witnessed people mistreating those with disabilities in the past and how the innovation has influenced them to speak up for others and to treat them better. To the question, “How has the Lego robot impacted the way you might treat other people?” Elliot stated, “Well, I wouldn’t make fun of other individuals with disabilities because, again, it’s not their fault that they have it and I would try and help them if they need help.” Eight participants, including Elliot, gained a

better understanding of disabilities through the innovation which has resulted in a desire to treat individuals with disabilities better. Synthesizing students' experiences with existing literature led to the assertion that while some students view the innovation as having little or no impact on their empathy, most believed that they gained a better understanding of individuals with disabilities, increased their empathy, and would treat individuals with disabilities better in the future.

The theme is drawn from the following categories: (a) positive impact of innovation, (b) no impact of innovation, (c) interactions with robot/innovation, and (d) self-awareness of own empathy.

Positive impact of innovation. This category was defined as the innovation increasing participants' empathy towards individuals with disabilities. Nine participants concluded that the innovation positively impacted their empathy levels. Part of empathy is understanding the situations, needs and feelings of others. It is an "other-oriented vicariously induced emotion" that supports positive social behaviors and limits aggressive social behaviors (Dadds, et al., 2007; Laible, Carlo, & Roesch, 2004). With a greater understanding of individuals with disabilities, participants decided to improve the way they treat others. Empathetic individuals are motivated by it to help others and reduce their distress (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Laible, Carlo, & Roesch, 2004). Miller felt a positive impact from the innovation and shared, "It's definitely taught me that I should help out in a situation not just standing there and just letting it happen like reacting and doing something about the situation and about others' emotions." He later added, "It's changed my thoughts on how individuals with disabilities can still do good things and be good people so it's like that." Several participants agreed

with Miller and have replaced misconceptions about individuals with disabilities with a greater connection and desire to help. Finley also felt that the innovation had a positive impact on empathy and wrote, "I think I care about other people's emotions more than before now." After engaging with the Lego robot and disability scenario, these students improved their empathetic abilities and inclination to help individuals with disabilities.

No impact of innovation. This category was defined as the innovation having no connection to or effect on participants' empathy towards individuals with disabilities. Upon reflecting on the innovation, 3 participants felt the innovation either wasn't connected to empathy or had no impact on their empathy. While most students saw a positive correlation between the innovation and empathy, it's important to note the few who shared a different perspective. Of these 3 participants, 2 students who reported no difference in their empathy expressed that they did not see a connection between the innovation and empathy. The other participant reported that the innovation had no impact had already self-reported high empathy levels prior to the innovation and saw that their levels of empathy were maintained. Grace already self-reported a higher empathy level to begin with and said, "I don't see them any different now than what I used to." In response to the question, "How has the Lego robot impacted the way you might react to somebody else's emotions?" Noah stated, "I don't know because it didn't really have anything to do with emotions." Without seeing a connection between the innovation and empathy, Noah wasn't able to express the innovation's impact. Participants who either had preexisting high empathy levels or did not see a connection between the innovation and empathy expressed no change in their empathy.

Interactions with robot/innovation. This category was defined as the approaches the participants took in working with the innovation and their justifications for their decisions in programming. In order to understand the students' experiences with the innovation and the impact it had, it was important to learn how they programmed the robot and the reasoning behind their decisions. Students were presented with a scenario which tasked them with programming the robot in order to teach someone with autism spectrum disorder how to greet and socially interact with others. Programmers use empathic design in an attempt to understand the lives and experiences of potential users, in order to create a product that meets the user's needs (Koskinen, Battarbee, & Mattelmäki, 2003; Kouprie & Visser, 2009). Empathy enables designers to make appropriate design choices for users who are different from the designers themselves by 'stepping into the user's shoes' and 'walking the user's walk' (Koskinen, Battarbee, & Mattelmäki, 2003, p. 438). I observed most of the participants using similar approaches when working with the innovation. Participants reflected on what body language, hand gestures and dialogue they use when greeting people and used that to guide their programming. When asked to justify why they programmed the robot in the manner that they did, Sadie said, "It's how I would greet someone," and Bella stated, "Because I had to program the robot as if it was my point of view." By reflecting on their interactions with others and taking on the role of the user in the simulation, participants interactions with the robot increased their empathy.

Self-awareness of own empathy. This category was defined as the participants' self-awareness or lack of awareness in regards to their own abilities to empathize. The participants' self-awareness of their perceptions and empathy was important in

understanding their experiences. In order to learn how the innovation impacted their perceptions and empathy, students needed to be self-aware in their responses. People with empathy will take on the other person's perspective and communicate an understanding of that person's situation (Borba, 2018; Riggio, Tucker, & Coffaro, 1989). Of all the participants, 12 participants took on the perspective of a person with a disability, thought about how that person would want to be treated, and then responded accordingly. The participants reflected on how it felt to be left out or to not be treated well and used their experiences to influence how they want to treat others. The participants' abilities to reflect on past experiences and express a greater understanding of others' emotions now compared to then aligns with studies that report an increase of cognitive empathy with age (Dadds, et al., 2007; Eisenberg & Fabes, 1990). Some students used their self-awareness to recognize that people are capable of having similar feelings, whether they have a disability or not. Avery said, "I can understand what they're feeling most of the time. Individuals with disabilities still have anger, sadness, and a lot of doubts, so they're still feeling the same type of emotions I would feel." Students used their self-awareness to navigate the scenario in the innovation, express the innovation's impact, and influence their interactions with people who have disabilities.

Theme 4: Value empathy. This theme was defined as recognizing the importance of empathy and the role it plays in society. For the participants, this meant the importance of friendships, treating others how they want to be treated, and relating to the positive and negative emotions of others. Throughout the study, participants consistently commented on the importance of empathy and its role in making connections with others. Participants naturally took on another person's perspective when sharing how individuals

with disabilities should be treated. These 12 participants shared past experiences, reflected on how the people being mistreated must have felt, and then expressed how they plan to treat people better in the future. It's important to understand the way our empathy, or lack of, influences our attitudes towards different groups of people, including our tendencies to create stereotypes, distance, and even isolate ourselves from these groups (Parchomiuk, 2019). By discovering their value of empathy, the students were motivated to change the way they treat others. Empathetic people are motivated by it to help others and reduce their discomfort (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Laible, Carlo, & Roesch, 2004). The students expressed the importance of taking the feelings of others into consideration and treating people equally. Oliver said, "Everybody is kind of the same. We're all people. We all have our thoughts and feelings and share those and enjoy being with friends or family." When asked about how other people treat individuals with disabilities, Elliot shared how he has witnessed bullying towards individuals with disabilities. He added, "I feel like that they shouldn't do that because it's not their fault that they have a disability." Several other participants mentioned bullying towards individuals with disabilities and agreed that people should be treated equally. Learning about students' experiences and their value of empathy in combination with pre-existing literature led to the assertion that students perceive empathy to be an important part of interacting with others, see value in human connection, and have consistent, high expectations for how people should treat others.

The theme is comprised of two categories: (a) social norms and expectations and (b) interactions with others and individuals with disabilities.

Social norms and expectations. This category was defined as the unspoken rules and expectations that participants held in regards to interacting with others. The participants were consistent in their thoughts on how people should interact with each other and their expectations for treating others with kindness. Their comments regarding social norms and expectations revolved around treating others how you'd want to be treated. A child's ability to experience and demonstrate empathy is directly related to his/her ability to take on the emotional experiences or perspective of another (Wilson & Ray, 2018). By thinking through how they would want to be treated by someone else, students were taking on the perspective of another person and using that to influence their actions and communication. Austin's advice was, "So then, be a friend and be nice. So, you'll be nice to them and they'll want to give back and be nice back." Students felt strongly that they should be kind to others and that, in return, they would receive kindness back. When asked about the treatment of individuals with disabilities, Bella shared, "Well, I would kind of treat them the same, because it doesn't matter if they have a disability or not, people still need to be treated mostly the same." Students shared views on how to treat people, regardless of their disabilities. Participants also had similar expectations for how to handle a situation when they see someone being mistreated. Austin stated, "If someone is getting bullied, tell them to stop." Others, like Avery, shared the social norm that it's not appropriate to talk negatively about individuals with disabilities and stated, "Don't discuss others in a bad way, even though they have disabilities." The social norms and expectations held by the participants support their beliefs in the value of empathy and the role it plays in our perceptions and treatment of individuals with disabilities.

Interactions with others and individuals with disabilities. This category was defined as previous experiences that the participants had with people who have disabilities and how these experiences impacted their perceptions and attitudes. Throughout the innovation, students referenced past experiences with people, both able-bodied and those with disabilities. These experiences played a part in their perceptions of others, drove their decisions when programming the robot and influenced the way they plan to treat people in the future. Participants reflected and shared that they often see individuals with disabilities being left out. These eight participants recalled times when they had been left out from an activity or a group and connected those feelings to what it must be like when someone with a disability is excluded. "By intuiting and projecting oneself into the other's situation or by imagining how one would think and feel in the other's place, one comes to feel as the other feels, and knowledge of one's own feelings then enables one to know—or to believe one knows—how the other feels" (Decety & Ickes, 2009, p. 9). Participants even shared personal experiences where they didn't know how to interact with someone with a disability and often chose to not engage with them because of this. When asked about communicating with someone with a disability, Sadie said, "I don't know if I really can, because you don't really know what's going on in their mind because it's different." Participants displayed empathy and commented that they should make an effort to invite them to play. When asked, "How has the Lego robot impacted the way you might react to someone else's emotions?" Austin responded, "I'd probably help someone now; go up to them and try and get them to play with me." Participants experienced empathy throughout their time with the innovation and

expressed the role it plays in interacting with others, including individuals with disabilities.

Chapter Summary

For this study, quantitative and qualitative data were collected. Quantitative data included the pre-survey and post-survey, which included demographic questions and the Basic Empathy Scale. Qualitative data included semi-structured individual interviews and student response journals. Four themes emerged from the data: (1) increased understanding of individuals with disabilities and realization that they aren't treated well, (2) Students perceive disabilities to severely limit participation in everyday life and impact families, (3) increased empathy and awareness of the manner of treating others, and (4) value empathy. The analysis of the data and creation of themes helped me to understand the outcomes of the study.

CHAPTER 5

DISCUSSION, IMPLICATIONS, AND LIMITATIONS

This chapter positions the findings within the existing literature on the impact of robotics on student empathy. The purpose of this study was to assess the impact of robotics on fifth grade students' empathy towards individuals with disabilities. Four primary themes emerged from the data analysis (see Table 4.3). Data from both quantitative (i.e., pre- and postsurvey) and qualitative methods (i.e., participant interviews and student response journals) were collected and subsequently analyzed. This chapter will present (a) a discussion, (b) implications, and (c) limitations.

Discussion

It is important to situate this study's findings within the larger literature, particularly the literature associated with programming robotics and empathy. The literature on (a) the importance of working with students with disabilities, (b) an overview of empathy and its importance, (c) theoretical framework, (d) the benefits of using technology to teach empathy and the use of technology-based simulations, and (e) the connection between robotics and programming to empathy help position this study in the larger body of knowledge. This discussion is organized by the two research questions.

Research Question 1: How does using robotics effect students' empathy?

This research question stemmed from wanting to understand robotics and how they can be utilized to impact fifth grade students' empathy towards individuals with disabilities. I hoped to integrate the Lego Boost robot into the classroom to positively

effect students' empathy towards individuals with disabilities. To design this study, I looked to previous research on technology-based scenarios created within a classroom and the use of technology to teach empathy. Integration of robotics in the learning process challenges students to be creative, improves cognitive skills, and motivates them to take an active role in their learning (Sanchez, Martinez, & Gonzalez, 2019). Robotics provide an interactive and hands-on learning experience that help students visualize real-world situations (Gomoll et al., 2016; Shankar et al., 2013; Zhong, 2020). Simulations provide immersion, which encourages students to create their own meaning of the material by experiencing it in a realistic setting (Golden, 2018). Empathy is a skill that is used to develop user-centered design, where the end-users influence how a design is created (Hansen et al., 2016; Kouprie & Visser, 2009; Sanders & Dandavate, 1999; Visser et al., 2005). For example, sociable robots must be programmed by programmers who possess empathy in order for the robot to communicate empathy to the user (Lee, 2006). Empathy allows designers and programmers to make appropriate decisions for users who are unlike them by 'stepping into their shoes' (Koskinen, Battarbee, & Mattelmäki, 2003).

In order to answer this first research question, I examined the effects of robotics on students' empathy towards individuals with disabilities by focusing on quantitative and qualitative measures of data. The combined quantitative data from the pre- and post-surveys, along with the qualitative data from individual interviews and student response journals provided insight on the impact of robotics on students' empathy towards individuals with disabilities. In order to discuss the data relevant to Research Question #1, I focused on the emerging Theme #3: Increased empathy and awareness of the

manner of treating others. The quantitative data revealed that robotics had no effect on fifth grade students' empathy towards individuals with disabilities yet the qualitative data revealed that there was an effect on fifth grade students' empathy towards individuals with disabilities. To respond to Research Question #1, this section will be explained through (a) evidence to support innovation efficacy and (b) evidence to contradict innovation efficacy.

Evidence to support innovation efficacy. The Basic Empathy Scale (Appendix D) was originally developed by Jolliffe and Farrington in 2006. A total score was gathered from both the pre-survey and the postsurvey and then compared against each other. The Basic Empathy Scale may not have been sensitive enough or well aligned with the innovation and length of the innovation may not have been long enough to detect changes in students' perceptions. Also, the students' perceptions of empathy were on average positive (pre-survey M = 68.89 v. post-survey M = 70.61). Quantitative data from the pre- and post-surveys revealed that some individual's empathy was impacted by the innovation. Of the 18 fifth-grade participants, seven of them scored higher on the postsurvey than on the presurvey, indicating an increase in empathy.

The qualitative findings from individual interviews (Appendix F) and student response journals (Appendix G) also revealed evidence of the innovation's efficacy. Data indicating effect on students' empathy levels was extracted from the category of *Positive Impact of Innovation* from Theme #3: *Increased empathy and awareness of the manner of treating others.* A child's ability to experience and demonstrate empathy has been directly related to their ability to take on the emotional experiences or perspective of another (Wilson & Ray, 2018). When working with the innovation and sharing their

experiences, participants expressed taking on the role of another person and using that perspective to connect and empathize with them. Following their time with the innovation, several students shared that they could better relate to individuals with disabilities and understand their situations. Miller stated, “It's helped me to understand that life is hard for them because they can't do the same things like other people can and understand how hard their day-to-day life can be.” Finley reported an increase in empathy and remarked, “I think I care about other people's emotions more than before now.” Other participants admitted to caring more about individuals with disabilities and expressed a desire to help them. Lily said, “Seriously, I want to treat them with all the kindness I have so they wouldn't be alone, that I'm just like them.” Empathy is an “other-oriented vicariously induced emotion” that supports positive social behaviors and limits aggressive social behaviors (Laible, Carlo, & Roesch, 2004). Empathetic people help others and are motivated to relieve them from negative social experiences (Laible, Carlo, & Roesch, 2004). After working with the innovation, students provided examples of ways they could include individuals with disabilities who are often left out, along with how they plan to defend individuals with disabilities from bullying and other negative social situations. Elliot shared, “Well, I wouldn’t make fun of other people with disabilities because, again, it’s not their fault that they have it and I would try and help them if they need help.” Empathy allows designers to make appropriate design choices for users who are unlike the designers themselves by ‘stepping into the user’s shoes’ and ‘walking the user’s walk’ (Koskinen, Battarbee, & Mattelmäki, 2003, p. 438). The innovation provided students with an opportunity to step into another’s role and truly take on their perspective. Creating a scenario where learners are able to experience empathic

understanding enables them to be empathic towards others (Wilson & Ray, 2018). The disability scenario and innovation provided students with an opportunity to experience another's perspective and empathize with them.

Collectively, the qualitative data and quantitative data shared in this section provide evidence to support innovation efficacy.

Evidence to contradict innovation efficacy. Data indicating effect on students' empathy levels was extracted from the categories of *No Impact of Innovation* and S*elf-awareness of Own Empathy* from Theme #3: *Increased empathy and awareness of the manner of treating others.* Some students stated that the innovation did not affect their empathy. Grace remarked, "I don't see them any different now than what I used to." Other students identified their lack of empathetic abilities and did not feel that the innovation positively impacted their abilities to recognize or understand the emotional state of others. When asked to describe their empathy levels, Elliot admitted, "I don't understand their emotions that well," and Kelsey responded, "Usually it's hard for me because we don't think the same things usually." In order to better understand the participants' scores, it was imperative to compare them to participants' scores from other studies involving the Basic Empathy Scale. One study that was conducted using Portuguese adolescents revealed a mean of 49.05 (Anastácio et al., 2016). Another study with Chinese children as participants resulted in a mean of 53.05 (Geng, Xia, & Qin, 2012). While there was not a significant increase in students' scores from the presurvey to the postsurvey, their scores were already above average compared to other students who have completed the Basic Empathy Scale.

Research Question 2: How does the innovation impact fifth grade students' perceptions of individuals with disabilities?

Empathy helps us understand people whose values, views, and behaviors are different from our own (Calloway-Thomas, 2010). Studies show that children with higher empathy levels were also reported as having higher self-regulatory abilities, low negative behaviors, and constructive social behaviors (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Murphy et al., 1999). Additionally, more time spent with individuals with disabilities correlates to higher empathy levels (Perenc & Peczkowski, 2018). Observing and cooperating with someone with a disability on a regular basis helps adolescents develop other prosocial skills, such as a respect for diversity (Perenc & Peczkowski, 2018).

In order to answer this research question, I constructed a scenario in which students would take on the role of a programmer and program the Lego robot to help someone with autism spectrum disorder learn how to greet someone. Simulation theorists report that we imagine ourselves in others' situations and take on their internal states as our own (Decety & Ickes, 2009).

With many classrooms and workplaces being inclusive towards individuals with disabilities, being able to empathize with others and work alongside them is an important skill for children and adults to possess. Inclusive learning environments in schools result in improved communication skills, greater social competence, stronger relationships with their peers (Bennett, DeLuca, & Bruns, 1997; Fryxell & Kennedy, 1995). Individuals with disabilities often have a unique perspective to share from and should be included in the decision-making process (United Nations, 2006). Students' perceptions of their

empathy and their increase in empathy following the innovation was derived from the categories of *Social Norms and Expectations* and *Interactions with Others and Individuals with Disabilities* from Theme #4: *Value empathy.* The qualitative data from these categories corroborates with the quantitative data, which revealed that students' perceptions of empathy were on average positive (presurvey M = 68.89 v. postsurvey M = 70.61) (see Figure 4.1). Empathy is considered a crucial construct in the regulation of everyday social interaction, interpersonal relationships, and prosocial and antisocial behavior (Albiero et al., 2009).

Participants perceived the innovation to enable them to (a) take on another's perspective and (b) help others avoid negative feelings.

Take on another's perspective. Empathy is the sharing and understanding of another's emotional state or context resulting from experiencing the emotive state and understanding another's emotions (Cohen & Strayer, 1996). For the innovation, students were asked to take on the perspective of a programmer as they worked to program the Lego robot to assist a person with autism spectrum disorder. Bella said, "The robot helped me understand their point of view. I took on the role of Laura and had to think about her point of view to get the robot to work." In order to complete the task, students had to take on someone else's perspective. The ability to do this is an indicator of empathy. Empathy is positively related to self-expression, socialization, social sensitivity and social adaptation (Utkur, 2019). Empathy is an important quality to possess and the innovation provided an opportunity to develop this quality in the participants.

When asked how the Lego robot impacted his empathy, Oliver responded, "It made me think that I should be more patient, and helpful, and understanding on how they

feel." Finley remarked, "I think I care about other people's emotions more than before now." Others reflected on the experience and realized it will change how they address situations in the future. Empathetic people help others and are motivated to relieve them from negative situations (Laible, Carlo, & Roesch, 2004). Hayes shared, "Now I'll try to think on their perspective and what they would want. When I see someone with a disability now, I try to picture their life and what it might be like." Taking time to understand the perspective and needs of someone with a disability leads to an increase in empathy for others (Dew, Balandin, & Llewellyn, 2008; Perenc & Peczkowski, 2018; Seligman & Darling, 1997). Many students perceived the innovation to impact their empathy by increasing their ability to take on another's perspective.

Help others avoid negative feelings. Throughout the innovation, some participants expressed a desire to help others process and work through negative emotions. A lack of empathy implies the inability to view the world from other individuals' perspective or to feel sympathy toward their suffering (Albiero et al., 2009). People who experience empathy, conversely, are motivated by it to help others and reduce their distress (Borba, 2018; Eisenberg, Eggum, & DiGiunta, 2010; Laible, Carlo, & Roesch, 2004). For example, many participants learned more about autism spectrum disorder after working through the scenario with the Lego robot. They acknowledged a better understanding after that some individuals with disabilities struggle in social situations and plan to use this new understanding to connect others in the future. Graham explained, "The Lego robot helped me understand what it's like to be ignored. I don't want someone to feel that way so I don't want to ignore people even if they have a disability or something. I can listen to them when they have something to say." Others

were more reflective on past experiences and interactions with others. Piper shared, “I feel like I need to be more respectful of others’ feelings. Like I wouldn’t want to be ignored or not have any friends. I need to listen better and react better.” Several participants perceived the innovation to impact their empathy by igniting their desire to help others avoid negative feelings.

Implications

This research has implications for me, elementary classroom teachers, and researchers. Three types of implications are considered: (a) personal implications, (b) implications for elementary school personnel, and (c) implications for future research.

Personal Implications

As a result of this study, I have learned many lessons that will help me in improving my own practices within my classroom. These include: (a) reflections on the action research process, (b) implementation of robotics, and (c) continuing to increase awareness.

Reflections on the action research process. Through action research, researchers can make improvements to their effectiveness by studying their own classrooms and by collaborating with others (Johnson, 2008; Mills, 2011). Empathy is an important skill I try to instill and develop in my students. As vital as I believe empathy to be, it was imperative that I not let that drive my decisions and perspective. Through this process, I learned the importance of removing yourself from any personal desires for change. When making observations while the participants worked with the innovation, I recorded only what I heard and saw. During the interview process, any additional questions I asked were based off of students’ responses in an attempt to clarify or learn

more details, instead of filling in the gaps with my assumptions based off of what I know about them and what they meant to say. In order for this study to be reliable, I let the data speak for itself and did not come to any conclusions that the data didn't lend itself to. Coding line by line and focusing on what the participant was trying to say allowed me to remove myself from my research questions or desired outcomes and only code what was there in front of me.

Throughout this process, I learned the importance of research and the role it plays in the practices I used in my classroom. I've been exposed to databases and have learned how to find existing literature, and have used this knowledge to learn about and improve other practices in my teaching. I have also used this knowledge to share research with my colleagues in order to improve our practices as a team, which then extends down to the other fifth grade students in our building. After seeing the effectiveness research-based practices can have in improving the learning process and student achievement in my classroom, I will continue to use my research skills to make improvements and have a positive impact on students.

Implementation of robotics. Prior to this research study, I had used different robots in my classroom for various activities. Robotics hands-on and very engaging for students. They also help foster critical thinking, teamwork, and problem-solving abilities. Robotics provide students with a highly interactive and hands-on learning experience (Gomoll et al., 2016; Zhong, 2020). They help students visualize challenging real-world applications and supports multiple representations of a problem (Shankar et al., 2013). The studies currently out there typically focus on using robotics to teach mathematics or other core subjects, as opposed to social skills. Robots are most commonly used for math

lessons, such as teaching algebraic concepts in a way that is concrete, authentic, accessible, and motivation (Zhong, 2020, p. 89). I believe there are endless ways to use robotics in the classroom and that they can be used to teach nearly any content or concept. Using robotics in the classroom has many benefits, including learning of other disciplines and applying knowledge to real world situations (Shankar et al., 2013). This study in combination with existing research reveal many benefits to using robotics in the classroom, therefore I will continue to use it collaborate with my colleagues in order to help them use robotics in their classrooms.

Continuing to increase awareness. During this study, I came to realize the lack of information and awareness that children and adults have regarding disabilities. In the interviews, many participants referenced physical disabilities when providing examples. They often referred to someone in a wheelchair when considering how disabilities impact people. Nowadays, most classrooms in elementary schools are inclusive and are comprised of students with and without disabilities. An inclusive environment results in improved communication skills, greater social competence, stronger relationships with their peers (Bennett, DeLuca, & Bruns, 1997; Fryxell & Kennedy, 1995). Inclusive education provides learners with the opportunity to recognize and accept differences in people, and is therefore central in promoting an inclusive and equitable world (Lohmann et al., 2019). Without being provided with accurate information and opportunities to use this knowledge, students cannot be expected to understand the impact of disabilities, advocate for individuals with disabilities, or empathize and connect with people who have disabilities. Observing and cooperating with someone with a disability on a regular basis helps adolescents develop other prosocial skills, such as a respect for diversity

(Perenc & Peczkowski, 2018). Since disabilities are not in any of the elementary curriculum standards, it is up to me to expose my students to this information. For many of my students, this study was the first time they had been given an opportunity to experience life in someone else's shoes. I was surprised at how much they seemed to enjoy the experience and was impressed with how deep and meaningful their reflections were. After seeing my students walk away from this experience with a better understanding of individuals with disabilities and, for many, an increase in empathy, it is important to me that I continue to provide disability awareness for students in my classroom.

Recommendations for Elementary School Personnel

This study focused on the use of robotics to impact fifth grade students' empathy towards individuals with disabilities. The study took place within an elementary school classroom. The findings from the quantitative and qualitative data reflect the thoughts, perceptions, and experiences of students in elementary school. Therefore, the findings of this study could extend to other elementary schools. This section of recommendations for elementary classroom teachers is divided into two sections. These include (a) professional development and (b) disability awareness.

Professional development. Throughout this study, many conversations revolving around robotics and technology took place between myself and colleagues. While laptops and iPads are common technological devices in classrooms, robots are scarcely used despite their effectiveness. Several studies have shown that the use of robotics can be a highly effective tool to enhance learning (Gomoll et al., 2016; Shankar et al., 2013; Zhong, 2020). Many showed interest in using robotics, but have never attempted to do so.

Most explained that they don't feel competent enough to use the robots themselves, let alone lead an activity where students are using them. While many districts, including the one that this study takes place in, provide a lot of professional development opportunities each year, with many focused on technology. However, there seems to be a lack of professional development opportunities that teach robotics and how to use them in an elementary classroom. Teachers who possess a desire to learn a new tool that will foster learning within their classrooms should seek out opportunities to obtain this knowledge. For some, this many involve attending professional development sessions outside of their school or district. Teachers who do not have these opportunities available should seek assistance from administration, instructional coaches, and other staff members who can help connect them to the desired resources. If such opportunities for classroom teachers do not exist, other school personnel, both at the school and district levels, have a responsibility to provide research-based learning opportunities for teachers and should consider developing the desired professional development sessions.

Disability awareness. This study revealed the lack of information that students are given regarding disabilities. Students will eventually become adults who actively participate in our society, so it's important that they have an understanding of disabilities and can contribute to positive changes for individuals with disabilities. Many disadvantages affecting individuals with disabilities are due to the barriers they face, and emphasize the importance of a global understanding and responsibility towards breaking down disabling barriers (World Health Organization, & World Bank, 2011). Students who aren't taught an awareness will likely become adults who don't value inclusivity in their communities. Policies often fail to account for the needs of individuals with

disabilities (World Health Organization, & World Bank, 2011). Other barriers include a lack of accessibility, consultation, and involvement (Lid & Solvang, 2016; Mudrick et al., 2012; Rimmer et al., 2017). These disabling barriers contribute to the disadvantages that individuals with disabilities experience. These disadvantages include poorer health outcomes, fewer educational achievements, less economic participation, higher rates of poverty, increased dependency, and restricted participation (Braveman, 2006; Whitehead, 1992). Unless provided with reliable information, students will likely develop misconceptions about individuals with disabilities. Negative attitudes and misconceptions held are a major barrier and can affect the inclusion of individuals with disabilities into mainstream society (Fisher & Purcal, 2017). It is vital that disability awareness be brought into classrooms. Since this information is not part of any elementary standards within the state of South Carolina, classroom teachers and other school personnel should find ways to incorporate this knowledge into their lessons, discussions, and activities. Administration and instructional coaches should help locate reliable sources and materials that can be used by classroom teachers to provide accurate information to students. As with any content, students should be provided an opportunity to apply their knowledge. Materials and activities should be incorporated into the lessons that allow students to apply their knowledge and skills and connect this information to real-world situations.

Implications for Future Research

The original plan for data collection involved a second scenario with a different task for participants to engage in. Due to attendance issues stemming from COVID-19 protocols, there was not enough time to complete a second scenario. Other students could

involve one or two additional scenarios for students to experience. A related implication involves the type of disability used in the scenarios. The scenario that was used in this study revolved around autism spectrum disorder. In order to represent different disabilities and increase students' exposure, future students could use other types of disabilities, such as physical disabilities or emotional disabilities.

The classroom this study took place in had a student population of twenty-three students, eighteen of which chose to participate in the study. Future studies could involve larger population groups in order to obtain more data.

Limitations

This study is no different from others in that there are limitations associated with in. Action research was also beneficial because it provided immediate results, which allowed changes to be implemented immediately (McMillan, 2004; Schmuck, 1997). Through this study, I was able to assess the impact of robotics on students' empathy levels towards individuals with disabilities. However, there were limitations that could be improved upon in future studies.

Action research attempts to solve a problem within one's sphere of influence (Creswell & Creswell, 2018). By conducting the study within my own classroom and with my students, there is a concern of researcher bias. "Since analysis ultimately rests with the thinking and choices of the researcher, qualitative studies in general are limited by researcher subjectivity," (Bloomberg & Volpe, 2008, p. 87). The issue of subjectivity and potential researcher bias from the researcher's participation in the study are a key limitation to be considered. Along with this is the concern that participants may have struggled to accept the researcher, their teacher, taking on the role of the interviewer

during the individual student interviews. Participants try to cooperate with and agree with the researcher by providing responses they perceive the researcher wants (Creswell & Miller, 2000). Participants may have wanted to give "right" answers or may have otherwise altered their responses because of their relationship with the researcher.

Responses to the surveys and interview questions revealed that several participants either self-identified with having a disability or being related to someone with a disability. These participants may have been familiar with individuals with disabilities or autism spectrum disorder which would account for their higher values on the survey.

The survey selected (Basic Empathy Scale) was designed to asses overall empathy, not empathy specifically towards individuals with disabilities. It is recommended that a different survey be selected when conducting future studies.

Another limitation in this study is the Chronbach alpha result. The Cronbach alpha was low. Therefore, interpretation of the data might be limited.

The average length of the student interviews was much less than expected. The individual interviews were expected to take 20-30 minutes, but lasted no longer than 11 minutes. Students may have been eager to get back to class or may have felt uncomfortable being interviewed by their teacher. Students' responses to the interview questions may not have been as in-depth as expected due to the short amount of time they completed the interview in.

This study took place during a time period that was greatly impacted by COVID-19. At the study's setting, participants did not attend school every day. For part of the study, participants attended school in-person one day a week, while doing eLearning the

other four days of the week. As the study progressed, students moved to attending school in-person two days a week, then four days a week, and eventually five days a week. At the same time, students were quarantining for an average of two weeks due to requirements within the COVID-19 protocols regarding exposure. These attendance issues offset part of the original timeline for data collection. Because the timeline was more spread out, I had to eliminate the second disability scenario I had intended on using.

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APPENDIX A

UNIVERSITY OF SOUTH CAROLINA IRB APPROVAL LETTER

UNIVERSITY OF
SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
DECLARATION of NOT RESEARCH

Emily Yow
12 Rusty Ct
Simpsonville, SC 29680

Re: **Pro00106064**

Dear Emily Yow:

This is to certify that research study entitled ***BRICKS FOR BUILDING EMPATHY: AN ACTION RESEARCH STUDY ASSESSING THE IMPACT OF ROBOTICS ON ELEMENTARY STUDENTS' EMPATHY TOWARDS PEOPLE WITH DISABILITIES*** was reviewed on **11/17/2020** by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager

APPENDIX B

SITE APPROVAL LETTER

GREENVILLE COUNTY SCHOOLS
Inspire Support Prepare

GCS DEPARTMENT OF ACCOUNTABILITY & QUALITY ASSURANCE

RESEARCH & INFORMATION SHARING AGREEMENT

STATE OF SOUTH CAROLINA)
COUNTY OF GREENVILLE)

School District of Greenville County
Research & Information Use Agreement

This Research & Information Use Agreement (the "Agreement") by and between the School District of Greenville County, South Carolina ("GCS"), a political subdivision of the state of South Carolina, and
<Requesters Name or Company Name >: Emily Yow
with principal offices at **<Requestor Address Here>** 12 Rusty Ct. Simpsonville, SC 29680
is entered into as of the date last written below ("the Effective Date")
<Requestor Name or Company Name Here> Emily Yow
will be collectively known as "Requestor" where appropriate.

This Agreement consists of the complete signature page, and the following attachments that are incorporated into this Agreement and made a part hereof by this reference:

1. Attachment 1: Research & Information Use Agreement Terms and Conditions
2. Attachment 2 GCS Research & Information Sharing Application

This Agreement is the complete agreement between the parties hereto concerning the subject matter of this Agreement and replaces any prior oral or written communications between the parties. There are no conditions, understandings, agreements, representations, or warranties, expressed or implied, which are not specified herein. This Agreement may only be modified by a written document executed by the parties hereto. Any disputes arising out of or in connection with this Agreement shall be governed by South Carolina law without regard to choice of law provisions.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be duly executed. Each party warrants and represents that its respective signatories whose signatures appear below have been and are on the date of signature duly authorized to execute this Agreement.

*If you are requesting to conduct research as a student, a university sponsor must be included as an individual. The sponsor, by signing below acknowledges s/he has read and approves this request for Research and Information Sharing in GCS and understands that supervision of this project rests with the sponsor. The privilege of conducting future studies in GCS is conditioned upon the fulfillment of such obligations. Violation of this statement of agreement will be considered a breach of contract.

Greenville County Schools' Authorized Information Representative Signature – Scott Turner	**Greenville County Schools' Authorized Research Representative Signature – Jason McCreary**
Title Deputy Superintendent	**Title** Director of Accountability and Quality Assurance
Date 2/24/21	**Date** 2/22/2021
	GCS Primary Project Contact Name Emily Yow
	GCS Primary Project Contact Phone 864-764-4651

APPENDIX C

SCENARIO

When Laura was born, she seemed perfectly healthy. As Laura grew older, her parents began to notice that Laura didn't seem to behave like the other children at her age. After many doctor's appointments and evaluations, Laura was diagnosed with autism spectrum disorder. People who have autism spectrum disorder often struggle to understand and appropriately behave in social situations.

You are a programmer who has been asked to program the robot to help people like Laura overcome obstacles. The Lego robot you are working with today is a prototype. Your task is to program the robot to greet Laura, so that she can learn how to appropriately greet someone. Program the robot to greet and interact with Laura. You can incorporate any actions you feel are important into the greeting to help Laura.

APPENDIX D

BASIC EMPATHY SCALE

For each statement below, please indicate your agreement or disagreement. Do so by filling in the blank in front of each item with the appropriate number from the following rating scale:

1	2	3	4	5
Strongly disagree		Neutral		Strongly agree

1. My friend's emotions don't affect me much.
2. After being with a friend who is sad about something, I usually feel sad.
3. I can understand my friend's happiness when she/he does well at something.
4. I get frightened when I watch characters in a good scary movie.
5. I get caught up in other people's feelings easily.
6. I find it hard to know when my friends are frightened.
7. I don't become sad when I see other people crying.
8. Other people's feelings don't bother me at all.
9. When someone is feeling 'down' I can usually understand how they feel.
10. I can usually work out when my friends are scared.
11. I often become sad when watching sad things on TV or in films.
12. I can often understand how people are feeling even before they tell me.
13. Seeing a person who has been angered has no effect on my feelings.

14. I can usually work out when people are cheerful.

15. I tend to feel scared when I am with friends who are afraid.

16. I can usually realize quickly when a friend is angry.

17. I often get swept up in my friend's feelings.

18. My friend's unhappiness doesn't make me feel anything.

19. I am not usually aware of my friend's feelings.

20. I have trouble figuring out when my friends are happy.

APPENDIX E

ADAPTED SURVEY QUESTIONS

Q#	Original Question	Question Used
1	My friend's emotions don't affect me much.	My friend's, who has a disability, emotions don't affect me much.
2	After being with a friend who is sad about something, I usually feel sad.	After being with a friend that has a disability and is sad about something, I usually feel sad.
3	I can understand my friend's happiness when she/he does well at something.	I can understand my friend's, who has a disability, happiness when she/he does well at something.
4	I get frightened when I watch characters in a good scary movie.	I get frightened when I watch characters with disabilities in a good scary movie.
5	I get caught up in other people's feelings easily.	I get caught up in other people's, who have disabilities, feelings easily.
6	I find it hard to know when my friends are frightened.	I find it hard to know when my friends with disabilities are frightened.
7	I don't become sad when I see other people crying.	I don't become sad when I see individuals with disabilities crying.
8	Other people's feelings don't bother me at all.	Individuals with disabilities' feelings don't bother me at all.
9	When someone is feeling 'down' I can usually understand how they feel.	When someone who has a disability is feeling 'down' I can usually understand how they feel.
10	I can usually work out when my friends are scared.	I can usually work out when my friends with disabilities are scared.
11	I often become sad when watching sad things on TV or in films.	I often become sad when watching sad things on TV or in films.
12	I can often understand how people are feeling even before they tell me.	I can often understand how individuals with disabilities are feeling even before they tell me.
13	Seeing a person who has been angered has no effect on my feelings.	Seeing a person with a disability who has been angered has no effect on my feelings.
14	I can usually work out when people are cheerful.	I can usually work out when individuals with disabilities are cheerful.
15	I tend to feel scared when I am with friends who are afraid.	I tend to feel scared when I am with friends that have disabilities who are afraid.

16	I can usually realize quickly when a friend is angry.	I can usually realize quickly when a friend with a disability is angry.
17	I often get swept up in my friend's feelings.	I often get swept up in my friend with a disability's feelings.
18	My friend's unhappiness doesn't make me feel anything.	My friend with a disability's unhappiness doesn't make me feel anything.
19	I am not usually aware of my friend's feelings.	I am not usually aware of my friend with a disability's feelings.
20	I have trouble figuring out when my friends are happy.	I have trouble figuring out when my friends with disabilities are happy.

APPENDIX F

SEMI-STRUCTURED INTERVIEW PROTOCOL

Interviewer: Thank you for joining me today. This will be an interview about your experience with the robot and disability scenario this week. This will take about 30 minutes. I have several questions that I would like to ask you today. As you respond, I may ask follow-up questions. This is part of the study that I am conducting on the impact of robotics on empathy. Remember, you and your parents gave consent to participate in this study, but I want you to know that you can stop participating at any time if you do not feel comfortable. There will be no penalty or consequences if you choose to stop participating. Throughout this interview, I will be recording our conversation and taking notes. I want to remind you that your name will not be used in this study. Please share your honest thoughts and feelings. The questions I ask will focus on empathy. Empathy is the "sharing and understanding of another's emotional state or context resulting from experiencing the emotive state and understanding another's emotions." In other words, empathy is being able to understand another person's emotions and feel what they feel. I can repeat this definition at any time you'd like. Do you have any questions before we begin?

Let's begin…

1. What did you program the robot to do? Why did you choose those actions?
2. Why do you think it's important to have empathy?
3. Describe your thoughts when you see someone with a disability.

4. How do you feel about individuals with disabilities?
5. How would you describe your empathy level towards individuals with disabilities?
6. How might your life be different if you had a disability?
7. How might your life be different if someone you care about had a disability?
8. What did the Lego robot help you to understand that you may not have understood before?
9. How has the Lego robot impacted the way you treat others?
10. How has the Lego robot impacted the way you react to others' emotions?
11. How has the Lego robot impacted your thoughts about individuals with disabilities?
12. How has the Lego robot helped you to understand individuals with disabilities?

Interviewer: Thank you so much for sharing your thoughts and experiences with me in this interview. I appreciate you taking the time to participate.

APPENDIX G

STUDENT RESPONSE JOURNAL PROTOCOL

1. What did you have to think about when programming the Lego robot?
2. What did you learn about individuals with disabilities from working with the robot?
3. How did your experience with the Lego robot help you understand how individuals with disabilities might feel?
4. How has the Lego robot impacted the way you treat others?
5. How has the Lego robot impacted the way you react to others' emotions?
6. How has the Lego robot impacted your thoughts about individuals with disabilities?
7. What else would you like to share about your experience with the robot?