2015

Understanding the use of tablet devices in the classroom when teaching a group of learners diagnosed with autism

Andrea Lynn Halabi

Iowa State University

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Understanding the use of tablet devices in the classroom when teaching a group of learners diagnosed with autism

by

Andrea Lynn Halabi

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Education (Curriculum & Instructional Technology)

Program of Study Committee:
Ana-Paula Correia, Major Professor
Carl Smith
Larysa Nadolny
Daniel Spikes

Iowa State University
Ames, Iowa
2015

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DEDICATION

This thesis is dedicated to my mother Marlene M. Halabi and to the memory of my father, Michel T. Halabi. From an early age they instilled in me a desire to learn and made sacrifices so I would have access to a high quality education and life. Without their support and guidance I would not be where I am today.

This work is also dedicated to my sisters Carmen M. Halabi and Scarlet M. Halabi Daoud and her family, to my cousin Roni N. Halabi and his family, and to my closest friends Joshua M. Kummer and Alex M. Breitsprecher. I could not have accomplished as much as I have without their support, patience, and understanding.
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I would like to acknowledge and thank the executive director of the school district for special services program, the classroom teacher, the participants, and the parents at the largest school district in the metropolitan area of a Midwestern state for allowing me to conduct my research and provide any assistance requested. Without their participation and collaboration, this study would have not been completed.

I would also like to recognize my dear friend Cristobal Salinas Jr. for all his encouragement, support, and guidance. A final appreciation goes to the colleagues, the department faculty and staff for making my time at Iowa State University a wonderful experience.
ABSTRACT

The increasing number of individuals diagnosed with autism, the shift in educational paradigms, and technology advances that allow affordability and accessibility were the motivation behind this study. Learners with autism have the potential to develop social and emotional skills as well as increasing motivation for learning while using technology, in particular tablet devices (i.e., iPads) as instructional tools. The purpose of this case study was to better understand the use of technology (in particular, tablet devices) to teach mathematics to a group of learners diagnosed with autism. Two research questions guided this study: (1) How do the motivational principles of the ARCS model impact the learners’ motivation with classroom activities (i.e., with excitement? apathy? sense of accomplishment)?; and (2) How do learners interact with technology used in the classroom (i.e., as an instructional tool? as a rewarding mechanism? as an entertaining strategy)? Moreover, the hope is to potentially gain more awareness into the motivational impact tablet devices can have on learners on the autism spectrum concerning engagement and participation in learning activities.

Participants in this study were five children diagnosed with autism between the ages of 8 and 11 who attended a middle school located at a large school district in a metropolitan area of a U.S. Midwestern state. The learners participated in a paper-based mathematics activity as well as interacted with an iPad to work on mathematics concepts. Observations and opportunistic interviews with learners and teacher were conducted. An in-depth semi-structured interview was also done with the classroom teacher.
In attempt to explore the research questions, data were analyzed using the Interpretive Descriptive qualitative research analysis method. Based on that analysis four themes emerged: (1) the motivational use of the tablet device in the classroom, (2) the classroom activities’ impact on learners’ social interactions, (3) learners’ behavioral changes resulting from change in classroom routine, and (4) teacher’s motivational strategy.

The overall study provided an understanding of the motivational impact tablet devices potentially have on learners on the autism spectrum concerning engagement and participation in learning activities. The impact of technology was contingent on its strategic instructional or reward mechanism implementation in the curriculum. The study revealed that technology in general and tablet devices in particular are used in the classroom as reward mechanisms and entertaining strategies to seize and retain the learners’ attention in order to achieve instructional goals.

The findings also revealed how the learners’ conceptual levels affect their response to the reward and influence their social behavioral skills that could become uncontrollable. Additionally, the findings raised awareness concerning the learners’ reactions to the change in their daily structured schedule and revealed some practices to manage learners’ behaviors.
CHAPTER 1.
INTRODUCTION

1 in every 68 births in the United States is on the autism spectrum, a rate that is nearly twice as great as the 2004 rate of 1 in 125; and, nearly 5 times more common among boys (1 in 54) than girls (1 in 252).

- Centers for Disease Control & Prevention, 2010

Once considered rare, Autism Spectrum Disorder (ASD) is now believed to be one of the most common and most encumbering of childhood disorders (Matson, 2007; Matson, Nebel-Schwalm, & Matson, 2007). Although children with autism may look like any other child, autism causes them to experience the world very differently. For example, children with autism may fail to respond to their name and often avoid eye contact with other people. They have difficulty interpreting what others are thinking or feeling because they cannot understand social cues, such as tone of voice or facial expressions, and do not watch other people’s faces for clues about appropriate behavior. They also tend to start speaking later than other children and may refer to themselves by name instead of “I” or “me.” Some speak in a singsong voice about a narrow range of favorite topics, with little regard for the interests of the person to whom they are speaking.

Autism Spectrum Disorders are neurobiological-based conditions that vary in their manifestation and are believed to reflect core neurodevelopmental idiosyncrasies (Matson & LoVullo, 2009). They begin before children reach the age of three with common deficits occurring in social interaction, communication, and sensory or repetitive behaviors that can result in educational, personal and occupational functioning concerns
(Balconi & Carrera, 2007; Lee, David, Rusyniak, Landa, & Newschaffer, 2007; Schlosser et al., 2007; MacDonald et al., 2007; Matson & Dempsey, 2008; Chung et al., 2007; Hilton, Graver, & LaVesser, 2007; Matson & Wilkins, 2007). Matson and LoVullo (2009) claimed autistic disorder to be the type of ASD that has been studied nearly five times (16,069 articles) more than all other ASD combined (3,540 articles).

**Table 1.** The Different Types of Autism. (Adapted from Dolah, Yahaya, and Chong, 2011)

<table>
<thead>
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<th>Types</th>
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<td>Autistic disorder</td>
<td>Markedly abnormal or impaired development in social interaction and a markedly restricted repertoire of activity and interests, usually noted within the first years of life.</td>
</tr>
<tr>
<td>Asperger’s syndrome</td>
<td>Severe and sustained impairment in social interaction and the development of restricted, repetitive patterns of behavior, interests, and activities. No clinically significant delays in language acquisition.</td>
</tr>
<tr>
<td>Rett’s disorder</td>
<td>A specific and highly distinctive pattern of development regression following a period of normal functioning through the first five months after birth. Has been diagnosed only in females.</td>
</tr>
<tr>
<td>Childhood disintegrative disorder</td>
<td>Marked regression in multiple areas of functioning following a period of at least two years of apparently normal development.</td>
</tr>
<tr>
<td>Pervasive developmental disorder not otherwise</td>
<td>Severe and pervasive impairment in the development of reciprocal social interaction, but the criteria is not met for a specific pervasive developmental disorder.</td>
</tr>
</tbody>
</table>
The main symptom that allows for the classification of autism from the other disorders is the “unusual social development” (Dolah, Yahaya, & Chong, 2011). Children across the autism spectrum differ from one another. As a group, they demonstrate comparable social impairment characteristics in communication, learning, sameness, repetitiveness, nonconforming behavior, and “the frequency, type, and quality of social interaction and social relationships with others” (Wolfberg, Bottema-Beutel, & DeWitt, 2012, p. 74; Bellini, Peters, Benner, & Hopf, 2007; Simpson, de Boer-Ott, & Smith-Myles, 2003; McConnell, 2002). These influence their academic performance, behavior, social and family relationships, and involvement in activities (Simpson et al., 2003). For example, general participation in activities is one such social skill that can be especially difficult for children with autism and it grasps the least attention in terms of interventions in the school systems.

Educational laws, technology advances and access to technology in the classroom are providing millions of children with special needs services at schools designed with their distinctive needs in mind advances that can attain improved learning outcomes (Burton, Anderson, Prater, & Dyches, 2013; Cihak & Bowlin, 2009).

The increase in autism and the shift in educational paradigms empowered by the educational and disability laws: Individuals with Disabilities Education Act (IDEA), No Child Left Behind Act (NCLB), Section 504 of the Rehabilitation Act, Americans with Disabilities Act (The ADA), and Assistive Technology Act; classrooms and especially inclusive settings can be academically and socially beneficial for both learners with and without disabilities (Sharpe, 1994; Daniel & King, 1997; Huber, Rosenfeld, & Fiorello, 2001). For example, IDEA outlines assistive technology as any service directly assisting
an individual with a disability in the selection, acquisition, or use of an assistive technology device for the purpose of increasing quality of life (Lang et al., 2014).

More importantly, the increase in Internet use as an instructional tool along with other technology advances have turned technology into a practical tool to teach social and emotional skills to children diagnosed with ASD (Neely, Rispoli, Camargo, Davis, & Boles, 2013; Tanaka et al., 2010; Scadden, 1998; Lombardi & Ludlow, 1997). Several studies show individuals with autism appear to have a natural affinity for computers and the controlled environment provided by technology tools (Moore, Cheng, McGrath, & Powell, 2005; Hardy, Ogden, Newman, & Cooper, 2002; Moore & Taylor, 2000). Other studies from advocacy organizations, research centers and universities have found that technology can improve social interactions for the children and enable adults to learn more about them (Strain & Bovey, 2011; Dawson, et al. 2010).

Tablet devices (i.e., iPads) have opened up the world of technology to the average classroom and have been instrumental in assisting some of the most challenged learners to read, talk, and connect. They have become more than just a novelty for many learners with ASD (Neely et al., 2013; Shah, 2011) by “altering the paradigm of traditional education and blurring the lines between assistive technology and instructional technology” (O’Malley et al., 2013, p. 2). They can also enable additional social behaviors such as sharing the device with a partner (Hourcade, Bullock-Rest, & Hansen, 2012). They are also “more normalizing and less stigmatizing” for individuals with a disability and they are a “common somewhat a coveted consumer product” especially for children with special needs motivating them to use it without drawing attention to their disability (Lorah et al., 2013, p. 638). Besides, table devices are becoming more and more
affordable, flexible, and a socially acceptable tool with features that have the potential to motivate learners with ASD to learn and to enhance their communication performance (Lorah et al., 2013; Light & McNaughton, 2012). One example is Hart & Whalon’s (2012) study that found a positive impact of using the iPad for video self-modeling on responding in class. Others studies have found similarly positive outcomes on tasks including checking spelling (Kagohara et al., 2012) and teaching numeracy skills (Jowett, Moore & Anderson, 2012). On the other hand, Keller and Suzuki (2004) caution that many features offered by tablet devices are appealing to learners only because they are innovative and may lose their appeal as learners adapt to them. Studies conducted on the use of technology indicate motivation plays an important role when learners interact with technology.

Keller’s ARCS Model of Motivation (1987a, 1987b, 1987c) provides a useful mental map to analyze learners’ motivation. ARCS stands for Attention, Relevance, Confidence, and Satisfaction. The ARCS model offers strategic and systematic design process featuring an analysis of audience motivation and problem-solving approach that guide instructors with the appropriate motivational strategies for learners (Keller, 2008; Gabrielle, 2003).

Purpose of the Study

Research indicates that the use of technology tools is increasing in the general education curriculum (Harris & Hofer, 2011; Harris, Mishra, & Koehler, 2009); however, the use of technology with learners with developmental disabilities has not been thoroughly investigated. O’Malley et al. (2013) and Kagohara et al. (2013) examined 15 studies pertaining to the use of technology with individuals with developmental
disabilities and disorders and found that these studies revealed positive academic outcomes, communication, and transferable skill development.

The purpose of this case study was to better understand the use of technology (in particular, tablet devices) to teach mathematics to a group of learners diagnosed with autism in the context of a specific classroom. Two research questions guided this research: (1) How do the motivational principles of the ARCS model impact the learners’ motivation with classroom activities (i.e., excitement? apathy? sense of accomplishment)? and (2) How do learners interact with technology used in the classroom (i.e., instructional tool? rewarding mechanism? entertaining strategy)? Ultimately, this study aims at gaining more awareness into the motivational impact tablet devices can have on learners on the autism spectrum concerning engagement and participation in learning activities. Therefore, the ARCS Model serves as the theoretical framework given the audience and context of this study. In this study, motivation is defined as active participation, engagement and interest of these learners while conducting classroom activities using tablet devices.

The decision to use mathematics as the main subject in this study is due to the fact that basic mathematics accuracy and speed are critical skills for learners with disabilities. Basic mathematics accuracy and speed, also referred to as mathematics fluency, “are strong predictors of mathematics achievement tests,” “are needed to acquire higher-order mathematics skills,” and “are essential for future successful independent living” (O’Malley et al., 2013, p. 4). Presently, many education systems are integrating within the curriculum the Common Core State Standards that set high expectations in mathematics and English Language Arts for all learners. The mathematics standards for
kindergarten through grade eight are organized by domain. For instance, learners in kindergarten through grade five are expected to not only master whole numbers arithmetic: addition, subtraction, multiplication, and division but to also achieve basic mathematics accuracy and speed and develop a strong conceptual understanding and procedural skill with fractions (O’Malley et al., 2013; Poncy, Skinner, & O’Mara, 2006).

The mathematics educational application implemented in this study for the tablet device activity is the Math-Drills app by Instant Interactive. This app was voted one of 12 best mathematics iPad app of 2012 by TeachThought and Teachers With Apps (“12 of the best math iPad apps,” 2012). More about this education application is discussed in Chapter 3.

Significance of the Study

Societal attitudes are significant as they determine to a large degree the extent to which the “personal, social, educational and psychological needs of persons with disabilities will be realized” (Munyi, 2012, para. 32). While spending my childhood in Lebanon, I was prevalent to experience a different perspective concerning individuals with special needs, a perspective similar to that of Franzen’s (1990). Society’s neglect, superstition, and fear influenced the living conditions of these individuals and increased their isolation. This life experience has captivated my perplexity on people’s emphasis on the disability of the individual instead of their ability.

A child with a disability is a symbol of a curse befalling the whole family. Such a child is a "shame" to the whole family, hence their rejection by the family or the community. Children who are met by those beliefs and attitudes can hardly develop to their full potential: "They get less attention,
less stimulation, less education, less medical care, less upbringing and
sometimes less nourishment than other children"


Witnessing the changes in the special education laws to ensure all schools are as readily and fully accessible to persons with disabilities as to the non-disabled, the advancements in technology that are changing our perspectives of what is impossible, and the significant changes in the perceptions towards children and adults with disabilities has inspired my passion to examine how readily accessible technology devices can overturn the disability label, attest to every child’s capacity to develop and perform to the best of their abilities, and ascertain their place within the community and society as a whole. My personal stance and the intent of this study is to remove the ‘disability’ stigma and focus on our ability to serve children with disabilities equally with all others, whether the subject is human rights, economic efficiency, or social desirability. Research on technology in the classroom has not extensively focused on either learners or the learning contexts of these groups. This case study was an attempt to fill that gap.

Thesis Organization

Chapter 1 introduces the research topic, the study’s purpose, and a discussion of the significance of the study. Chapter 2 discusses the ARCS Model of Motivational Design and reviews the literature regarding autism’s history, its diagnostic, symptoms, and signs, and its central feature being social behavior skills. It explores the special education laws that changed autism in the classroom, the technology in the classroom, including a brief discussion on the assistive technology and tablet devices for learning
and teaching. It concludes with a discussion on how evidence-based interventions impacted learners with autism.

Chapter 3 describes the methodology used in this study. It includes the research approach implemented, a description of the research context, and a presentation of the research participants. It features the data collection methods and the technique used to analyze the data collected. It concludes with a discussion on the Institutional Review Board proposal approval process and the recruitment procedure for the involved school.

Chapter 4 reports the findings of the study. It provides a detailed description for the context followed by descriptive observations and opportunistic interviews with learners for Day 1: Paper-based Activity Day and Day 2: Educational Application-based Activity Day. The chapter concludes with the semi-structured interview with the classroom teacher.

Chapter 5 features conclusions and summaries. It provides a discussion and summary of the major findings obtained from the study following the observations and interview provided in Chapter 4. It lists the three implications encountered along with the limitations and delimitations of the study. It highlights several recommendations for future research and it concludes with a summary of the findings’ contributions to current research.
CHAPTER 2.
LITERATURE REVIEW

The ARCS Model of Motivational Design

“The ARCS Model of Motivational Design is the only coherent and comprehensive instructional design model accommodating motivation.”

- Means, Jonassen, & Dwyer (1997, p. 5)

Motivation is a highly important aspect of learning and performance yet it only accounts for “16% to 38% of the variations in overall learner achievement” (Means, Jonassen, & Dwyer, 1997, p. 5) supporting the marginal research pertaining specifically to the motivational needs of learners (Huett, J.B., Moller, Young, Bray, & Huett, K. C., 2008; Shellnut, Knowlton, & Savage, 1999; Means, Jonassen & Dwyer, 1997). Empirical evidence denotes motivation to be one of the most critical concerns in how and why people learn. For instance, Csikszentmihalyi (cited in Gabrielle, 2003) investigated the significance of motivation and positive psychology for over thirty years and concluded motivational issues are as important to learning as cognitive issues. Moreover, Hancock’s (1994) motivational study concluded that both low conceptual learners (LCL) and high conceptual learners (HCL) desire higher motivation in situations that meet their learning needs. LCL group has relatively few cognitive structures and prefers structured, hand-fed instruction compared to HCL group that is more complex cognitively and prefers less structured learning environments (Bixler, 2006; Hancock, 1994).

There are several instructional design models that focus on motivational theories and encompass strategies, principles, categories and subcategories to develop and sustain the learners’ motivation. These models are: The ARCS Model by John Keller, the Time
Continuum Model of Motivation by Raymond J. Wlodkowski, the Motivational Framework for Culturally Responsive Teaching, also by Wlodkowski, and the Taxonomy of Intrinsic Motivations for Learning by Thomas W. Malone and Mark R. Lepper (Bixler, 2006). Table 2 provides a general comparison of these four models concerning motivation.

**Table 2.** Comparison of Four Models Concerning Motivation, adapted from *Motivation and its relationship to the design of educational game*. (Adapted from Bixler, 2006)

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<tr>
<td>1. <strong>Attention</strong> – Obtaining and sustaining</td>
<td>1. <strong>Appeal</strong> – How stimulating is the learning?</td>
<td></td>
<td>1. Provide optimally – challenging activities.</td>
</tr>
<tr>
<td></td>
<td>2. Provide a variety of activities and different presentation techniques.</td>
<td></td>
<td>2. Change sensory conditions to arouse curiosity.</td>
</tr>
<tr>
<td>1. <strong>Relevance</strong> – Meet the needs of the learners</td>
<td>1. <strong>Value</strong> – Is the learning important?</td>
<td>1. Establish the relationship of instruction to learners’ lives.</td>
<td>1. State goals or allow goals to emerge.</td>
</tr>
<tr>
<td></td>
<td>2. State goals.</td>
<td>2. State goals.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. <strong>Continuum motivation</strong> – Use what was learned outside the learning experience.</td>
<td>3. Create an understanding that learners will learn about something that they want to learn about.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Develop attitude by ensuring personal relevance and choice.</td>
<td>4. Develop attitude by ensuring personal relevance and choice.</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Confidence</strong> – Develop an expectancy for success.</td>
<td>1. Use clear examples.</td>
<td>1. Establish inclusion of learner with teachers and other learners.</td>
<td>1. Provide an optimal level of challenge.</td>
</tr>
<tr>
<td></td>
<td>2. State criteria for evaluation.</td>
<td>2. Indicate and demonstrate your commitment to helping learners learn.</td>
<td>2. Provide performance feedback.</td>
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<td>3. Provide performance feedback.</td>
<td>3. Clearly state the rules and procedures of the class/course.</td>
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<td></td>
<td>4. Reduce or remove failure-causing components.</td>
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Table 2. continued

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</thead>
<tbody>
<tr>
<td>1. <strong>Satisfaction</strong> – How good do people feel about their accomplishments?</td>
<td>1. Enhance meaning by creating challenging experiences that include learner’s values and perspectives.</td>
<td>1. Provide control over the learning environment.</td>
<td></td>
</tr>
<tr>
<td>2. Give learners control over reaching goals that are intrinsically motivating.</td>
<td></td>
<td></td>
<td>1. Use fantasy to help the learner experience power, success, fame, and fortune. Also helps the learners relate new learning to a past experience.</td>
</tr>
</tbody>
</table>

The ARCS model seems an adequate framework for the present study involving children on the autism spectrum. It defines the effective factors in keeping their motivation in learning and teaching process and presents strategies to increase their motivation and participation and build their confidence to apply their learning. Although motivational categories such as those featured in Table 3 are centered on the learners, none have been developed specifically for learners with special needs. This group of learners is a contributing member of society and it is important to expose them to motivational strategies that increase participation and involvement.

John Keller instituted the Attention, Relevance, Confidence, and Satisfaction (ARCS) Model of Motivational Design back in the early 1980s based on his macro theory of motivation and instructional design to supplement the learning process with motivation (Keller & Suzuki, 2004; Keller, 1987). Keller argued that while motivation is idiosyncratic, there are external aspects that affect the learners’ motivation (Keller, 1999;
Gabrielle, 2003). These factors include “systematic instructional design of tactics and strategies intended to improve motivation and performance, as well as encouragement and support by instructors, tutors, or peers” (Gabrielle, 2003, p. 15). For Keller, motivating the learners is a “sequential learning process” (Wongwiwatthanakun & Popovich, 2000; Keller, 1987). He suggested that educators must initially gain the learners’ attention before initiating any activities to intrigue their curiosity in understanding the reason the activities are relevant to them personally and implement motivational strategies to build confidence in completing the tasks to achieve the level of satisfaction desired resulting in sustained motivation (Wongwiwatthanakun & Popovich, 2000).

Keller’s ARCS model is based on a synthesis of motivational concepts and has three distinguishing features: (1) it represents sets strategies to improve the motivational instruction appeal, (2) it incorporates a systematic motivational design process, and (3) it consists of the four principal conditions that typify human motivation and they are: Attention (A), Relevance (R), Confidence (C), and Satisfaction (S) (Keller & Suzuki, 2004; Song & Keller, 2001; Wongwiwatthanakun & Popovich, 2000; Keller, 1987).

**Attention (A)** – The Attention principal is the most essential as it is vital for gaining, building curiosity and sustaining the learners’ attention (Keller, 2008). Keller proposed three strategies to implement to arouse the learners’ attention and they are: perceptual arousal, inquiry arousal and variability (Poulsen, Lam, Cisneros, & Trust, 2008; Keller, 2000; Wongwiwatthanakun & Popovich, 2000).

**Relevance (R)** – Relevance is as important as attention. The content must be familiar and of value to them to maintain their motivation (Keller, 2000). Keller (2000) suggested
three strategies along with subcategories for each to design lessons with content relevant to learners to sustain their motivation. The strategies and subcategories are: goal orientation – present worth and future usefulness; motive matching – needs matching and choice; and familiarity – modeling and experience (Poulsen et al., 2008; Keller, 2000; Wongwiatthanukit & Popovich, 2000). These four principals represent sets of conditions that are necessary for a person to be and to remain fully motivated. Each of the four encompasses subcategories, process questions and motivational strategies to keep learners satisfied and motivated as shown in Table 1, adapted from Applying the ARCS model of motivational design to pharmaceutical education by Wongwiatthanukit & Popovich (2000).

**Confidence (C)** – According to Keller (2000), confidence is frequently associated with the learners’ motivation level and their determination to complete a task. Additionally, modeling positive expectations for success attains confidence (Poulsen, et al., 2008). Keller suggests the following categories to integrate confidence when designing activities: performance requirements, success opportunities and personal control (Poulsen, et al., 2008; Keller, 2000; Wongwiatthanukit & Popovich, 2000).

**Satisfaction (S)** – Keller argues to sustain the learners’ motivation after gaining their attention, relating the content, and building their confidence in completing the task, they must be rewarded (Poulsen, et al., 2008). He suggested three reward strategies to fulfill the motivational sustainability: intrinsic reinforcement, extrinsic rewards and equity (Poulsen, et al., 2008; Keller, 2000; Wongwiatthanukit & Popovich, 2000).

And in particular, these four principal conditions represent sets of conditions that are necessary for a learner to be fully and remain motivated. Each of the four
encompasses subcategories, process questions and motivational strategies to keep learners satisfied and motivated as shown in Table 3, adapted from *Applying the ARCS model of motivational design to pharmaceutical education* by Wongwiwatthanankanit & Popovich (2000).
Table 3. Motivational categories as suggested by the ARCS Model. (Adapted from *Applying the ARCS model* by Wongwiwatthanukanit & Popovich (2000))

<table>
<thead>
<tr>
<th>Category and Subcategories</th>
<th>Process Questions</th>
<th>Motivational Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention (A)</td>
<td></td>
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</tr>
<tr>
<td>A.1. Perceptual arousal (i.e.,</td>
<td>• What can I do to capture the</td>
<td>• Create curiosity by using novel approaches, injecting personal and/or emotional</td>
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<tr>
<td>capturing learner interest)</td>
<td>learners’ interest?</td>
<td>material</td>
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<tr>
<td></td>
<td></td>
<td>• Using animation, inverse, flash, sound, and other audio and/or visual capabilities of</td>
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<tr>
<td></td>
<td></td>
<td>the audiovisual instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Using unusual, humor, contradictory, or bizarre content to stimulate attention</td>
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<td></td>
<td></td>
<td>• Avoiding dysfunctional attention getting effects such as a flashing word that</td>
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<td></td>
<td></td>
<td>distracts the learner’s concentration.</td>
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<tr>
<td>A.2. Inquiry arousal (i.e.,</td>
<td>• How can I stimulate an attitude of</td>
<td>• Stimulate information seeking behavior by presenting an unsolved case, posing or</td>
</tr>
<tr>
<td>stimulating learner inquiry)</td>
<td>inquiry?</td>
<td>having the learner generate questions or provide problem solving opportunities that</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nurture active thinking challenges.</td>
</tr>
<tr>
<td>A.3. Variability (i.e., maintaining</td>
<td>• How can I maintain learners’</td>
<td>• Maintain learner attention by varying the elements of instructions such as</td>
</tr>
<tr>
<td>learner attention)</td>
<td>attention?</td>
<td>presentation style, use of concrete analogies, human-interest examples or unexpected</td>
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<td></td>
<td></td>
<td>events.</td>
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</table>
Table 3. continued

<table>
<thead>
<tr>
<th>Category and Subcategories</th>
<th>Process Questions</th>
<th>Motivational Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relevance (R)</strong></td>
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</table>
| R.1. Goal orientation (i.e., meeting learner needs/goals) | • How can I best meet my learners’ needs/goals?  
• Do I know their needs?                         | • Provide clear statements or examples that represent the objectives and utility of the instruction, and either present goals for their accomplishment or have the learners define them. |
| R.2. Motive matching (i.e., matching learner interests and learning styles) | • How and when can I provide my learners with appropriate choices, responsibilities, and influences?  
• How and when can I link my instruction to the learning styles and personal interests of the learners? | • Use teaching strategies that match the motivational profile of the learners.  
• Make instruction responsive to learner motives and values by providing personal achievement opportunities or self-study, cooperative activities, leadership responsibilities, and exposure to positive role models. |
| R.3. Familiarity (i.e., creating links to learners’ experiences) | • How can I tie the instruction to the learners’ experiences?                         | • Make the materials and concepts familiar by providing or using concrete language, examples, concepts, and analogies that are related to the learners’ educational level experience and values.  
• Learn and use the learners’ names, request for experiences and ideas from the learners. |
<table>
<thead>
<tr>
<th>Category and Subcategories</th>
<th>Process Questions</th>
<th>Motivational Strategies</th>
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</thead>
<tbody>
<tr>
<td><strong>Confidence (C)</strong></td>
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<tr>
<td>C.1. Learning requirements (i.e., developing a positive expectation for success)</td>
<td><strong>How can I assist in building a positive expectation for success?</strong></td>
<td><strong>Gain the learner’s trust and positive expectations by explaining the prerequisite knowledge, skills, or attitudes that will help him/her succeed at the task.</strong></td>
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<td><strong>How will the learning experience enhance the learners’ beliefs in their competence?</strong></td>
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<td></td>
<td><strong>How will the learners clearly know their success is based on their efforts and abilities?</strong></td>
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<tr>
<td>C.2. Success opportunities (i.e., supporting or support or enhancing learners’ believe in his/her competence)</td>
<td></td>
<td><strong>Provide many, varied, and challenging experiences which increase learning success as the course moves forward.</strong></td>
</tr>
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<td>C.3. Personal responsibility (i.e., establishing learner’s effort and ability as his/her basis for success)</td>
<td></td>
<td><strong>Maintain learner attention by varying the elements of instructions such as presentation style, use of concrete analogies, human-interest examples or unexpected events.</strong></td>
</tr>
<tr>
<td>Category and Subcategories</td>
<td>Process Questions</td>
<td>Motivational Strategies</td>
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<tr>
<td><strong>Satisfaction (S)</strong></td>
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</tr>
<tr>
<td>S.1. Natural Consequences (i.e., intrinsic reinforcement)</td>
<td>• How can I provide meaningful opportunities for learners to use their newly acquired knowledge skills? (How can I encourage and support their intrinsic enjoyment of the learning experience?)</td>
<td>• Provide problems, simulations, or work samples that allow learners to realize they can solve “real world” problems.</td>
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<td></td>
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<td>• Provide learners positive recognition by giving opportunities to help others who have not yet mastered a task.</td>
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<td></td>
<td></td>
<td>• Acknowledge learner actions or characteristics that are necessary for success, continue these acknowledgments of any risks or challenges that are met.</td>
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<tr>
<td></td>
<td></td>
<td>• Nurture learners’ motivation by informing learners about areas of related interest or application of concepts and how learners might continue to pursue to their interest in the topic.</td>
</tr>
<tr>
<td></td>
<td>• What will provide rewarding consequences to the learners’ successes?</td>
<td>• Use verbal praise, real or symbolic rewards, and incentives, or allow learners to showcase the results of their effort (“show and tell”) to reward their success after instruction.</td>
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<tr>
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<td>• Avoid diluting the motivational benefits of feedback but use this frequency when learners are trying to mask a new skill.</td>
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<td>• Use extrinsic rewards for correct responses and do not chastise learners for wrong answers, help learners understand mistakes as learning opportunities.</td>
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<td></td>
<td></td>
<td>• Use extrinsic rewards judiciously so that the rewards do not become more interesting than the instruction itself.</td>
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<tr>
<td></td>
<td></td>
<td>• Use reinforcement intermittently as learners become more competent at a task and progress with the instruction.</td>
</tr>
<tr>
<td>S.2. Positive consequences (i.e., extrinsic rewards).</td>
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<tr>
<td>S.3. Equity (i.e., demonstrating fair treatment among learners)</td>
<td>• How can I build the learner’s perception of fair treatment? (How can I assist the learners in anchoring a positive feeling about their accomplishment?)</td>
<td>• Make performance requirement consistent with stated expectations, objectives, and/or standards and provide consistent measurement standards for all learner’s tasks, tests, and accomplishments.</td>
</tr>
</tbody>
</table>
Autism Spectrum Disorder

"Imagine you were in a foreign, noisy, and crowded city at night, not understanding the language spoken, recognizing a few words but not really comprehending situations taking place around you, wanting to express a need for help but not being able. This experience may begin to help you relate to what a child with autism feels on an ordinary day."

- Ramadan, (2002)

**Historical Snapshot**

Autism, a neurological disorder and a lifelong complex developmental disability impacting the functioning of the brain (About Autism, 2014), is becoming more predominant than cancer, diabetes, spina bifida, and Down syndrome in children (Filipek et al., 1999; Rogers, 1998). It was once considered a rare childhood disorder associated with severe intellectual disabilities, lack of social awareness, and absence of meaningful expressive language (Lord & Bishop, 2010; Lotter, 1966). However, it is no longer a rare disorder associated with severe intellectual disabilities and lack of social awareness. Autism has gone from being an obscure condition to a familiar diagnosis since Bleuler coined the term over 100 years ago (Rapaport, 1951).

Following Bleuler’s use of the term autism in 1908, its definition transformed over the next 100 years, and many advances and classification in the diagnosis of autism and related conditions along with a growing recognition of the broader spectrum of conditions related to autism took place (Volkmar, State, & Klin, 2009; Fombonne, 2005). Table 4 is a timeline representing the significant events that transformed the definition of autism over the years followed by descriptive detail of each event. This table was created as an outcome of this literature review.
Table 4. Transformation of the Definitions of Autism over the Years from 1908 to 2013 (original)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>MAJOR EVENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1908</td>
<td>Eugen Bleuler described autism as one of the most important symptoms of schizophrenia.</td>
</tr>
<tr>
<td>1927</td>
<td>Eugène Minkowski identified autism as the “trouble generator” of schizophrenia.</td>
</tr>
<tr>
<td>1943</td>
<td>Leo Kanner – the Austrian psychiatrist who introduced the concept of “early infantile autism.”</td>
</tr>
<tr>
<td>1944</td>
<td>Hans Asperger – a scientist from Germany who identified a similar condition now known as the Asperger’s Syndrome.</td>
</tr>
<tr>
<td>1950</td>
<td>“Refrigerator Mothers” – a label and an intimate portrait released portraying an entire generation of mothers who were blamed for their children’s disorders.</td>
</tr>
<tr>
<td>1950</td>
<td>Autism as ‘childhood schizophrenia’ due to the believed parent-child psychodynamics relationship.</td>
</tr>
<tr>
<td>1964</td>
<td>Bernard Rimland presented the first argument in that autism is a biological condition and unrelated to the bond between parents and children.</td>
</tr>
<tr>
<td>1970</td>
<td>Rejection of the notion ‘childhood schizophrenia’ – studies on twins and families revealed an evidence of genetic component leading to a difference in brain development resulting in autism.</td>
</tr>
<tr>
<td>1980</td>
<td>DSM III identified infantile autism as Pervasive Developmental Disorder involving 3 domains.</td>
</tr>
<tr>
<td>1987</td>
<td>DSM III redefined the definition of autism from 16 to 8 criteria among the 3 core behavioral symptoms.</td>
</tr>
<tr>
<td>1988</td>
<td>The movie “Rain Man” was released. It introduced the disorder the Savant Syndrome, and raised public awareness.</td>
</tr>
<tr>
<td>1991</td>
<td>Autism was promoted as a special education category and schools were to begin identifying and serving learners with autism.</td>
</tr>
<tr>
<td>2009</td>
<td>The U.S. Centers for Disease Control and Prevention estimated a 78% increase in autism in children.</td>
</tr>
<tr>
<td>2013</td>
<td>DSM eliminated all sub-diagnoses and referred to as Autism Spectrum Disorder.</td>
</tr>
<tr>
<td>2013</td>
<td>The new criterion has 2 core behavioral symptoms rather than 3 for diagnostic.</td>
</tr>
</tbody>
</table>

In 1908, Eugen Bleuler described one of the most important symptoms of schizophrenia, the preponderance of inner life with an active turning-away from the
external world, as autism (Rapaport, 1951). Bleuler’s student, Eugène Minkowski elaborated on autism’s initial definition into being the "trouble generator" of schizophrenia back in 1927 (Parnas, Bovet, & Zahavi, 2002).

In 1943, the Austrian psychiatrist, Leo Kanner, introduced the concept of “early infantile autism” (Bender, 1959). Kanner, one of the first professors of ASD in the United States, used the term autism and referred to it to describe the children with emotional and social problems he observed in his study (Baker, 2013; Folstein & Rosen-Sheidley, 2001). He noted the following characteristics he observed in 9 boys and 2 girls (Bishop, 1989; Kanner, 1973; Kanner, 1943): inability to relate to anyone, failure to develop speech or abnormal, largely non-communicative use of language in those who did speak, abnormal responses to environmental objects and events, eagerness for sameness, constructive cognitive skill based on the non-verbal test performance, normal physical status: good muscle coordination.

In 1944, Hans Asperger, a scientist from Germany, identified a similar condition in children known today as Asperger’s syndrome (Frith, 2004; Gillberg, 1991). The differences between these disorders are early speech and formal language skills, cognitive abilities, and “apparent onset conditions” that appear after the first several years of life (Felder, 2014).

By 1950, autism was considered the “childhood schizophrenia” due to the believed parent-child psychodynamics relationship (Baker, 2013; Mattila et al., 2011). Recently, a film titled Refrigerator Mothers was released, presenting an intimate portrait of the mothers of autistic children of the 1950s and 1960s. Refrigerator Mothers illustrated an entire generation of mothers, already laden with the challenge of raising children with
profound disorders, who lived for years under the dehumanizing shadow of professionally promoted "mother blame.” Looking for help and support, mothers encountered instead a medical establishment that pinned the blame for their children's bizarre behaviors on their supposedly frigid and detached mothering. Along with a heartbreaking label for their child, they received a devastating label of their own: as "Refrigerator Mothers" (History of autism blame, 2010).

Bernard Rimland, a research psychologist and parent of a son with autism, presented the first solid argument stating autism is a biological condition and unrelated to the bond between parents and children depicted in the movie Refrigerator Mothers. The concept of “Refrigerator Mothers” was rejected and autism was restated as the result of genetic mechanisms in 1964 (Project Autism, 2010).

During the 1970s, autism studies on twins and families were conducted and the results indicated ambiguous evidence of a genetic component that led to aetiological research confirming autism to be the result of biological differences in brain development (Muhle, Trentacoste, & Rapin 2004; Folstein & Rosen-Sheidley, 2001; Folstein & Rutter, 1977). These findings resulted in rejecting the notion of “children's schizophrenia.”

The Diagnostic and Statistical Manual of Mental Disorders (DSM) III was the main diagnostic reference of mental health professionals in the United States in the 1980s. It defined infantile autism as Pervasive Developmental Disorder (PDD), involving three domains all developing within the first three years of age: (1) lack of responsiveness to others, (2) communication deficiency, and (3) inexplicable behaviors (Baker, 2013).

In 1987, the revised DSM III, redefined the above definition to include 8 to 16 criteria among the three core behavioral symptoms and provided a new category, for
children meeting some of the autistic disorder criteria but not all. These three core behavioral symptoms as illustrated by the American Psychiatric Association (2013) are:

1. Reciprocal social interactions: Children with classic autism are unable to interpret other people’s conversations, ignoring them and often strenuously avoiding eye contact leading to isolation from people around them.

2. Verbal and nonverbal communication: reciprocal communication, through speech, gestures, or facial expressions, is impaired. Young children fail to use eye gaze or pointing to communicate and direct their parent's attention. Early language is limited. Deficits in pragmatic skills are present throughout life and affect both language and social interaction.

3. Restricted and repetitive behaviors or interests: Children with autism can develop elaborate rituals in which the order of events, the exact words, and the arrangement of objects must be followed.

The movie, *Rain Man*, was released in 1988 and with it the savant syndrome disorder was introduced. According to Treffert (2009), it is an extremely rare syndrome and people with autistic disorder, developmental disability, or mental retardation may be born with it. They tend to have amazing memory focused in one area (Treffert, 2009; Heaton & Wallace, 2004). In the movie, the actor Dustin Hoffman presented the character Raymond Babitt, who has an autistic disorder with an amazing photographic memory and mathematics skills (Treffert, 2009). Although not every child on the autism spectrum has these types of skills, the movie was important for raising public awareness of the disorder (Volkmar et al., 2009).
In 1991, the federal government made autism a special education category, prompting schools to begin identifying and serving learners with autism (Shattuck, 2006; Newschaffer, Falb, & Gurney, 2005). In 1994, both Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) and Asperger's Syndrome were added to *DSM-IV* (American Psychiatric Association, 2013).

More recently in 2009, the U.S. Centers for Disease Control and Prevention estimated that 1 in 110 children have autism spectrum disorders, an increase from 1 in 150 in 2007 (“Top 10,” 2012, para. 8). The improved screening and diagnostic techniques provide an explanation for the 78% increase (“Top 10,” 2012, para. 8). In 2013, the DSM made significant changes to the autism criteria based on new literature and clinical experiences. The sub-diagnoses are now eliminated and referred to as Autism Spectrum Disorder and the new criteria uses two areas to determine diagnosis rather than three: social communication/interaction and restricted and repetitive behavior (American Psychiatric Association, 2013).

Knowledge about autism has come a long way and seized the attention of many. Federal agencies, advocacy groups, and others have raised millions of dollars for research to determine the causes of autism and identify treatments. The latest findings from the extensive research and studies are changing what we know about autism. These findings suggest the possibility of decreasing the severity of the symptoms or even reversing autism symptoms in some infants and toddlers (Glicksman, 2012). By accurately identifying signs and symptoms in children, as presented in the next section, early diagnosis may prevent severe autism development.
Diagnosis, Symptoms, and Signs

Genetic testing and screening for related medical issues may be recommended; however, behavioral evaluations specific to autism have been the physicians' and psychologists’ main practice to diagnose autism until recently (Johnson & Myers, 2007; Muhle et al., 2004; Action, 1999). The behavioral evaluations involve examining the three behavior systems: social interaction, verbal interactions, and repetitive behaviors, done by a team of medical specialists including neurologists, psychologists, and speech therapists (Johnson & Myers, 2007; Rhoades, Scarpa, & Salley, 2007; Baird, Cass, & Slonims, 2003). With the increase in funding for research and the present technology advancement in the medical field, new diagnostic techniques are being discovered. For example, brain imaging technology tools such as Magnetic Resonance Imaging (MRI) is empowering scientists to trace infants’ neurodevelopment, leading them to diagnose it at an early age (Glicksman, 2012). In a new study, researchers compared the brains of infants who had siblings with autism with those of infants who did not have that high-risk factor, using the diffusion tensor imaging (Travers et al., 2012). The results revealed differences in the white matter or the fibers that surround neurons and support transmission of neural signals among high-risk six-month-olds who would later develop ASD. These changes were seen six months to a year before affected children typically show the full range of outward signs of autism (Wolff et al., 2012). Other research studies have also shown that early diagnosis is important since treatment is most effective at a younger age (Glicksman, 2012).

Although the three core behavioral symptoms emerge during the first three years of an individual’s developmental life stage; social deficits and behavioral patterns might
not be recognized as symptoms of ASD until the child is unable to meet social, educational, occupational, or other important life stage demands (Autism and Developmental Disabilities Monitoring Network - Surveillance Year, 2014). These symptoms and signs also differ in severity and combination for each individual, reiterating the statement “no two children appear or behave the same way” (American Psychiatric Association, 2013, para. 4).

For most children, the onset of ASD symptoms is gradual; however, “approximately 30% have an apparent “regressive” onset” (Miles, 2011). These children start off communicating; however they gradually or suddenly lose language and begin to distance themselves. Within a matter of days, communication deteriorates and the lack of responsiveness increases. Repetitive movements may develop immediately or not until the child is 3 or 4 years of age (Miles, 2011).

Roughly 25% of children who fit the diagnostic criteria for ASD at the age of two or three years begin to talk and communicate and by age six or seven years they blend to varying degrees into the regular school population (Huang et al., 2014; Miles, 2011). Even for this group, social impairments generally continue. For the remaining 75%, most have some improvement with age but continue to require parent, school, and societal support (Huang et al., 2014; Miles, 2011). Some studies indicate that fewer than 5% of children with autism completely recover; however, a decrease of the diagnostic criteria to include less impaired children seems to be increasing that percentage (Miles, 2011).

Not all symptoms are medically identified. Children with autism can demonstrate behaviors that may negatively impact daily living and health. Children may develop meltdowns, aggressive, or sometimes self-injury behaviors due to change in routine, an
offending touch, being asked to do something against their well, or for no apparent reason (Debbaudt, 2001; Swaggart et al., 1995; Attwood, Frith, & Hermelin, 1988). In school, children with autism often stand and watch other children from a distance (Swaggart et al., 1995). Some children respond to social overtures but take little social initiative, whereas others seek interaction but have little sense of how to proceed toward normal friendships (Boyd & Shaw, 2010; Debbaudt, 2001). These behaviors are evinced differently as the children progress from toddlerhood to adolescence (Boyd & Shaw, 2010), as exhibited in Table 5. Table 5 presents the changes in autism symptoms in children through their growth stages based on the three core behavioral symptoms: reciprocal social interactions, verbal and non-verbal communication, and restricted and repetitive behaviors or interests.

**Table 5.** Presentation of Autism Changes from Toddlerhood to Adolescence. (Adapted from Boyd & Shaw, 2010)

<table>
<thead>
<tr>
<th>I. Social Issues</th>
<th>A. Toddlers and preschool age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lack of or delayed response to name being called</td>
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<tr>
<td></td>
<td>Limited engagement in reciprocal, social games (e.g., peek-a-boo)</td>
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<tr>
<td></td>
<td>Lack of social referencing (i.e., “checking-in” with caregiver) or joint attention</td>
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<td></td>
<td>Lack of eye contact</td>
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<tr>
<td>B. School age</td>
<td>Difficulty forming and maintaining friendships</td>
</tr>
<tr>
<td></td>
<td>Difficulty with reciprocal social exchanges</td>
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<tr>
<td></td>
<td>Lack of social “chit-chat”</td>
</tr>
<tr>
<td>C. Adolescence</td>
<td>Continued social awkwardness</td>
</tr>
<tr>
<td></td>
<td>Difficulty with social relationships (e.g., dating)</td>
</tr>
<tr>
<td></td>
<td>Limited social-perspective taking (i.e., understanding other’s point of view)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Communicational Issues</th>
<th>A. Toddlers and preschool age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lack of or delayed language</td>
</tr>
<tr>
<td></td>
<td>Limited use of gestures (pointing to objects)</td>
</tr>
<tr>
<td></td>
<td>Immediate or delayed echolalia</td>
</tr>
<tr>
<td>B. School age</td>
<td>Stereotyped or repetitive use of language (e.g., reciting movies or television shows)</td>
</tr>
<tr>
<td></td>
<td>Difficulty initiating social conversations</td>
</tr>
<tr>
<td></td>
<td>Literal use of language (e.g., difficulty understanding sarcasm or metaphors)</td>
</tr>
</tbody>
</table>
Table 5. continued

<table>
<thead>
<tr>
<th>III. Restricted, Repetitive Behaviors and Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Toddlers and preschool age</td>
</tr>
<tr>
<td>• A typical object exploration (e.g., visually “sighting” objects or mouthing objects)</td>
</tr>
<tr>
<td>• Attachment to odd or unusual objects</td>
</tr>
<tr>
<td>• Odd hand or body mannerisms (e.g., toe walking)</td>
</tr>
<tr>
<td>B. School age</td>
</tr>
<tr>
<td>• Lack of pretend or imaginative play</td>
</tr>
<tr>
<td>• Presence of narrow or circumscribed interests (e.g., dinosaurs)</td>
</tr>
<tr>
<td>• Insistence on routines or sameness</td>
</tr>
<tr>
<td>C. Adolescence</td>
</tr>
<tr>
<td>• Obsessive-compulsive behaviors</td>
</tr>
<tr>
<td>• Presence of narrow interests that may have changed over time</td>
</tr>
</tbody>
</table>

Note: This table is not intended to represent the actual age of emergence or cessation of these behaviors in autism, but rather to reflect how core features of autism can change over time.

Social Behavioral Skills: The Central Feature

Among diagnostic, symptoms and signs, social skills are essential for their daily life and school activities. Social interaction is an important piece of the student’s educational plan, as increasing social interaction and competency are vital to overall progress. The desire to interact with others is often in place in individuals with autism, but the processes that allow social interaction to occur can be so overwhelming.

Individuals use social skills to interact with each other, both verbally and non-verbally. According to Hartup (1989) in Social Skills Interventions for Children with Asperger’s Syndrome or High-Functioning Autism: A Review and Recommendations (Rao, Beidel, & Murray, 2008), social skills in children have been repetitively connected to constructive development outcomes, including peer acceptance, academic achievement, and mental health. Thus, they matter, and unresponsiveness to these skills can result in
problematic social interactions and disruptive behaviors (Koegel, Koegel, Hurley, & Frea, 1992).

Literature relating to social skills’ impact on children with autism and the environments they participate in suggests social skills interventions can be an effective instructional method to teach them the skills necessary to navigate their social environment. For example, McConnell’s (2002) meta-analysis review of 55 studies examining social skills interventions for young children with ASD indicated social skills interventions to be effective for these children. Studies by Rogers (2000) and Hwang & Hughes (2000) revealed children with ASD responded positively to a wide variety of social skill interventions featuring child-child and adult-child interactions (Bellini et al., 2007). Though, for these interventions to be deemed effective, studies have shown the importance of matching the social skills strategy to the type of skill acquisition deficits (Bellini et al., 2007). The “Social Skills” (2002) suggested for the social skills to be effective, they should consist of two essential elements applicable to individuals and school environments: one element entails a teaching process that uses a behavioral or social learning approach and the other involves a universal language or set of steps that facilitates the learning of new behavior.

Despite the enormous difficulty and complexity involved in creating interventions and programs, there is no particular treatment protocol for all children with autism, but most individuals respond best to highly structured behavioral programs (Myers & Johnson, 2007; Dawson & Osterling, 1997). However, the National Institute of Child Health and Human Development lists Applied Behavior Analysis (ABA) among the most recommended treatment methods for autism spectrum disorders, in addition to Speech and
Language Therapy, Occupational Therapy, Picture Exchange Communication System (PECS), Alternative Augmentative Communication (AAC), Sensory Integration Therapy, and the school-based Training and Education of Autistic and Related Communication Handicapped Children (TEAACH) method (Early Intervention, 2010).

Many other technology, video, and computer-based programs have been developed with techniques aimed at improving social understanding and functioning of individuals with ASD that are yet to be fully researched and measured for effectiveness. For instance, social stories are personal stories with a focus on a child’s or others’ feelings to help them understand social situations (Quirmbach, Lincoln, Feinberg-Gizzo, Ingersoll, & Andrews, 2008; Gray, 2000; Hagiwara & Myles, 1999). Social scripts help the children initiate contact and conversation gradually (Weiss & Harris, 2001). Technology, such as the use of computer software or virtual reality programs, is being integrated to help them improve the recognition of facial and vocal expressions. For instance, researchers in the United Kingdom developed a program to help children with autism recognize facial emotions with the use of the computer (Baron-Cohen, Golan, Wheelwright, & Hill, 2004). In Alabama and Texas, researchers developed computer-based programs using virtual reality to improve their social interactivity skills and expressions of emotions (Hopkins et al., 2011). Interactive robots are also being designed with the same social skills interventions goal (Dautenhahn & Robins, n.d.).

While literature has presented the impact of social impairments and the effectiveness of social skills interventions and programs in the school, workplace, and home environments, only a limited number of children with autism receive appropriate social skills interventions and programs (Bellini et al., 2007) in schools. Teaching
individuals with autism how to form relationships and understand the feelings of others is likely more important than academic learning when considering the future potential of an individual. Schools carry an important responsibility to work this into the curriculum, whether the learner with autism is in the inclusive or the special education classroom.

**Autism in the Classroom**

"We must build a world free of unnecessary barriers, stereotypes, and discrimination.... policies must be developed, attitudes must be shaped, and buildings and organizations must be designed to ensure that everyone has a chance to get the education they need and live independently as full citizens in their communities."

- Barack Obama, April 11, 2008

**The Special Education Laws**

Children with special needs have historically received unequal treatment in the U.S. education system. Traditionally, these learners were separated from their peers (Harrower & Dunlap, 2001). However, in the early 20th century, the enactment of required attendance laws in the states began to change the educational opportunities for these learners (Yell, Rogers, & Rogers, 1998). Additionally, the recent theoretical arguments related to social development and legal issues related to civil rights intensified the demand to include these learners in general education classrooms along with their developing peers (Harrower, 1999; McDonnell, 1998). And parents of learners with disabilities joined forces with activists during the late 1960s and early 1970s to force states to provide an equal educational opportunity for these learners. Their actions resulted in a fundamental rise of federal legislation (Yell et al., 1998)

The *Individuals with Disabilities Education Act* (IDEA), the *No Child Left Behind Act* (NCLB), Section 504 of the Rehabilitation Act, the *Americans with Disabilities Act*
(The ADA), and the Assistive Technology Act are among the educational and disability laws continuing to influence the education of learners with special needs. The summary of each act below was adapted from Disability & Education Laws (2010).

The Individuals with Disabilities Education Act (IDEA) is a federal law that authorizes special education for children with disabilities in the United States. It lists 13 categories of disabilities and autism is one of them. Congress originally enacted the law in 1975 to ensure that children with disabilities have the opportunity to receive a free appropriate public education, just like other children. The law has been revised many times over the years. Congress passed the most recent amendments in December 2004, with final regulations published in August 2006 (Part B, for school-aged children) and in September 2011 (Part C, for babies and toddlers). It requires all U.S. public schools to provide for the special needs for all children, ages 3 through 21, with disabilities. For infants and toddlers with disabilities birth up to age 3 and their families, special services are provided through an early intervention system.

The No Child Left Behind Act (NCLB) of 2001 is the nation’s general education law that amended the Elementary and Secondary Act of 1965 (Schrag, 2003). One of its primary purposes is to make schools and teachers accountable for how well their learners are learning. Through standardized testing, learners’ progress is measured in reading, mathematics, science, and other academic content. The law emphasizes assessment and accountability, requires states to show Adequate Yearly Progress (AYP) in raising learner achievement, and demands the participation of learners with disabilities in large-scale statewide or district wide testing. In the case of Special Education, NCLB supports early intervention and learning in the early years and includes learners with special needs in the
standardized testing, and assesses their AYP as an accepted subgroup. They are also provided accommodations during test taking and alternate kinds of assessments. NCLB also offers grants for Education Technology as “a movement toward providing access to general curriculum to children with disabilities” (Schrag, 2003) in hopes to improve their academic outcome.

**Section 504 of the Rehabilitation Act of 1973** is a civil rights law with a broader definition of disability than that of IDEA. It prohibits all programs and activities, whether they are public or private - that receive federal funds - from discriminating based on disabilities. Section 504 requires school districts to provide a free appropriate public education (FAPE) to qualified learners in their jurisdictions with a physical or mental impairment that substantially limits one or more major life activities, regardless of the nature or severity of the disability. It provides services to children who may not qualify as disabled under IDEA 2004 but who need additional support services to fully access the education system.

**The American Disabilities Act of 1990** is a civil rights law that applies to every entity regardless of whether it receives federal funds, except for churches and private clubs. The law provides safeguards to protect individuals with disabilities from discrimination of any kind, which means children cannot be denied access to any program, such as field trips, school clubs, organizations, or sports activities, solely because of a disability.

The **Assistive Technology Act** was first passed as the Technology-Related Assistance Act of 1988. It is referred to as the Tech Act for short and was amended in 1994, 1998, and 2004. It offers every state funding to provide individuals with disabilities
with assistive technology to partake in education, employment, and daily activities with other members of their communities. The law is aimed at people with all disabilities, of all ages, and in all environments, including early intervention, K-12, post-secondary, vocational rehabilitation, community living, and aging services.

As a result of these laws, special education changed and “90% fewer developmentally disabled children are living in institutions, hundreds of thousands of children with disabilities attend public schools and regular classrooms; three times as many disabled young people are enrolled in colleges and universities; [and] twice as many young Americans with disabilities in their twenties are in the American workplace” (Yell et al., 1998, p. 226). More specifically, the laws have led to an increased amount of inclusive classrooms and use of technology tools in schools to meet their needs and provide them access to the general curriculum. This leads to a shift in educational settings and paradigms.

**The Shift in Educational Settings and Paradigms**

Each developmental stage brings its own challenges for all children and this holds true for learners on the spectrum shown in Table 6. The variety of educational settings continues to grow and change to meet the distinct needs of learners with special needs, making teaching more difficult on the state and national achievement accountability scale (Vakil, Welton, O’Connor, & Kline, 2009). Their distinctive intellectual abilities lead to various academic expectations, resulting in different levels of learning where there is not one unified way agreed upon to teach that will benefit all learners (Simpson et al., 2003).
Table 6. Developmental Changes in Learners with ASD Across the School Years. (Adapted from National Autism Center, 2009)

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Age</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Development</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant/Toddler</td>
<td></td>
<td>• May avoid touch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May isolate from groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• An infant may not imitate facial expressions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Failure to respond to the emotional needs of others.</td>
</tr>
<tr>
<td>Early School Years</td>
<td></td>
<td>• May not engage in social games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May prefer younger children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May appear “bossy” when playing with other children</td>
</tr>
<tr>
<td>Adolescence/Early Adulthood</td>
<td></td>
<td>• Gaps in social skills become even more apparent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dating challenges</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Social challenges sometimes related to issues such as poor hygiene (e.g., rigid adherence to rules regarding frequency of bathing)</td>
</tr>
<tr>
<td><strong>Communication Development</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant/Toddler</td>
<td></td>
<td>• May lack speech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Immediate or delayed echoing of others' words</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of scripted phrases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May not respond to name</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unlikely to use gestures</td>
</tr>
<tr>
<td>Early School Years</td>
<td></td>
<td>• May sound like “little professors” who are lecturing on a topic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Conversations are one-sided</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May not see how their behavior hurts others</td>
</tr>
<tr>
<td>Adolescence/Early Adulthood</td>
<td></td>
<td>• Poor understanding of abstract concepts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Challenges in understanding jokes or slang</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May mimic language from television or movies</td>
</tr>
<tr>
<td><strong>Restricted, repetitive, nonfunctional patterns of behavior, interest, or activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant/Toddler</td>
<td></td>
<td>• Repetitive motor movements like rocking, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May line up toys for visual examination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May categorize toys instead of playing with them</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some rigidity in routines</td>
</tr>
<tr>
<td>Early School Years</td>
<td></td>
<td>• Rule-bound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May create own rule to make sense of the world</td>
</tr>
<tr>
<td>Adolescence/Early Adulthood</td>
<td></td>
<td>• May engage in elaborate rituals to avoid motor tics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May obsess for hours about an encounter w/peer</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant/Toddler</td>
<td></td>
<td>• Tantrums</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sensitivity to light or sound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Feeding challenges (e.g., food texture)</td>
</tr>
<tr>
<td>Early School Years</td>
<td></td>
<td>• Academic concerns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Difficulties concentrating &amp; irritability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May be disruptive during transitions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May be clumsy in sports activities</td>
</tr>
<tr>
<td>Adolescence/Early Adulthood</td>
<td></td>
<td>• Symptoms of depression or anxiety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May not understand rules regarding sexual behavior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increased risk for seizures (associated w/puberty)</td>
</tr>
</tbody>
</table>
In the past couple of decades, autism changed tremendously and so did its treatment and educational instruction. Schools for children with autism were only considered within a specialized institute. However, with the call to all educators to provide equal learning opportunities for all children regardless of race, gender, and ability, the advanced knowledge of the disorder gained over the years, and the changes with public policies, general and special education educators “have risen to meet the challenges and maintain educational settings in the regular education setting with typically developing peers” through collaboration in inclusive classroom setting (Vakil et al., 2009, p. 322).

The inclusive classroom is a theoretical movement to provide equal academic environments to all learners across the educational and developmental spectrum, ranging from typically developing learners to severe and profoundly disabled learners, by reorganizing schools to prevent the separation between learners with and without special needs in the classroom (Edmunds, 2000; Ferguson, 1996; Minke, Bear, Deemer, & Griffin, 1996). The inclusive classroom is an ideal concept to “provide social interactions and opportunities for children with autism that might otherwise be lacking in a self-contained setting” (Boutot & Bryant, 2005, p. 14) with teachers’ care, compassion, support, patience, positive attitude, and proper training (Dahle, 2003).

The increased opportunities for learners with learning and developmental disabilities to participate in an inclusive classroom has resulted in important outcomes including “the acquisition of functional, adaptive, daily living, and social skills and the competencies to achieve necessary for the highest level of independence” (Burton et al., 2013). Research has shown experience (for example, Mastropieri & Scruggs, 2001), and professional development, along with administrative and special education support, as
contributing factors leading to positive attitudes toward including learners with disabilities. In a study conducted over a period of three years examining the attributes leading to successful inclusive classrooms through observation, surveys, and interviews, seven associated variables were found: administrative support, support from special education personnel, an accepting positive classroom atmosphere, effective general teaching skills, peer assistance, disability-specific teaching skills, and an appropriate curriculum (Mastropieri & Scruggs, 2001).

Research has also indicated that for these inclusive classrooms to be of value and success for learners, teachers must be willing to adapt and modify the curriculum and instruction as needed, to meet the needs of all learners with and without disabilities (Walker, 2012; Stanovich & Jordan, 2002). One of the many ways is for educators to accept and allow for differences in the ways learners approach and complete classroom tasks by using a wide range of materials, as some learners find traditional teaching materials are not appealing or easy to use (Broderick, Mehta-Parekh, & Reid, 2005).

For instance, many learners with autism find writing with pencils and pens difficult and thus prefer to use a typewriter or computer instead. John McDonnell, Chair of the Department of Special Education in the Graduate School of Education, University of Utah, adds, for inclusive classrooms to be effective and beneficial, learners should be grouped in specific classes but allocated among all teachers, they ought to receive instructional support aimed at maximizing their participation in the general education curriculum and engagement with their peers, teachers have to adapt and implement a variety of instructional strategies in their curriculum, and colleges need to revamp their educational programs to train professionals and paraprofessionals to empower them with
the knowledge, experience, and tools to work effectively in an inclusive classroom setting (Lettrich, Spataro, & DePasquale, 2005; Sharpe & Hawes, 2003).

Successful inclusion of learners with ASD in the regular educational setting will also depend on the severity of the disability, the attitude and training of the educator, and the collaboration of the educating parties involved. Inclusion might be the best situation for many learners with ASD, but it is not the most productive for all learners. According to Gallagher (2004), traditional educational practices create a barrier for the different styles of meaningful learning experiences that promote intellectual growth and autonomy. Equally, “placement and programming decisions for children with autism can be a difficult task” (Boutot & Bryant, 2005). Researchers, practitioners, and parents may disagree at times about the definition of the "best" environment; however, litigation regarding the education of learners with ASD has become more common than any other type of litigation, due to IDEA and its regulations (Ivanonne et al., 2003). These litigations are not only breaking the different learning experience barrier for students with special needs, but they are also providing students and schools with the proper technology needed in schools to supplement the needs for enriched education.

Technology in the Classroom

“Technology has become part of the educational process, but too often it is separate and not integrated into the learning experience.”

- Starr, (2011, para. 1)

Technology development is one of the five general ongoing social movements that impacts special education in the 21st century, with the other four identified as demographic changes, social structure shifts, educational reforms, and moral and ethical
renewal (Lombardi & Ludlow, 1997). Additionally, over the past decade, there was an increase in the variety of technology tools introduced in schools in an effort to improve education and motivate learners (Kenney, 2011). Yet, research on the association between technology tools and education in the special education classroom remains insignificant.

A technology can be an assistive device to support an ability that is either missing or impaired for learners with learning disabilities ranging from cognitive problems to physical deficiencies. According to Scadden (1998), without these assistive devices, learners with disabilities may not receive the same quality of educational services provided to their peers. As a result, assistive educational technology development has become a central discussion when tackling the challenges individuals with ASD encounter (Neely et al., 2013).

**Assistive Technology**

An assistive technology device is defined as "any piece of equipment, or product system that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" [IDEA, Part A, Sec. 602(1), para. 2]. It may be a high-tech or relatively low-tech technology, ranging from a robotic therapist down to laminated picture cards (Lang et al., 2014; Ganz et al., 2012; Shane et al., 2012; Vanderborght et al., 2012). The term incorporates evaluation of needs, purchasing, leasing or otherwise providing for acquisition, selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing, coordinating and using other therapies, training or technical assistance for the learner (or individual) and family, and training or technical assistance for professionals, employers, or other individuals who provide services (IDEA, 1997). According to Lewis (1998), assistive technology serves two major purposes: to
counterbalance the effects of the disability by increasing the individual's strengths and to provide an alternative mode of performing; thus allowing learners to compensate for the disability in the classrooms by potentially enhancing academic achievement in written expression, reading, mathematics, and spelling, improving organization, and promoting social acceptance. Lang et al. (2014) presented 11 studies revealing assistive technology as a significant intervention approach in improving communication, social, and daily living skills of individuals with ASD.

Assistive technology integrated in academic curriculum has advanced significantly since 1997, along with effectiveness in the general education classroom and the notion that education is central to improving the lives of people with learning disabilities (Aarons & Gittens, 1998). Children with autism are often the recipients of assistive technology (Lang et al. 2014; Francis, Mellor, & Firth, 2009; Hess, Morrier, Heflin, & Ivey, 2008; Mechling, 2011; Shane et al., 2012) due to their learning and behavioral characteristics and the impact these handheld technology tools, in particular tablet devices such as the Apple iPad, have on their communication and social skills (Mirenda, 2001).

The use of handheld technology has become widely accepted as part of the classroom-learning environment; as such devices are readily available to learners and teachers (Lorah et al., 2013; Peluso, 2012). According to Alyahya and Gall (2012), with more than 2.5 million iPads sold to schools in the United States since 2012 and “more than 20,000 education applications built especially for iPads, technology has the potential to fundamentally change teaching and learning” (p. 1267).
**Tablet devices**

When the first tablet device, the Apple iPad, made its debut in April 2010 (Ritchie, 2014, para. 3), it was acknowledged as something of a “phenomenon-teaching tool” for individuals with special needs including those with emotional and social skill deficits (Neely et al., 2013; Ramdoss et al., 2011). “It’s a multisensory product” that allows the children to overcome the difficulty of using a mouse and a computer by “touching and dragging things with their fingers” (Herbert, 2010, p. 16).

Five years later, tablets are still playing a big role, particularly in the special need community. Two of the important uses of tablet devices have been the communication feature for people with complex communication disorders and the visual displays that are often highly appealing and motivating for learners on the autism spectrum (Sennot & Bowker, 2009). Visual displays can improve both “receptive and expressive communication” (Hodgdon, 2000). According to Johnston, Nelson, Evans, & Palazolo (2003), visual displays have been used to “prompt joint attention in children with autism; establish conversational referents in children with severe and multiple disabilities; promote memory recall in children with ASD; enhance attention to, and understanding of, social messages and behavior in children with ASD; increase the comprehension of linguistic concepts in children with autism; and facilitate social initiation and communicative intent in both children with severe disabilities and children with ASD” (p. 86).

iPad creates and defines an entirely new category of devices that will connect users with their apps and content in a much more intimate, intuitive and fun way than ever before” (Ritchie, 2014, para. 3). iPads were not the first devices used in special education classrooms. Special education teachers have used a variety of visual software and tools for years to teach and supplement lessons in mathematics, reading, writing, organization, and memory, including handmade visual aids, expensive communication devices, and TVs (Murray & Olcese, 2011; Holzberg, 1994). However, with the camera feature, teachers have more visual options to offer the children. For example, children can tap words and sentences on the screen for the specialized apps to voice them out and they can take photos and videos that can be personalized and modified. Moreover, children with poor fine-motor skills find the touch-screen design easier to use than a desktop computer with a mouse or a laptop with a touchpad (Kagohara et al., 2013; Shah, 2011). Other advantages are their simplicity and the ease with which they can be customized—important for all learners, but especially those with special needs (Puckett, 2011).

The ability for learners with ASD to use traditional speech-generating devices and the positive impact this can have on communication and other skills is well recognized (Ganz et al., 2012). There is prevalent and encouraging subjective information about learners with autism learning to use tablet devices to communicate; however, there is still limited scientific research. Recent reviews have confirmed that learners with autism and other developmental disabilities can be taught to use a range of speech generating devices but only a small number of studies have looked at using tablet devices specifically (van der Meer et al., 2011).
Van der Meer and colleagues (2011) taught three learners to use a small hand held device such as an iPod Touch, a phone-sized device that can access apps, games and the internet to respond to the verbal cue ‘Let me know if you want a snack/toy’. Two of the three learners became proficient at using the device, although it is important to note that systematic and relatively intensive training was required. The third learner, who had the most limited communication skills prior to the study, did not learn to use the device even after 40 training sessions, indicating that there are likely some baseline skills required to learn to use these types of systems.

Van der Meer et al. (2012a; 2012b) conducted another study by using signing and picture exchange to compare the differences between iPods and iPads as speech-generating devices and found that learners favored different devices based on how quickly they learned to use the communication system. Achmadi et al. (2012) expanded on van der Meer’s studies by looking at teaching two learners and more advanced operations such as turning on the device and following multiple steps to make a request. Both learners learned to unlock the device and access multiple pages to make requests.

A more comprehensive trial of iPads by the State of Victoria (Australia) Department of Education and Early Childhood Development (DEECD) was done in 2011 to study the impact of iPads on learning in both general and special education classroom settings (Pegrum, Oakley, & Faulkner, 2013; Ellis, 2011). The study aimed to investigate the iPad’s capacity to increase independent learning and motivation, to improve teachers’ capacity to plan for and meet individual needs and to extend learning beyond the classroom and improve parental engagement. The study yielded positive results on learning; however, the researchers noted that the quality of teaching was the factor which
enabled the iPad to be used effectively to improve learner motivation, engagement, and learning outcomes. Importantly, teachers found that the iPad was especially valuable for learners in special education settings, due to “its design features, multi-functionality and access to specific purpose apps” (Pegrum et al., 2013; Ellis, 2011).

While the popular media and reports have suggested that iPads and other tablet devices are a ”godsend” (Hardawar, 2013), a ”miracle device” (Johnson, 2011) and capable of ”in a sense, curing the disorder” (Brandon, 2011), it is clear from research that iPads require support, teaching, and careful planning if they are to be useful for learners with autism. Overall, tablet devices such as iPads appear to hold promise for learners with autism in terms of communication, supporting features of autism, and in curriculum access when their use is individualized. iPads are leading to a paradigm shift toward the use of technology in the classrooms and as interventions, especially for individuals with ASD (Neely et al., 2013; Murray & Olcese, 2011). They have replaced a number of tools for parents, therapists, educators, and children as "a more affordable alternative to the dedicated augmented-communication devices some nonverbal kids use to communicate, which can cost between $6,000 and $8,000” (Kelly, 2014, para. 23). It is important to note, however, that there is limited empirical evidence at this point and that research to date clearly indicates that "it is quality teaching and support that makes positive outcomes possible, not just the device" (DEECD, 2011).

**Readily Available Applications**

“The accessibility features and availability of apps along with positive benefits of touch-screen apps” make tablet devices particularly appropriate for children on the autism spectrum and with other mental and communicative challenges (Kagohara et al., 2011;
Mechling, Gast, & Krupa, 2007). Moreover, with the increase of iPad usage as a learning and communication tool for children with autism, an app rating can provide guidance into selecting an app that has been scientifically tested and proven effective to the children with ASD. There are three rating categories - anecdotal, research, and evidence. An app is identified as anecdotal when it has not been linked to any scientific research; the research category is when there are some related studies but direct support is lacking; and the evidence category is when research illustrates concrete scientific evidence of its effectiveness (Autism Apps, n.d., para. 3).

Research also shows touchscreen apps and multitouch displays enable individuals with autism to learn and communicate in new ways. For instance, touchscreen apps strengthen the ability to communicate of learners with autism by using their visual learning strength (Hourcade, Bullock-Rest, & Hansen, 2012; Kagohara et al., 2011), while multitouch displays encourage social interactions and help children practice social skills. For example, Piper, O’Brien, Morris, & Winograd (2006) designed a tabletop app for children with autism in the form of a four-player cooperative game after discovering the positive impact that engagement had on the children (Hourcade et al., 2012). Hendrix, van Herk, Verhaegh, & Markopoulous (2009) conducted further studies using tabletop applications to test the social behaviors and engagement of children with autism. Their studies noted an increase in children’s responses to peers, with more positive affect, and a greater likelihood to express emotions (Hourcade et al., 2012).

Despite the current studies published and evidence provided, there are more narratives on the effects of apps on social, visual communication, or behavior support functions than there are scientific research that evaluated them (Kagohara et al., 2012).
Parents', teachers', and therapists’ interactions with children with autism find the apps beneficial by sharing “the profound difference that apps for Apple and Android products have made in helping autistic children develop skills” (Joshi, 2011, para. 2). The number of apps developed with features for autism is colossal.

These apps are classified into communication, social interaction, and behavior categories as depicted in Table 7 (Hartmann, 2011). Communication apps such as “Tap to Talk” help support the children with autism who cannot speak or have language delays, while other apps such as "Hidden Rules" focus on guiding the children with handling social situations in daily life and on fine-motor skills to help with functions such writing or manipulating small objects (Joshi, 2011).

Not only is the number enormous, choosing the most appropriate app for individuals with autism based on their unique needs can also be overwhelming for parents and teachers. Thus, with the large number of apps targeting the core features of autism, it is important that teachers and parents carefully evaluate the needs of individual learners, the most appropriate app available, and the potential benefit for each learner. Bronwyn Sutton, a Speech Language Pathologist and Educator with 25 years experience and expertise in working with students with autism and language impairments created The Apple Guide online resource to help parents and teachers choose the best app based on the individual’s needs. She purchased and used every app and ranked each app based on research criteria to help parents and teachers make an informed decision (The App Guide, n.d., para. 4).

With the rapid advancements and proliferation in technology use in the classroom for instruction and the continuous changes and evolvement of ASD, evidence-based
Interventions are effective techniques to identify best practices for children, parents, and educators.

**Table 7. Successfully using iPads to Support Learners with Autism. (Adapted from Hartmann, 2011)**

<table>
<thead>
<tr>
<th>Categories</th>
<th>App Types</th>
<th>App Sub-Types &amp; Names</th>
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<tbody>
<tr>
<td>Communication</td>
<td>Augmentative &amp; Alternative Communication</td>
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<td>• Proloquo2Go</td>
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<td>Playschool Art Maker</td>
<td>Stop &amp; Go</td>
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<td>Playschool Art Maker</td>
<td>Aunty Maggie’s Recipe</td>
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<td>Choiceworks</td>
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<td>What would you do at school?</td>
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<td>iPrompts XL</td>
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<th>Behavior</th>
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Evidence-Based Interventions

"Being aware of ASD diagnoses and their myriad presentations will be an important step in helping children with ASD in the school setting. Working closely with other educators, treatment providers, and diagnosticians in the field will help close the gaps between identification, intervention, and the best possible outcome for the child."

- Evidence-Based Practice and Autism in the Schools (2011)

Overview of Evidence-Based Interventions

The concept of evidence-based intervention was referred to and described over the years by pairing the following different terms: “research-, empirically-, or scientifically- with based, supported, or validated (and then) applied to treatments, practices, instruction, or interventions” (Mesibov & Shea, 2010). For example, in psychology, the concept was originally termed "empirically validated treatment" (EVT)
and "empirically supported treatment" (EST) and the concept developed as “a means of
documenting the benefits of adult psychotherapy in the context of pressures from
psychiatric medication and from managed care” (Mesibov & Shea, 2010; Chambless &
Ollendick, 2001).

According to the literature, the concept started in the medicine field back in the
1970s and was known as "evidence-based medicine" (EBM) (Mesibov & Shea, 2010;
Reichow & Volkmar, 2010). In 1992, it was introduced in the dentistry, nursing,
psychology, education, library, human service professions, and information science fields
and became prevalent (Mesibov & Shea, 2010). The concept has two basic principles and
they are: “all practical decisions made should be based on research studies and research
studies are selected and interpreted according to some specific norms characteristic for
evidence-based practice (EBP)” (Rogers & Vismara, 2008; Rogers, 1998).

There exists one major barrier to the adoption of evidenced-based practices for
ASD and that is “the lack of consensus on how to identify and evaluate scientifically
valid and effective interventions” (Lindgren & Doobay, 2011). NCLB defines
“scientifically based research” as “research that involves the application of rigorous,
systematic, and objective procedures to obtain reliable and valid knowledge” (NCLB,
2002; Lindgren & Doobay, 2011). That signifies that for a practice to be deemed
scientific, “it must meet particular standards that include random samples of subjects that
are assigned to control and experimental groups or a series of replications of well-
controlled studies using rigorous single-subject designs, it must reliably yield positive
results, and survive a rigorous peer review process” (Lindgren & Doobay, 2011). These
particular research guidelines are difficult to conduct in many real-life settings leading to negative impact on the overall ASD research.

Aside from the strict requirements, professionals continue to conduct ASD research and apply the principles to their specialized fields to study the “different forms of interventions for a variety of clinical populations, including treatment and education for children with autism” (Mesibov & Shea, 2010, p. 570).

**Evidence-Based Interventions for Learners with Autism**

Leo Kanner noted several characteristics during his observation of the nine boys and two girls, resulting in defining children with autism as those who demonstrate “serious failure to develop relationships with other people before 30 months of age, problems in development of normal language, ritualistic and obsessional behaviors also referred to as insistence on sameness, and potential for normal intelligence” (Lovaas, 1987, p. 3; Lovaas, Koegel, Simmons & Long, 1973; Kanner, 1943). And since his initial description of the syndrome of "early infantile autism" (Kanner, 1943), ASD’s prevalence continues to increase and social interaction remains the central feature of autism and an area of “great vulnerability even for the most cognitively able individuals on the autism spectrum” (Reichow & Volkmar, 2010, p. 150), resulting in a high demand for effective practices for children with autism (Simpson, 2005).

Lovaas and colleagues published articles in 1987 and 1993 describing the “recovery of almost 50% of a group of a pre-school age children with autism who were treated intensively with applied behavioral analysis for several years” (Rogers & Vismara, 2008, p. 8); Lovaas, 1987; McEachin, Smith, & Ivar Lovaas, 1993). These articles not only resulted in major impacts on public schools and public service
organizations that fund interventions for all children with disabilities, but they also led to the development and design of specialized intervention programs explicitly for children with autism (Rogers & Vismara, 2008). Rogers and Vismara (2008) furthered their research by conducting a broad review of interventions conducted on children with autism to determine their impact. Their research caused positive benefits such as “often improving developmental functioning and decreasing maladaptive behaviors and symptom severity at the level of group analysis” (Rogers & Vismara, 2008, pp. 8 & 32). However, these interventions’ impact on independence, vocational, and social functioning in the adulthood life stage was unidentifiable.

Moreover, highly structured educational programs based on the Applied Behavior Analysis (ABA) are fundamental for early autism treatment (Lindgren & Doobay, 2011). According to Mesibov and Shea (2010), these structured programs encompass four essential mechanisms based on experimental support and they are: “(1) structuring the environment and activities in ways that are understandable to the individual, (2) using individuals’ relative strengths in visual skills and interest in visual details to supplement relatively weaker skills, (3) using individuals’ special interests to engage them in learning, and (4) supporting self-initiated use of meaningful communication” (p. 572). The mechanisms of these structured educational and teaching programs aim at facilitating the acquisition of skills, removing barriers to learning and improving functional skills and quality of life, unlike the “miracle” interventions (Lindgren & Doobay, 2011) that caused impractical expectations about treatment results and hindered the progress of identifying effective interventions for children and adolescents with ASD (Simpson, 2005).
Mesibov and Shea (2010) wrote that structured educational and teaching strategies are based on comprehensive principles of the “culture of Autism rather than a specific curriculum, manual, or set of intervention techniques” (p.576). Thus, they can be designed for “the ’concrete’ learners who communicate and learn best through the use of objects, pictures, and other tangible methods and for the ’abstract’ learners who find spoken and written language and other symbolic content meaningful” (Mesibov & Shea, 2010, p. 576). The success of these structured programs expanded into classrooms internationally (Mesibov & Shea, 2010). Such interventions in the ASD community, and especially early interventions, are noteworthy for the cognitive and social development improvements (Lindgren & Doobay, 2011). These interventions assist the learners in identifying behavioral challenges with specific emotions, feelings, thoughts, anger, and anxiety. They guide them to examine their own thoughts, evaluate their feelings, differentiate emotions, and acknowledge when they intensify.
CHAPTER 3

METHODOLOGY

“Like healthcare, education involves complex human interactions that can rarely be studied or explained in simple terms. Complex educational situations demand complex understanding; thus, the scope of educational research can be extended by the use of qualitative methods. Qualitative research can sometimes provide a better understanding of the nature of educational problems and thus add to insights into teaching and learning in a number of contexts.”

- Anderson (2010)

The Research Approach

The methodological approach taken in this study was a qualitative case study. The study agrees with Stake’s (1995) definition of an instrumental case study in that research provides an understanding of a particular issue. In this case, the motivation of learners with autism using the technology of a tablet device while partaking in a class mathematics activity. Additionally, the study purpose and problem statement agree with Yin’s (2003) conditions and Stake’s (1995) criteria supporting a single case study methodology.

Yin’s (2003) three conditions for selecting a research strategy; “(1) the type of research questions posed, (2) the extent of control an investigator has over actual behavioral events, and (3) the degree of focus on contemporary as opposed to historical events” (p.5) justify the case study choice as follows:

(1) The research questions that guided this study are “what?” and “how?” According to Yin (2003), “how” questions are “more explanatory and are likely to lead to the use of case studies, histories and/or experiments as the preferred research strategies” and “the “what” questions are a justifiable rationale for conducting an exploratory study” (p. 6).
However, any one of the five research strategies: experiment, survey, archival analysis, history, and case study described by Yin can be used.

(2) According to Yin (2003), the extent of control over behavioral events, the researcher must determine to what extent he or she can control the behavioral events associated with his or her study. In this study, the researcher had no control over the participants’ motivation, thus indicating the use of a case study methodology over other types of research methods.

(3) This study looked at current matters, thus an experimental, survey, or case study format would be appropriate. This study examined the use of current technology tools and their motivational impact on learners with autism in the classroom as a basis for research, suggesting the use of a case as the research methodology.

Stake’s (1995) three criteria for deciding if a case study design should be used were examined and supported the design choice. The three criteria are: “(1) Which cases are likely to maximize what is learned? (2) How easy is it to access research informants? (3) Carefully consider the uniqueness and context of alternative selections, for those may aid or restrict our learning” (p. 4). Each of the criteria was applicable to this study as follows:

(1) For the first criterion, the most appropriate way to maximize what is learned was to observe the participants’ reaction to completing the activity on the iPad and paper and observe their reaction in the classroom while using the provided technology tools such as the electronic white board, computers, and electronic games such as the Wii. Current and previous research on the motivations of children with autism using tablet devices show a
general increased motivation in daily living chores; however, it lacks specific data about the classroom environment.

(2) After receiving approval from the school district where the study was conducted, the executive director for the special services program of the school district read my proposal, and I explained the goal of the study and visited nine different classrooms at three different schools. The director then invited me to visit nine classrooms with learners on the autism spectrum. Thus, access to learners with autism was not restricted once approval was obtained from the school district and classroom teacher.

(3) The lack of association between certain classroom curriculum and the mathematics activity, the specific age criteria, and some learners’ severe autism behaviors observed during the school visit, resulted in purposeful sampling to determine the participants. I was aware that the information gained might add to current research or restrict what is learned from this study.

The Research Context

This study involved learners with autism between 5 and 12 years of age. The learners participated in a mathematics activity at a middle school located in the largest school district in a metropolitan area of a U.S. Midwestern state.

The school district is in one of the state’s largest cities that is in the eastern part of the state. The city began to grow economically in 1871 with the development of one of the nation's largest meat packing companies and is still considered to be the manufacturing capital of the state. Other major local industries soon followed. During this same period, many of the city's arts and educational institutions were formed. Private enterprise continued into the first half of the 20th century and this metropolitan area has become a
telecommunications hub and is one of the leading centers in the country for the defense electronics industry.

The school district is home to approximately 16,000 learners, 21 elementary schools, 6 middle schools, 3 comprehensive high schools, and an alternative high school. Of the nearly 16,000 learners, approximately 2,200 need some form of special education or special services. The school district provides a full continuum of quality educational services for learners with disabilities, including comprehensive services to help meet the academic, social, emotional, behavioral, adaptive, and physical needs of all learners with disabilities. Learners with low-incidence disabilities such as autism or hearing impairments are served in district-wide programs at selected schools. All programming provided for learners with special needs is consistent with the federal law, the Individuals with Disabilities Education Act (IDEA).

IDEA entitles every learner to a free and appropriate public education (FAPE) in the least restrictive environment (LRE). To ensure a FAPE, a team of professionals from the school district meet with the learner’s parents to identify the learner’s unique educational needs; to develop annual goals for the learner; and to determine needed accommodations, program modifications, testing accommodations, and other special services that the learner needs. These needs and the appropriate placement are recorded in an Individualized Educational Program (IEP).

The public school where the study was conducted serves approximately 180 learners in grades PK-5 with a learner: teacher ratio of 13:1, with students of color comprising nearly 30% of the learner body, and the majority of those being Hispanic or
Black. The school offers gifted and talented classes and special education programs in addition to standard statewide class curriculum.

Of the three classrooms I visited, the classroom I selected and where this study took place is one of the two special needs classrooms located on the second floor in the same wing of the school building. These two classrooms are designed for learners with behavioral symptoms and who are medically diagnosed with autism. One special education certified teacher leads the classroom and two paraprofessional educators assist throughout the day when instructed. Upon walking up the two flights of stairs, a colorful SUPERFLEX takes on the Unthinkables! poster (Figure 1) is hung in the hallway. The sign represents different behaviors in the form of fun-like caricature images to teach students how to act and behave toward others and also himself/herself feeling good.

Additional behavior signs are posted throughout the classroom. The common sign in all nine classes I visited in October 2014 was the "ZONES of Regulation" sign (Figure 2). This particular sign encompasses four colors (1) blue, (2) green, (3) yellow and (4) red. Each of these four colors represents different level of expressive feelings and behaviors. The colors are used as a communication tool to help the learners identify their feelings when they are in a state hindering them from being expressive verbally. Moreover, the teacher utilizes the sign in the classroom as an activity for the students to practice their behavioral reactions when presented with certain real-life scenarios. There are multiple forms of the "ZONES of Regulation" signs displayed throughout the classroom, two more of which are shown in Figures 3 and 4.
Figure 1. "SUPERFLEX takes on the Unthinkables" poster
Figure 2. One of the main “The ZONES of Regulation” posters in the classroom.
Figure 3. Another example of “the ZONES of Regulation” posters in the classroom.
Figure 4. One of the main “the ZONES of Regulation” posters in the classroom.

The classroom is divided into four sections. Section 1 is located toward the back of the room and serves as the main area for all the academic activities. In this same area, there is a large electronic whiteboard used for curriculum activities (see Figure 5), the learners personal work desks blocked separated from their peers with black walls (see Figures 6 and 7), and the teacher’s desk in the far corner with a stationary desktop that learners use at times.
Section 2 is at the main entrance and features a large board where curriculum flyers of the chapters and progress are posted (see Figures 8 and 9). This area is also dedicated to game time. Learners are provided with a large TV screen where they play Wii games during their ‘Free-Time’ and watch movies.

Section 3 is the large sensory room located across the main classroom door where learners spend time alone when they are unable to manage their social behavior such as frustration and anger. Lastly, section 4 is the play area found to the left hand side from the main entrance. A mid-size wooden table is provided with games such as Candy Land, LEGO®, and drawing activities. Due to confidentiality and privacy for all participants, pictures are not available for sections 3 and 4.

Figure 5. The electronic whiteboard.
Figure 6. Individual student's desk.

Figure 7. Black dividers between desks.
Figure 8. Grade levels 4 & 5 mathematics curriculum.

Figure 9. Grade levels 2 and 3 reading curriculum.
The Research Participants

Numerous emails were sent to multiple school districts. Due to lack of response, I modified the university’s Institutional Review Board (IRB) proposal to expand my school options. Upon receipt of the approval, an email with a brief introduction of this study along with the approved IRB proposal were sent to the executive director for special services program of the school district to recruit learners to participate for this study.

The executive director agreed to meet and scheduled visits on Monday, October 13, 2014, to nine different classrooms for children with autism at three different schools within the same district. The visit was academically and personally momentous. I met some of the most remarkable children who were thrilled to share their artwork, their awards from completed activities, and their sensory rooms. Three of the learners became very attached during our short visit, asking me to promise them a visit in the near future. One learner gave up his seat in the classroom and held my hand the entire time we were in the classroom. Following our heartwarming visit, I selected the top three classrooms to conduct the study and only one classroom teacher agreed to have his learners participate.

Five learners from this particular classroom at that school agreed to participate in the study. The participants consisted of six males, of which three were White and two were African American. Three were between 7 and 9 years of age and the other two were between 10 and 12 years of age. All participants have been diagnosed with autism.

Technology Used

The technology tablet device used in this study was Apple’s fourth generation iPad. The fourth generation iPad was released on October 23, 2012, maintained the
Retina Display feature as its predecessors; however, Apple upgraded its software to a fast and vibrant 32-bit of performance, improved the Lightning connector for cellular versions, and provided faster optional Wi-Fi (Warren, 2012). The average price for the fourth generation iPad ranges between $499 and $829 depending on the gigabyte data storage capacity and Wi-Fi feature.

The university’s Center for Technology in Learning and Teaching (CTLT) provided six fourth generation iPads for the study. The Instructional Support Specialist for the CTLT downloaded the paid version of Math-Drills that would allow the researchers and users to track the learners’ progress. These fourth generation iPads were the same as the students use in their classroom.

The mathematics educational application used in this study, Math-Drills app by Instant Interactive, is aligned with the Common Core Standards. It allows learners to master basic mathematics in the four operations – addition, subtraction, multiplication, or division - by practicing and monitoring their progress. The mathematics game begins with a fun traffic light on Mathematics Avenue, changing from red to yellow to green. Users may select from the four operations or “Mixed” from the menu. The settings menu gives a plethora of options to mix things up and keep kids motivated. It can be timed to track speed. Problems answered incorrectly and/or slowly will appear more often. Users can also choose Problem generation, Problem counts, Answers, Input, Themes, Arrangement (showing problems vertical or horizontal), Review assistants, Sounds, and Colors. There are two sets of scores: personal and hall of fame. Each learner has his or her own personal scores. The hall of fame contains the top scores amongst all learners.
Graphs are available to track growth over time, best times, and number of correct answers. Figure 10 illustrates major features of the app.

![Figure 10. Features from the Math-Drills app.](image)

**Data Collection Methods**

The main methods of data collection were physical observation of the participants completing the activities and of their typical classroom behavior, coordinating classroom activities over a two-day period, along with an in-depth, semi-structured interview with the classroom teacher (see Appendix F). I also talked with the learners and the teacher during the activities and captured their comments. These spontaneous interviews (with no pre-arranged appointment) resulted from conversations I had with the children as they completed the proposed activities. They wanted to let me know what they were feeling and experiencing while interacting with the activities on paper or on the iPad. Handwritten notes were taken during these impromptu talks. Observations were also made (see Appendix G). Observations represent "the process of learning through exposure to or involvement in the day-to-day or routine activities of participants in the researcher setting" (Schensul, Schensul, & LeCompte, 1999, p. 91). Their purpose is to enable the researchers to learn about the activities of the people under study in the natural
setting through observing and participating in those activities. It provides the context for development of sampling guidelines and interview guides (DeWalt & DeWalt, 2010).

The case study consisted of a Paper-based and Educational Application-based activity. The decision to choose an activity presented both on paper and on the tablet device was to observe any potential changes in the learners’ participation and motivation while conducting the activity. The Paper-based Activity (see Appendix H) took place on Friday December 5, 2014. The Educational Application-based Activity (see Appendix I) occurred on Monday December 8, 2014. The teacher requested to structure each of the 30-minute sections in 2-15 minute intervals, giving the learners a 5-minute break due to the short attentiveness they exhibit, a characteristic of children in the autism spectrum (Mirenda, 2001).

Prior to the data collection process, an Institutional Review Board approval to be in the classroom, have the learners participate in the activity, and to interview the classroom teacher was granted on July 17, 2014, by the university’s Institutional Review Board (Appendix A). A background check protocol on the researcher, requested by the IRB, was also conducted and approved by the university’s Office of Risk Management on August 25, 2014 (see Appendix B). The teacher’s consent form (Appendix C) was collected on November 21, 2014. Additionally, the parent and guardians consent forms (Appendix D) were signed and collected between November 21, 2014, and November 25, 2014, and the participants’ assent forms (Appendix E) were collected on December 5 before the activity began.

Zwiers' and Morrissette’s (1999) three considerations were applied during the collection process. “The first consideration must be for the well-being of children
involved. Ideally, the collection of research data will be at best positive and rewarding for the child participant, at worst innocuous and benign” (p. 136). In this study, only those participants who signed the assent form and were in the teacher’s classroom, who were willing to participate in the study were selected to participate. The entire study was explained to the learner in both verbal and written form before passing out the mathematics paper-based activity and the educational app on the iPad. Furthermore, the learners were informed that if he or she decided to participate in the study, but decided at any time during the activity to stop, all he or she had to do was tell the researcher.

The second consideration identified by Zwiers and Morrissette (1999) was the consent forms. Parents/guardians had to be informed as fully as possible about the study’s purpose, goals, necessity, method, possible outcome, goals of the research, and any possible negative or positive effects on their children. Prior to any data collection, I shared a detailed written Parental Consent Form (Appendix D) with the parents/guardians discussing the research goals, the need for the research, the activity’s process, and possible negative or positive effects on their child. Upon receiving their permission, I proceeded to schedule the activity dates where I disclosed the appropriate assent form to the learners, giving them the same explanation about the study and the decision regarding their willingness to participate in the study (Appendix E).

The third and final consideration identified by Zwiers and Morrissette (1999) was how the data will be used. “It will be the researcher’s responsibility to ensure confidentiality of the raw data and participant identity” (p. 140). In this study, the learners were identified only by the pseudonym. All forms and documents were kept in a locked drawer at work, and any electronic documents, such as the recorded interview
Data Analysis Methods

Basic qualitative description is not highly interpretive in the sense that a researcher consciously chooses to describe an event in terms of a conceptual, philosophical, or other highly abstract framework or system (Thorne, Reimer Kirkham, & MacDonald-Emes, 1997). The description in qualitative descriptive studies entails the presentation of the facts of the case in everyday language. In this case, the qualitative information was obtained during the school visits, observations, and the interview with the classroom teacher, then characterized and analyzed using the Interpretive Descriptive qualitative research analysis method (Thorne et al., 1997).

Thorne et al. (1997) developed Interpretive Descriptive (ID) as a non-categorical methodological approach to developing clinical understanding (Hunt, 2009). The ID model dates back to the “nineteenth century to Dilthey’s philosophy, Weberian sociology, and George Herbert Mead’s social psychology” (Holloway & Wheeler, 2013, p. 25). This research methodology “focuses on the way humans make sense of their subjective reality, attach meaning to it and on their experiences being as important as focusing on explanation, prediction and control” (Berg & Lune, 2004, p. 327). It examines a phenomenon with the goal of identifying themes and patterns among subjective perspectives, while also accounting for variations between individuals.

In this case study, the Interpretive Descriptive model is used to analyze the data collected. For example, while examining the learners’ use of the tablet device outside of their classroom routine, a change in their behaviors was evident. Its usage did not align
with their perception of what it is typically used for in the classroom, resulting in a readjustment to a different routine on a short notice. The readjustment led to challenges, rejection, uncontrollable behaviors, lack of interest, focus, and motivation from some learners. Such observations were the basis for the themes described in the Discussion and Summary of the Major Findings section of the Summary & Conclusions chapter.

“Credibility, neutrality or conformability, consistency or dependability and applicability or transferability are essential criterion for quality paradigms” (Lincoln & Guba, 1985, p. 300). One way that reliability and validity are established in a qualitative study is by using Yin’s (2003) three principles of data collection. These principles “deal with the problems of establishing construct validity and reliability; (1) Use of multiple sources of data, (2) Creation of a case study database, and, (3) Maintain[ing] a chain of evidence” (pp. 97-105).

In this study, reliability and validity were addressed through descriptive observations, member-checking, and established techniques of qualitative data analysis. The teacher’s recorded interview, observations of the learners while completing the activity, and classroom visits along with impromptu conversations with the children, suggested by Yin’s (2003) three principles.

The principles were followed in the subsequent ways:

1. The parent or guardian completed, signed, and returned the informed consent form before meeting the participants.
2. The learners, depending on their age, printed and/or signed the assent form prior to start of the activity.
3. The teacher signed the consent form and agreed to conduct the interview.
4. The interview was audiotaped using the iTalk application on my password-protected smartphone and transferred to my password-protected encrypted laptop.

5. Notes were taken on the Observational Protocol form while learners were participating and during the impromptu conversations that occurred while observing the learners.

6. The paper activity forms, consent/assent forms, interview notes, and observational protocol forms were placed in a sealed envelope upon leaving the school premise and are being kept in a locked filing cabinet at the researcher’s work space.

7. The interview and notes transcriptions were coded and categorized for analysis.

8. The chain of evidence regarding the outcome of this study is made available to any researcher with similar research issues so that they can trace the process in its entirety.

Ethical Considerations

It is the university's policy that when research involves human subjects, a comprehensive review of the research design must be completed, reviewed, and approved prior to the start of the data collection process. The purpose of the IRB is to ensure that the risk to human subjects is minimal and that an explanation of the study’s risks and benefits is thoroughly explained to each participant. Included in the IRB Application and Approval was a detailed explanation of the proposed study, the original IRB Approval
letter, the modification, copies of the assent and consent forms, and the observational protocol (see Appendix G).

The extensive IRB approval process began on May 4, 2014 and was finalized on October 22, 2014. Due to my limited knowledge of autism and academic and professional special education, the departmental Director of Graduate Education (herself an expert on Special Education) methodically helped throughout the steps of the proposal. The process involved two full IRB committee board reviews and numerous electronic and in-person meetings with the IRB representatives, along with two modifications to expand my outreach to more schools to conduct the study.

Researcher’s Positionality Statement

This statement was created in order to understand how my cultural background and experiences have influenced my perceptions of education and technology, my view of children with special needs, my research interests, and my choice of methodology.

Growing up in a volatile country, Lebanon, that not only has known much turmoil through decades, including a seventeen-year civil war, but also where children with special needs are underserviced and undereducated, led me to explore my passion in this case study exploring the impact today’s technology has on motivating the children with autism in the classroom. Moreover, my 12 years of training, coaching, and managing a diverse group of individuals with different backgrounds, ability-levels, and academic levels in the banking and finance industry made me realize my passion to help others learn.

All children should have opportunities to experience success. I believe that helping children acquire academic information is only a small part of education. Since
education is life preparation, all children, regardless of their ability level, ought to gain daily living skills and have the same academic opportunities. While standardized test scores may indicate acquisition of certain skills, test scores alone cannot and should not be used to define educational success. Through school experiences, children learn to be responsible, make decisions, solve problems, interact with others, and express themselves creatively.

I believe that all children--regardless of race, gender, socioeconomic class, or ability level--should have the opportunity to attend school and receive formal education. Every individual should receive an education focused on increasing independence, acquiring life skills needed for the future, and improving overall quality of life. Most importantly, it should be remembered that all children should be accepted for who they are. All have special gifts, and it is crucial for the educator to recognize these individual strengths and abilities.

I believe that all children are capable of learning. Learning is the gaining of additional knowledge or the acquisition of a new skill. It can involve changing or replacing a behavior. Children should be exposed to learning materials in a variety of ways as it is possible now with the rapid increase in technology advancements. There are visual, auditory, tactile, and kinesthetic learners. Many individuals learn using a combination of these learning styles. It is the responsibility of the educator to experiment with different teaching methods and use those that are most effective.

Whoever works with a special needs child has the responsibility to identify those gifts, since they often go unnoticed. People often focus on the deficiencies of special needs children, but I feel more attention should be focused on their gifts. I am conscious
of individuals’ ability-levels and of the need to provide them with the tools and services they need as individuals to succeed academically and in society. After all, every child is part of a community and should be given the opportunity to participate in the same projects and events as every other community member, regardless of any physical or mental limitations they may have. As an advocate, understanding diversity is an important skill not only in the classroom, but also as a member of a community and a citizen of the world.

The combination of my cultural background, my strong beliefs in the overlooked gifts that children with special needs possess, and my passion for coaching and training that I gained from my professional experiences have instilled in me the desire to help others and make a difference in the life of others, especially the lives of gifted children. I believe integration is a fundamental right of all children, especially students with learning disabilities. Achieving such integration is possible with the planning and the use of available resources.
CHAPTER 4.

FINDINGS

“One of the principal objects of theoretical research in my department of knowledge is to find the point of view from which the subject appears in its greatest simplicity.”

- Willard Gibbs (1839 - 1903)

The purpose of Chapter 4 is to present the discoveries made during the observations and interview with the teacher and to attempt to address the research questions previously stated. Moreover, it is to potentially gain more awareness into the motivational impact that technology devices can have on learners on the autism spectrum related to engagement and participation in learning activities.

The chapter is organized in four sections: The Context Revisited, Day 1: Paper-based Activity Day, Day 2: Educational Application-based Activity Day, and Interview Day: Teacher’s Insights. Comprehensive and descriptive observations of the learners’ behaviors and responses to the activity are characterized and analyzed in individual profiles and presented in the Day 1: Paper-based Activity Day and Day 2: Educational Application-based Activity Day sections below, preceded by a description of the context and participants' profiles. The interview with the classroom teacher is transcribed in the Interview Day: Teacher’s Insights section.

The Context Revisited

The study was completed on Friday December 8, 2014 and initiated on October 13, 2014 with the first in-person meeting with the executive director of the school district for special services program. In addition, the researcher had three more in-person meetings on October 28, 2014, November 10, 2014, and November 17, 2014 to get all the
necessary permissions from the school and establish rapport with the study participants.

The interview with the classroom teacher was held on Friday December 5, 2014 during the assigned teacher preparation time. Prior to the beginning of the observations and interview, an explanation of the study was given in both verbal and written form to each of the study participants. All questions and concerns were addressed, and the participants and researcher signed the informed consent and assent documents.

Due to ethical and confidentiality considerations when conducting a study involving children, each learner was assigned a pseudonym. The pseudonyms are coded as follows: Abel, Mark, Rick, Joel, and Patrick. Table 8 presents the basic demographic of the participants. Also, any school name and teacher name were omitted and identified as school and teacher, respectively; so that the utmost care was given to maintain the confidentiality of all involved.

**Table 8. Participants’ Basic Demographic Information**

<table>
<thead>
<tr>
<th>Pseudonyms</th>
<th>Race</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abel</td>
<td>African-American</td>
<td>10</td>
</tr>
<tr>
<td>Mark</td>
<td>African-American</td>
<td>8</td>
</tr>
<tr>
<td>Rick</td>
<td>White</td>
<td>8</td>
</tr>
<tr>
<td>Joel</td>
<td>White</td>
<td>11</td>
</tr>
<tr>
<td>Patrick</td>
<td>White</td>
<td>9</td>
</tr>
</tbody>
</table>

The study sample was five male learners with autism. The learners, who are on the autism spectrum, ranged between 7 and 12 years of age and between grade levels 2 through 6 academically. The ethnic makeup of the sample included White and African-American.
A typical school day begins at 8:50 a.m. and ends at 3:35 p.m., with a 25-minute recess time and a 20-minute lunch period. Every learner in this classroom has three social skills goals to achieve and they are: following directions, positive peer interaction, and reduced incidents of aggression. These goals are tracked daily, using an individualized form hung on a clipboard accessible by the teacher, paraprofessionals, and learners. The forms list the daily class schedule and the learners’ individualized point goal sheet (see Figure 11). These forms are completed daily before school dismissal and used as an evaluation tool of the child's academic and social behavioral skills improvements for the teacher and parents/guardians.

Figure 11. Learners’ individualized point goal sheet.
The learners are assigned a different set of structured activities based on the general education curriculum. Activities such as reading, mathematics, writing, social studies/sciences, and social skills are mandatory for all learners, however tailored to each learner's grade level. Community circle group, specials, and computer projects are activities that are modified based on individual needs. Learners are rewarded with "free-time" when completing assignments and achieving goals. Due to the nature of this study, the teacher willingly rearranged the activities on both days to accommodate my research needs.

The Participants’ Profiles Revisited

Abel is a ten-year-old African American male. He is the only learner in the classroom who abides by the schedule and craves structure. Any change to the daily schedule upsets and agitates him and can trigger uncontrollable crying, moaning, and trudging around. For instance, modifying the schedule for the study made him feel perturbed the entire day. Having me around him made him even more uncomfortable. Any questions he had for me regarding the activity and my presence in the classroom were directed toward the teacher. Moreover, attempting to make eye contact with me at any time the teacher asked him to, made him tense and caused him to walk away toward his desk, considered his comfortable, personal space.

Mark is an eight-year-old African American male with a two to three year old maturity level as described by the teacher. He recently joined this classroom following his autism diagnostic. Mark excels at reading and craves attention just as any two- to three-year-old child. His smile brightens up an entire room as long as he is within his own element. Being newly diagnosed and new to the program, the ability to control his
behaviors is still at early stages. Therefore, an outbreak in uncontrollable behaviors can last up to two hours. According to the teacher, he has shown some small improvements in the two months he has been in his class and has confidence he will continue progressing as he learns new skills.

Rick is an eight-year-old White male who is the quietest of all. He does as he is told, he speaks only when spoken to, and he is expressive through his drawings. He enjoys conversations especially those that involve his artwork; however, he avoids eye contact. Rick is extremely bright in analytical subjects such as mathematics and aspires to become an engineer just like his father. His main social skill goal that he is aiming to achieve is overcoming the desire to always be alone and learn to participate in a group setting. For example, during their 5-minute break period, the teacher called him over to join in playing the Wii bowling game to steer him away from being alone. He was very quiet while playing, lacked motivation to play, and did not express any type of emotions when winning and losing, unlike some other kids. When asked if this is typical of this learner, the teacher said, “it is for him and in fact his goal is to learn to express those feelings. He has improved but needs more work to express his feelings. He is now spending the majority of his day in general education classes with a paraprofessional and only participates in the afternoon in this particular classroom, to continue improving his social skills after a full year working on building his social skills.”

Joel is an eleven-year-old White male who improved the most in the shortest amount of time. Upon joining this teacher’s classroom, his literacy level improved by two grade levels, and his social skills developed at a higher rate, compared to the rest of the learners in the classroom and given the time he has been at this school. He successfully
surpassed his behavioral testing skills and can now attend general education classes for the majority of the subjects without being accompanied by a paraprofessional. Joel was eager to have a conversation with me while I was observing. He was overly excited to tell me about his childhood, his family, his aspirations, and the difference between high school and college.

Joel also shared many personal stories; however due to confidentiality, I can only release only parts of the conversation. According to him, “I wish I have a brother or a sister to teach me how to be normal and to feel what is normal… You know I just don’t want to be different. I want to be like all the kids downstairs [general education classrooms] … I want to be like my dad. I want to be strong like him… Sometimes I do bad things but I don’t know what I’m doing until I talk about it or after I come out of the sensory room. I can’t help it. I’m better now and my mom tells me I am. I want her to be proud.” Joel was diagnosed at a very young age with autism and his parents have been seeking medical and therapeutic treatments, which have been beneficial to the improvement of his social behaviors.

Patrick is a nine-year-old White male whose behaviors are somewhat similar to Rick. He is very focused on being the top learner and excels in mathematics. He can carry a conversation as long as others initiate the conversation and it relates to something he is passionate to share. He’s working on the eye contact social skill characteristic; however, he has more work to do to reach that goal. He is only in this particular classroom for mathematics and social skills due to his uncontrollable behavior when participating, which is disturbing to learners in the general education classrooms. His excitement for mathematics and anything he is extremely passionate about, such as electronics, make
him exceptionally anxious, leading him to act out intensely and unconsciously. He enjoys playing with the LEGO® set. According to him when asked why he enjoys playing with the LEGO®, he said “it makes me think just like an engineer, which is what I want to be when I grow up and finish college."

Day 1: Paper-based Activity Day

Friday December 5, 2014 marked the first day of the study that consisted of the paper mathematics activity. Upon arrival and signing in at the school’s main office at 12:00 p.m., I was directed to go to the second floor where I was greeted by one of the learners from that classroom where the study took place. Due to the greeter’s schedule, appointments, and missing signature on the parental consent form, he was unable to participate on either day. However, it was interesting to note his greeting gestures to an unfamiliar face, as it is a major improvement in his social behavioral skill step that he has been working on for three years. His ultimate goal, that he aims to achieve by the end of the school year before moving on to middle school, is to acknowledge people, identify his feelings, and calm down without adult support when encountering frustration, challenges, or independent tasks, as shown on his form (see Figure 12). Due to his specific goal, his daily goal sheet differs from that of the other learners in the classroom.

At the time of my arrival, the learners were scattered throughout the noisy classroom, working on their assigned Specials activities. Abel was watching movie trailers on his laptop at his desk; Mark was at the teacher’s desk using the desktop to practice some additional addition and subtraction mathematics problems; Rick was reading leisure books, Joel was playing with the LEGO® set while Patrick was away
participating in the general education Social Studies class. They were all occupied with their activities while I was conducting my observations of their interactions.

**Figure 12.** Learners’ individualized form, based on feelings goal.
Shortly after settling in, Mark began shouting while working alone at the teacher’s desk on the mathematics activity assigned by the teacher. Following several failed attempts to calm him, the teacher directed him to the sensory room. As a rule, learners ought to spend time in the sensory room to calm their uncontrollable behaviors if they worsen. The sensory room is a large room painted in a lavender soothing color, with a rocking chair, large inflatable yoga ball, a small size swing, a small round tub designed for water use only, and a turtle shaped tub with a flat bottom covered with a lid allowing the children who need isolation time in a covered safe space to hide inside of it. They may use any of the room features such as the water tub, the swing, the rocking chair, or the inflatable ball to help them ease the tension and alleviate their anxieties. For example, Mark, who spent 90 minutes bellowing in the sensory room, used the inflatable ball to toss it and kick it against the wall before moving to the rocking chair where he sat in a fetal position rocking himself. Once he managed to calm his anxieties, he came out, smiling and tranquil. He met with the teacher by a *Zones of Regulation* poster (see Figures 4, 5, & 6) to discuss his behavior and the steps to follow to regulate his behavior before he went back to his activity.

When asked if this behavior is typical and recurring, the teacher stated, “*You just never know when it’s going to happen and what’s going to stop it. In this room, we go from happy to uncontrollably upset. All the learners in this room went through this stage and they’ve all improved. He joined us couple of months ago and is still at a maturity level of a two to three years old. He has some work to do and he will get eventually to his goal of controlling his behavior.*” Surprisingly, while the commotion was taking place and distracting me personally during my observation, the other learners carried on with
their own activities, uninterrupted. Abel had a large headset on and was listening and watching movie trailers. Watching movie trailers, and in particular action movie trailers such as Transformers, allowed him to better express his feelings.

As we were approaching the 2:00 p.m. scheduled time to conduct the paper-based activity of the study, the teacher had them gather around the carpet area by the whiteboard where they all typically meet when working in one big group. While they were in a group, I verbally explained the purpose of my visit, presented the activity, and read the assent form. The learners agreed to participate and signed the form. They were all excited especially when they found out it is all mathematics, their favorite subject. The teacher stressed to them that this activity is not graded and they should work on as many problems as they could.

I passed around the paper version, featuring addition, subtraction, division, and multiplication topics, ranging from single to four digit problems (along with supplemental charts and tables for each topic should the assistance is needed). As the teacher recommended, the activity was set for 30 minutes divided into two 15-minute sections, as they typically do with all their daily activities. Their attention span is minimal, thus anything exceeding 15 minutes will result in intense behaviors and loss of interest and motivation. Upon receiving their activity mathematics sheets, they were all dismissed to their desks and began working. Learners’ behaviors and their responses to the activity are described in detail as individual profiles.

**Abel**

Abel, a ten-year-old African American male, situated himself at his desk located to the right side of the whiteboard facing the wall. He was very immersed in the activity
and was the first one to complete the first 40 problems during the first 15-minute section. Upon signaling break-time, he became nervous and upset. He started humming and shouting, “I lose,” “I’m a loser,” “I’m not done with the homework. I can’t leave because there’s a lot and I don’t want to get a bad grade.” As I walked up to him to explain the activity is not graded to help calm him, he became more upset and walked away from me in search of the teacher. The teacher intervened and reassured him he was not grading them. The teacher shared “This activity is outside of Abel’s element. Typically, activities have fewer problems than this particular activity and the learners can complete the majority if not all of the problems within the first 10 to 15 minutes of the allotted time.” Abel sat back at his desk, and put on his headphones, and watched a short movie trailer.

Break time was over, and it was time to get back to the activity. Abel had lost his focus and motivation by then. He started wrestling with the easiest problems, such as ‘4+12’, that he had no issues with during the first part of the allotted time. He became too frazzled to reason, resulting in jumping and droning. He then proceeded to the Zones of Regulation and pointed to the ‘Do your Best’ statement on the Green Zone Tools on the poster (see Figure 4). A few minutes later, he returned to his desk, grabbed his pencil and began solving the problems again. He regained his motivation and solved all but 10 problems in the last few minutes he had remaining.

I asked for his feedback afterwards and he replied, “I didn’t like it because it was too long and I got a bad score on it because I didn’t finish it.” He had become accustomed for over a year to having every worksheet activity evaluated on the point sheet, even though the teacher and I emphasized that they would be rewarded with free
playtime instead of points, regardless of how many he solves. The fact that we referred to it as ‘activity’ made it difficult for him to accept that it was not being evaluated.

**Mark**

Mark, an eight-year-old African American male, had just calmed down after spending 90 minutes in the sensory room. He was excited and ready to show me how good he is in addition and subtraction, which he shared with the class while I was explaining the activity. He chose to sit at the big wooden table across from the whiteboard but near the teacher. Upon handing him the activity, he flipped through the pages, skipped over the addition and subtraction problems, and placed all his energy on the multiplication and division problems stating, “I don’t know how to do those. I can’t do any of them.” He became overwhelmed, requiring the teacher’s constant attention. The teacher incessantly reminded him of his progress within the two months since he had joined the classroom, as a means to encourage him to try. The teacher suggested crossing off the multiplication and division problems and try to solve what he has learned recently. He seemed more at ease with that suggestion for as long as the teacher was beside him.

The moment the teacher walked away, the same behavior would reoccur.

To determine if he was simply seeking attention because of the delay of his maturity development or if he was lacking confidence in applying what he had learned, I decided to intervene. I asked him to show me how to solve one of the simple addition problems, and sure enough, he was excited to show me and did it. The moment I walked away to observe the other learners, his behavior resurfaced and would only stop if the teacher or I stood beside him and complimented him with encouraging words such as “Good job!” “Keep up the great work!” “Show me how you count on your fingers” and
“You can do it.” During the second 15-minute activity time, he decided to stop the activity and walk beside me “to make sure the other kids are doing their work” as he stated. The motivation was extinct and the desire for attention was evident.

**Rick**

Rick, an eight-year-old White male, seemed indifferent about the activity. He grabbed the handouts and headed to his desk that was adjacent to the teacher. He was quietly immersed in the activity and remained in the same position until the teacher called break-time. While working on the problems, he went through them in order and by row. He only proceeded to the next problem if he solved the previous problem. He was instructed to walk away from his desk and play with his classmates. Rather, he went to the playroom area where he sat alone at the far end and began drawing and coloring sea creatures. When asked the reason he chose to draw and color sea creatures, he said, “*I love swimming and the water is nice and quiet... and also because nobody asks these sea animals why they’re quiet and if they’re ok... You know like nobody bothers them.*” I continued my conversation as he was being responsive and asked if he has any pets at home and not only did he say he does, but he proceeded to tell me the following, “*I have a puppy and a kitten that my parents got me to play with... I like the kitten because she sits on my lap and that’s it... the puppy is cute but he’s not quiet and I don’t like that.*”

While we were chatting, he carried on with his drawing and coloring and not once did he make an eye contact with me. The verbal interruption did not interfere with his concentration, as it is his artwork that allows him to be expressive.

As we regrouped to begin the second 15-minute section, he went back to his desk. Three minutes into it and he rested his head on the desk. His motivation to do the activity
slowly began to drift away as I watched him omit even the simple addition and subtraction problems that were in no particular order. During the first section, he managed to complete 49 problems while he only did 5 problems during the second section. As we were encouraging him to continue trying, he became aggravated and the feel of tension was evident by his body language. He began taking a few deep breaths as taught during their Social Skills section and suggested by the Zones of Regulation in an attempt to control his behavior.

Joel

Joel, an eleven-year-old White male, who was talkative before starting the activity suddenly became quiet upon receiving the handouts. He moved to his desk that was set across from the whiteboard with his back towards it as displayed in Figures 7 and 8. Joel was anxious, focused, and working diligently on the problems. Some of the problems presented were for one grade level higher than his. Thus, at any time he successfully solved those problems, he would look around for me, smile upon making eye contact, and quietly hum, “I did it.”

During the quick 5-minute break, his agitation changed to exasperation and uncontrollable gesture behaviors. Joel was so full of excitement, frustration, and tension while working on the activity that it surfaced as he walked away from it. He was directed to the sensory room for approximately 10 minutes to calm down. When asked what happened to that smile after he joined us he said, “I stopped and now I can’t think of where to start again. I never go on break before finishing my homework. This is different from what we do every day.” He then stared directly at my eyes for few short seconds and asked, “Do you still think I’m smart?” After reassuring him of his intelligence, he carried
on with the activity and completed a total of 72 problems, the most out of the five participants.

**Patrick**

Patrick, a nine-year-old White male, was full of confidence in his ability to complete all five pages without referring to any tables and charts. He sat at his desk that was adjacent to that of Joel and worked as instructed. He seemed motivated by his confidence while working at quickly solving the problems - to beat the other four participants during the first 15 minutes. However, that level of motivation and confidence dropped within six minutes after the 5-minute break.

His level of concentration on the multiplication and addition signs plummeted, resulting in frustration, with him pounding on the table, panting heavily, and moving around his desk area. The teacher approached him, and as an attempt to calm him down, he asked him what was frustrating him. Patrick stated, “I can’t do this but I don’t know why I can’t. No, no, no, I can do these, right Mr. Teacher? This is a plus sign so I just need to add the numbers but why do I keep multiplying?” The teacher and the learner talked through the steps, and he got back on track. While he was expressing his frustration, he avoided eye contact until the teacher instructed him “Look at me, take a deep breath, and talk through it with me how you would solve it on the whiteboard.” He ended with 68 completed problems in 21 minutes.

**Observations Recap**

The 30-minute schedule time slot ended and the learners were instructed to accompany the paraprofessionals for their surprise reward, as promised earlier. The learners went outside while I stayed with the teacher to begin the interview.
return, they completed their daily goal sheets, gathered their belongings, grabbed their jackets and backpacks, and lined up, waiting for the dismissal school bell. As they were waiting in line, Mark kept staring at me for a while then proceeded to say, “I will see you on Monday, ok, now promise me that you are coming back to see me.” Joel came back up to me, asked about my Christmas gift wish list, and shared his. As he was walking toward the staircase to leave, he looked back, smiled, and waved at me. The teacher shared that these gestures, especially from Joel, are extremely rare toward an unfamiliar person. We carried on with the interview featured in the "Interview Day: Teacher’s Insights" section of this chapter.

Day 2: Educational Application-based Activity Day

I walked in at 1:00 p.m. on Monday December 8, 2014, carrying a large black tablet device case protector that caught the attention of Mark. He ran over to the door and shouted, “Oh you came just like you promised. I knew it, I was right.” He then looked at the bag and as he was examining it by pulling on the zipper he asked, “are these the cool iPads from your school that we are going to play with today?” The teacher called him back as Abel, Rick, and Joel were finishing up the social skills activity, Ryuu - The Game®, Using a Fantasy World of Dragons to Build Social Skills in Humans, while Patrick was in the general education Social Studies classroom. Mark was extremely thrilled, so that it was becoming difficult for him to contain himself and focus on the game.

Ryuu – The Game® (Figure 13) is a collection of social skills card games and learning activities that teach communication skills by combining fantasy worlds, card collecting, and role-play, inspired by Yu-Gi-Oh! and Pokémon®. It teaches social and
emotional skills to children and teens with autism, Asperger Syndrome, and other autism spectrum disorders. The games follow six Dragons as they evolve from “Bablings” to “Big Wings” in four stages, becoming more socially skilled with every evolution. (Ryuū – The Game®, n.d.).

Learners were taking turns drawing cards and reading them aloud to their classmates. Their task was to think about which dragon they are like. How can the dragons evolve as they learn social skills? Which invisible Forces will help them or hinder them? Learners Abel, Mark, and Rick struggled while expressing their emotions and articulating what they would do in the situation presented on the cards. Joel portrayed more knowledge and confidence in the ways he would handle the situations. After they finished playing, the teacher awarded them 15 minutes of free playtime of their choice to help lessen their fretfulness from the social skills game. Learners Abel and Rick played the Wii bowling game while Mark had me watch him build different shapes with the LEGO® set. Rick, who is very quiet, had difficulties with hand coordination and concentration on the ball and the pins while playing. The teacher joined them and had
Rick follow his movement steps. After several attempts, he made small progress with his aim and arm movement. Once again, eye contact with the teacher was non-existent while playing. He was only nodding his head while looking down or at the TV.

Two p.m. came and it was time to start the Math-Drills mathematics activity on the iPad (see Figure 14 & 15). It features basic mathematics in the four operations of addition, subtraction, multiplication, or division, and allows the learners to practice and monitor their progress. The app provides numerous features to customize the drill set for a learner, including the number of problems, arrangement of the problems, and more. It tracks and gathers scores on user drills and tests. It provides "reviews" assistance, including block manipulative, a number line, and a facts chart. The app is a self-contained system for generating a huge range of mathematics drills and keeping track of the results for multiple children.

Figure 14. Second set of features from the Math-Drills app.
The learners gathered and formed a circle on the carpet by the Whiteboard. The excitement upon seeing the iPads and knowing that each is personalized with their names was apparent. The following expressions were coming from every direction and they were, “This is so cool”; “Oh look - they have so many apps, it’s more fun than ours, Mr. Teacher”; “We get to play with the iPad two times today”; “Can we play with the other games when we are done? ”; “This is just like mine at home and I love it”; “My mom promised Santa will get me one this year for Christmas.”

After I provided them with the instructions on how to use the iPad and we did a practice problem together, the teacher asked them to head back to their desks to work on the activity. They did not and chose to remain seated on the carpet, immersed in the activity. When I inquired about their reaction to his command, the teacher stated, “iPad is not mandatory in the class and it is used more for leisure and extra fun activities just like the laptop. So whenever they use the iPads, they sit in their ‘fun’ zone where they gather
when they play LEGO® or read books for fun.” Therefore, the learners did not perceive this activity to be the same as the Paper-based Activity. It was perceived more of a “fun” activity without the stigma that is attached to handouts. They raised some concerns about grades and doing well. We proceeded with the 100 problems, 30-minute activity, divided in two 15-minute sections, with a 5-minute break in between. Each of the learners’ behaviors and responses to the activity are presented in individual profiles.

Abel

Abel is habituated to strict structure, according to the teacher during the impromptu conversations. Thus, using an iPad for a second time in one day after he used one earlier for his reading assignment made him tense and reluctant to participate. As stated in the assent form and explained verbally, he has the option to stop at any time, and he did. He left the group and went to his desk. As he was watching a movie trailer, he called me over and asked if he could join again. When asked the reason he changed his mind, he said with an anxious and quivering voice, “I need to do this because I didn’t do good on the first test you gave us the other day. I need to show the teacher that I can make my goal. My mom has to know that I made my goal so Santa can bring me an iPad for Christmas and maybe this is easier because it’s on the iPad.”

He joined the group again and began working on the activity. He seemed more at ease working on the problems. There was still the sense of anxiousness, while he was counting on his fingers and watching the clock. While on break, he did not participate in any games, but rather he went the sensory room where he rested on the floor quietly. He returned from break and was more focused than during the first section. He managed to
complete 72 out of 100 assigned problems, 26 more problems than the paper-based activity. When asked how he felt about his accomplishment, he shared:

*I didn’t finish all the problems but I think I did good, yeah I did. I mean the teacher said this is hard and he wouldn’t have been able to finish it, too. But you know those little boxes that came on the screen to help us when we got stuck, yeah, those are fun and I like them more than the tables you gave us the other day and the tables the teacher gives us sometimes. So I think I can really use one at home so Santa should really bring me one. Can you talk to Santa with the teacher? You are just like Mr. Teacher and Santa would listen to you.*

He was smiling and more relaxed. He even volunteered to help me pack up the iPads in the protective case after everyone was done.

I inquired about Abel’s behaviors, the teacher said, “I’m surprised he approached you to ask if he can participate again. Normally this is something that he would come and ask me but maybe because he knew you brought the iPads. He also has a motive and anytime you give any of these kids something to work for like free playtime or like an iPad from Santa, in his case [an external motivational factor from his family to encourage him to do well academically], they will accomplish more and that’s what he did here. He’s also very visual so having the ‘Assistant’ feature in this activity pop on the screen unexpectedly is similar to his movie trailers when a scene occurs unexpectedly, taking his imagination to a different place, which relaxes him and helps him achieve more.” The teacher added, “Just so you know, he’s been anxious ever since I told them we are going to change the schedule a little when you come. He’s been anticipating your
Mark

Mark was ecstatic, all smiles, and beyond immersed in the activity. According to the teacher, he has his own iPad at home that he uses daily for everything ranging from morning daily chores to bedtime stories. His passion for getting attention was just as strong as it was on the first day. He was beaming with joy. He had me kneel by him the majority of the first section to show me how good he is counting. I felt like he was yearning to hear the encouraging statements such as “Good job,” “Way to go,” “You can do it,” and “Show me how many more you can do.”

Mark had just started learning basic multiplication but had not learned multiplication and division. Thus, I had him only work addition and subtraction problems. Upon realizing his activity was different after looking over his classmates’ iPads, he asked to change it. We changed the settings in the middle of the activity to add multiplication only, and sure enough, he solved problems he had not done in class yet. The problems he had complained about on Day 1 and continuously moaned that he could not do them, he solved on his own while using the iPad. The teacher was amazed and the learner was elated. He shouted, “I’m smart.” He kept telling his classmates how smart he was and how he did not have any incorrect problems, based on the tracker provided on the screen. However after the 5-minute break, he lost his enthusiasm and motivation to continue with the activity. He closed out of the Math-Drills app and selected the Disney literacy app that highlights the words as they are being read by a voice-over. Mark enjoys reading the most and reads at a grade level higher. This app was new for him and was
greatly enjoying it, however he used up his energy on the activity, so that his attention span was very brief. He closed out of it within 5 minutes and began chatting with the paraprofessionals. His maturity level of a 3 year old, as identified during the impromptu conversation with the teacher, triggers him to create unannounced excuses. The repetitive excuse was, “I’m bored,” which according to the teacher is a typical reaction after having to do the same activity for longer than 15 minutes.

Rick

Rick was just as indifferent about this activity as he was on Day 1. He grabbed the iPad and sat in the same position the entire first section with his legs crossed, one hand on his cheek and the other on the iPad. Mark’s constant chatting did not disturb him at all. When asked if he needed assistance with the iPad, he moved his head sideways indicating he did not need help, while staring at the iPad. As we were approaching break-time, the loss of focus and motivation were apparent as it was taking him longer to solve the easy problems. After break, he began solving at a slower rate and was making more errors. He even began skipping some problems. As we were approaching the end of the second section, he set the iPad next to him and started watching Patrick as he was approaching the 100th problem. Rick managed to complete 48 out of 100 problems.

Rick’s attention span was shorter than that of Day 1. When I asked the teacher about the learner’s behavior, he said, “Rick tends to rest his head on his desk when doing activities and with the sitting position he was in, he didn’t get to take that mental break he usually takes. He was given the choice to go to his desk, but once again he probably perceived the iPad as a fun, non-graded activity, unlike the paper that usually indicates to them they’re being graded to determine their goal achievement level.”
Joel

Joel was just as happy as Mark to see me. He was excited for the activity and anxious to begin. While distributing the iPads, he told me, “iPad is favorite my technology (sic.) to use for everything and I take it everywhere I go, especially when we go visit my cousins who live far away. My cousins have their own iPads and we always play together. It’s fun.” When asked the reason it’s his favorite technology, he said, “It’s so fun. I use it to play, to read, and it helps me learn new things everyday like just the other day when I learned how to make my bed and my mom was very happy. You should get one too, it will help you do your homework and I can show you the fun games to play.”

Joel was fast at solving the problems and even attempted to solve successfully the more difficult division problems. He completed 67 problems out of 100 by the end of the first section without relying on the "Assistance" feature. He would look up to the ceiling, mumble the numbers to himself, and then pretend to write the numbers on the carpet as he would do typically on the paper before selecting the correct answers. Upon announcing break-time, he asked if he could continue working; however, we denied the request to ensure all participants were given the same experience. He sat in the same position anxiously waiting for the start of the second section.

During the second section following the 5-minute break, he continued working diligently, however within the first 8 minutes, he lost focus, interest, and motivation. Joel began skipping, as Rick did, and completed a total of 8 problems. He appeared to be mentally exhausted and looked drained. He asked if he has to complete all the problems to get the free playtime reward afterwards and the teacher intervened to prevent any
uncontrollable behavior from occurring by telling him, “*Do as much as you can and only what you know. You’re doing great and you are getting the free playtime.*” Suddenly, his eyes lit up and decided to do two more problems. He regained his focus and did more than just two problems. He completed an additional seven problems leading to a total 82 problems out of 100.

**Patrick**

Patrick started out with the activity as Rick did. He did however change positions anytime he encountered a challenging problem. He was the only learner out of all five participants who utilized the "Assistance" feature. When asked which he preferred, the paper table charts or electronic charts, and the reason for his choice, he looked away. The teacher pulled out one of Ryuu® game cards pertaining to communicating with others. After they role-played, the teacher had me approach him with the question. Initially, he was tense and nervous to make eye contact. However, after several attempts he succeeded at making eye contact with me while answering my question. He said, “*This one that’s on the iPad because it gives small clues to help me but I can still solve it all by myself.*” During break time, he played with the LEGO® set as he typically does during breaks.

During the second section, he situated himself in a comfortable position. He rested on his stomach, set the iPad upwardly in the same position one would place it to watch videos and carried on with the activity. According to the teacher, he positions himself in the same manner when using the iPad in class. He seemed more focused, calm, and undisturbed by others chitchatting and watching him solve the problems. He completed all 100 problems with few minutes to spare. He covered the iPad and handed it to me while again looking down. I asked him if he could share what he liked about the
activity we did and he said while stuttering, “I like it more than the paper because it shows you if I did it right or if I made a mistake before I start the next one. It also asked me if I wanted to try to work on the wrong ones again and I did. Anything on the iPad is more fun because engineers created it. I wish we can use it for everything like I do at home and not just for fun like we did today. Maybe when I get older I can talk to the principal so I can help other kids.” Following our quick conversation, he excused himself to the sensory room where he chose to spend his free playtime. According to the teacher, this is the most he has conversed with anyone and not only was he doing a mathematics activity using an iPad on an unscheduled day, he also incorporated a short social skills activity while immersed in another topic. The teacher added, “The mix of it all within a short period of time pushed him beyond his comfort zone. Choosing the sensory room over free playtime is indicative of his stress and tension levels that he was probably experiencing but maintained under control as it is his goal he’s working to achieve.”

Observations Recap

The time allotted for the activity and my presence came to an end. The iPads got collected and packed in the case, with voluntary help from Abel before he situated himself at his desk to watch movie trailers. As promised earlier, each of the participants chose their reward following the end of the activity. Mark joined Rick and the paraprofessionals in the play area and to play Candy Land. Patrick remained in the sensory room while Joel went to Social Studies general education. As I was walking out the door, Mark shouted, “Promise you’ll come back for art class. You saw how good we
are in mathematics, now you have to come watch us in art class.” I left telling him that I can’t promise, but whenever I can, I’ll make sure to come and visit.

Interview Day: The Teacher’s Insights

On Friday December 5, 2014, I conducted an in-depth, semi-structured interview with the teacher at 3:00 p.m., following the Day 1: Paper-based Activity Day, while the learners were outside playing during their earned free playtime. The interview took place in his classroom during his scheduled preparation time. The type of interview questions asked (Appendix F) provided further understanding of the learners, their behaviors, their progress, curriculum, and the use of technology in the classroom.

The teacher is a 32-year old White male who was born, raised, and is currently raising his two children with his wife in the same Midwestern state where the study took place. The teacher began his teaching career substituting for special education teachers. It was then when he discovered his passion for teaching children with special needs. He decided to pursue it professionally. He completed his course requirements, obtained his teaching certificate, and graduated with his degree in Education from a highly reputable public university located in the northwest part of the same state. Following his graduation, he joined the largest school district with special education programs in the same Midwestern state and began his teaching career three years ago. He is currently working toward earning his Master of Education.

He teaches the third level higher function social behavioral skills program where this study was conducted. According to him and in his words, “[o]ur kids’ main hurdle is to overcome the social behavior impairment to get them in the gen. ed. [general education] classes.” Upon achieving their goals, they begin to slowly transition into the
general education classrooms with or without paraprofessionals. The goal of this social behavior skills classroom is to move the learners to the inclusive type of classroom without impacting their learning.

He added, “There are no standards or set criteria to determine when they are ready. We begin with Specials as a first small step and based on their performance and point sheets, they can begin to transition them into other classes.” Each learner has an IP (Individual Program) deficit goal(s). IP deficits include mathematics, reading, and writing. Typically science is the first class they transition, as it is not an IP deficit. The paraprofessional (para) may support the learners by writing or taking notes until they are capable of performing all tasks on their own. However, the learner demonstrates all the learning. The teacher stated that there is research that supports their instruction and evaluative methods.

During the interview, when asked about the learners’ daily class structure, routine, and daily activities, the teacher shared, “Each learner is a little different but each has a written schedule for those who can read [see Figures 12 & 13] and picture schedule for those who can’t.” The schedule features monitoring logs designed based on their behavioral Individual Program (IP) goal, allowing them to be used in the general education classrooms and track their behavioral progress. One of the tracking categories is following directions. The maximum points allotted are 2 for following directions within 1 or 2 prompts. Learners may get 1 point for 3 or more prompts or 0 should they not follow any directions. Another category is disruptive behaviors such as crying or pounding on the table. This is tracked by tallying how many disruptive behaviors the
learners have daily. The teacher reiterated, “Each individual sheet is a little different based on the learners’ IP needs.”

The learners’ schedules rotate daily and are divided between his social behavioral skills classroom, general education classrooms, and community circle homerooms. Each of the learners is allocated time to attend general education classes in order to achieve academic goals. The teacher has six learners total. Two of the learners attend his classroom for social skills sessions only. In the teacher’s words, “[t]hey have the content well over their heads but they still struggle with behavior.” Three of the learners spend their entire school day in his classrooms due to their severe social behavioral skills. In his words, “[t]hey can’t focus in big groups, their attention span is very low, they’re very distracting to their peers, as well to where they throw tantrums and throw their desks if they get frustrated.” They attend specials, lunch, recess, community circle, Physical Education (PE), science, and social studies with their peers in the general education, accompanied by a paraprofessional. However, mathematics and reading are two of the IP goals that at times can take longer to achieve and transition into general education classrooms. The last learner attends general education classes the majority of the school day, “about 75% of the time,” due to his ability to control his behaviors. The remainder of his day is spent in the teacher’s classroom to work toward achieving his IP goals. The teacher explained, “I have to give them this time in gen. ed. classes, especially if they have academic goals to achieve.”

All learners but one, due to his social anxiety, attend the community circle classroom in the morning and their general education throughout the day, when scheduled. In order to provide that learner with the same experience and improve his
communication, the teacher holds one-on-one community circle sessions with him. The objective of the community circle classroom is to improve the learner's communication and encourage participation and interaction in large groups. In the teacher’s own words, “[i]t’s lots of talking.” The sessions consist of a variety of activities, such as reading books and lessons or part lessons, personal responsibilities, attendance, bowling lessons, and weekend activities. He added, “each of the lessons encompasses different sentence starters to initiate the dialogue and each homeroom structures the lessons to meet the needs of their learners.” His 4th and 5th grade level classroom lessons encompass in-depth discussions for getting to know fellow classmates, the teacher, and expectations. The teacher proceeded to share, “Rick doesn’t get a lot out of it but it’s good for him to be around the same age peers.” He joins the community circle room with his peers for certain lessons such as Spanish, as it is his favorite curriculum subject. His attendance is set for a limited duration due to this short attention span.

The learners are scheduled to attend different types of classrooms taught by different teachers. However, the curriculum content is the same across all classrooms and follows the same educational standards. The teacher follows the state’s common core standards and incorporates the Core Plus More that allows him to customize the instruction to meet the learners’ individual goals. For instance, he integrates more visual teaching than teachers do in general education. In fact, the teacher collaborates with the general education teachers on the content, but not on his teaching method.

In discussing the curriculum content, structure, and instruction, he pointed at the mathematics and reading scaffolds posted on the board (See Figures 10 & 11), while sharing the power standards method they follow. They have 90 minutes set for
mathematics. He instructs for a maximum of 20 before grouping the class by level for the remainder of the scheduled time. He has 3 different mathematics groups: 2 second graders, 2 fifth graders, and 2 fourth graders. All the mathematics goals are basic facts. He implements flashcards, computer programs such as Xtramath.org, and worksheets to complete at their desks. The worksheets demonstrate their knowledge and determine any additional practice needed. Should one of the learners in any of the group require more individual instruction, the teacher will review it until he demonstrates full knowledge of it. In his words, “[if they can essentially master multiplying and dividing decimals then that encompasses lots of skills.” Reading, on the other hand, is instructed differently. He has reading interventions or leveled reading for the two 5th graders and they are based on their IP goal. He also has writing block scheduled for the learners.

Being on the spectrum, the learners have sensory needs and generally possess shorter attention spans requiring structured instruction. Moreover, the learners’ different academic levels, maturity levels, and social behavioral skills necessitate a motivating instructional approach to grasp their attention, while demonstrating the relevancy of the content to their daily needs and building confidence in applying the skills (that result in satisfaction for the learners for gaining new skills).

Thus, when inquiring about his approaches to motivate them, he stated that he typically provides many frequent fun breaks to retain their attention, as he suggested to do while facilitating this study. For gaining their attention at the beginning of the class, he announces the duration of every activity, the total number of fun breaks they have, and the type of free playtime rewarded toward the end of the day for completing all their daily activities. Every curriculum activity is set for 10 to 15 minutes, while his instruction of
the concepts lasts for a maximum of 20 minutes. An example of a fun break activity would be Just Dance. It helps the learners release some of the energy and refocus. Other activities are penny boards or first-then-charts that encourage the learner to complete their worksheet for time on the iPad, laptop, or in the play area. Some learners chose sensory room over electronics or games. For example, one learner chooses to fill the bucket with water to play as it soothes him. In the teacher’s own words, “[i]t varies based on the kid. You just find what motivates them and reward them with it.”

All the fun and rewarded activities done over breaks are relevant to the curriculum and concepts taught. They provide additional practice to increase their confidence and satisfaction in applying the skills and concepts in general education classrooms and daily life routines.

When inquiring about evaluations, the teacher indicated that the learners receive a copy of their sheets daily to take home to their parents, who request homework to help their children prepare for middle and high schools. The teacher has prizes at school for the children who receive full points on the sheets for the entire week and also for some of the parents. He furthered discussed their ongoing evaluations in preparation for higher grade levels. The teacher’s ultimate expectations of the learners are to be polite, courteous, and increase their communication. Moreover, he expects them to build the confidence they need to apply the skills to the best of their abilities.

In attempt to evaluate the difference between the activity used for this study and his classroom activities, he concurred that the 30-minute duration for the same mathematics operations in this particular activity is lengthy and redundant in format to retain their attention. Typically, the teacher will do as many problems and sometimes
exceeding the 100 problems, however he mixes the format between the electronic whiteboard, computer, and worksheet. He added that redundancy could lead to frustration and tension behaviors as seen today, which is typical. According to the teacher and in his own words, “[J]oel has generally more confidence that he can regain his focus, unlike Abel who once outside his element, begins shouting, “I’m wrong” “I lose” and “I’m a loser,” as he did during the activity. Patrick has anxiety built when he does not get it, because he usually gets it - and you feel it. Joel is just all over with his mind but what he understands, he understands well.” In order to alleviate frustration, the teacher will only provide an activity for approximately 10 minutes and that helps him evaluate their retention and comprehension of the concept.

The teacher ended the interview stating, “My kids are just like any other kid. I don’t look at them any different. I have 2 kids who without a doubt will be engineers someday. They are mathematics minds, very graphic, and computer savvy. They grasp onto things very quickly. Yes they have needs that require more help, guidance, and support but this is why I’m here. Ultimately, my goal is to equip them in the two years I have them with as much basic communication, interpersonal, and self-regulation skills as they can take to help them with changes to their routines, to follow a schedule in a polite manner without disrupting the class, and to be ready for the next grade level.”

Interview Reflection

Generally, studies on the use of technology in the classroom focus on learners without any special needs. These studies yield valuable results on how to best integrate these technologies in the classroom to benefit and motivate the learners academically. However, with the shift in educational laws resulting in the inclusive classroom setting to
include children with special needs, research on the use of technology in the classrooms with a focus on the group of learners with special needs is fundamental. It provides deeper understanding on their impact on the children academically and most importantly, personally, such as with their social skills, daily living needs, and sensory needs.

These tools are used as a motivational instruction to improve certain skills other children possess. These children now have the same academic privileges just as any learner does. As the teacher stated, “My kids are just like any other kid. I don’t look at them any different.”
CHAPTER 5.
SUMMARY AND CONCLUSIONS

“At today’s rate, by 2025, one in two children will be autistic”

- “At Today’s Rate” (2014, para. 2)

The purpose of this case study was to better understand the use of technology (in particular, tablet devices) to teach mathematics to a group of learners diagnosed with autism. Two research questions guided this study: (1) How do the motivational principles of the ARCS model impact the learners’ motivation with classroom activities (i.e., with excitement? apathy? sense of accomplishment?) and (2) How do learners interact with technology used in the classroom (i.e., as an instructional tool? as a rewarding mechanism? as an entertaining strategy?) Ultimately, this study is expected to contribute understanding into the motivational impact tablet devices can have on learners on the autism spectrum concerning engagement and participation in learning activities.

In this chapter, key findings are summarized and linked to references in the literature and their implications for better understanding the use of tablet devices with children diagnosed with autism are discussed. Conclusions are followed by implications, limitations, delimitations of the study, and recommendations for future research.

The study revealed technology, in general, and tablet devices, in particular, are used in the study classroom as reward mechanisms and break-time strategies. The teacher motivates the learners to complete the activity by rewarding them with the iPad during breaks and for achieving their weekly goal sheets. It is a motivational technique to gain their short attention span for the 10-15 minutes of assigned curriculum activity.
Summary and Discussion of the Major Findings

In an attempt to explore the research questions, data were analyzed using the Interpretive Descriptive qualitative research analysis method. Based on that analysis, four themes emerged: (1) the strategic motivational use of the tablet device in the classroom, (2) the classroom activities’ impact on learners’ social interactions, (3) learners’ behavioral changes resulting from change in classroom routine, and (4) teacher’s motivational strategy. The following paragraphs summarize these themes.

(1) The strategic motivational use of the tablet device in the classroom was evident while observing the participants and conducting the semi-structured interview with the teacher. The tablet device, iPad, provided by the school district to these learners is integrated as both an instructional and a motivational tool. Although the learners may use it when practicing or reviewing mathematics problems or reading activities, the tablet device is strongly emphasized as a motivational reward strategy to encourage learners to complete the classroom activities. As an example, learners are given as a reward eight minutes of iPad time over break-time with their choice of any type of app twice weekly for completing the activities and their IP goal sheets.

Based on my observations, the primary use of the technology tools and devices in the classroom, such as the electronic Whiteboard, laptops, iPads, and TV games such as the Wii and Just Dance, is for practice activities, free playtime, reward prizes, and breaks (entertaining). Due to learners’ habitual perception of these technology devices in the classroom as a reward mechanism, their perception is projected to be different from that of the paper-based activities. Upon seeing the iPads, children gathered as a group on the carpet where they sat and worked on it, unlike on Day 1, where each student immediately
reached for their desks after handing out the paper-based activity. Their reaction to the iPad resulted in less tension and more controlled behaviors, leading to an increase in motivation to continue trying to complete the math exercises even after some students requested to withdraw. Completing paper-based activities, on the other hand, results in points on their goal sheets. Therefore, students reflexively identify a paper-based activity to be more of an evaluation form of their goals, leading to anxiety and tension.

(2) *The classroom activities’ impact on learners’ social interactions* revealed their distinctive perceptions of each activity - the Paper-based or the Educational Application-based type. The paper-based activity depicted an instructional activity while the technology-based activity represented an entertaining activity similar to that of a reward. For instance, upon handing out the paper-based activity on Friday December 5, 2014, while they were gathered on the carpet, the learners immediately headed toward their personal work desks after the teacher’s instruction. In contrast, on Monday December 8, 2014, upon seeing the iPads the learners disregarded the teacher’s instruction, remained seated as one group working interactively on the tablets (as they typically do when it is earned as a reward), and seemed less tense. Although the tablet’s impact on their motivation to partake in the activity was different than that of a typical non-instructional tool, it helped control their frustration, tension, and anxiety.

Their attention span, however, was as short as it was working on the Paper-based Activity. Nevertheless, they were more in control of their behaviors while working on activities involving the iPad as they saw it as linked to non-instructional time, even though they were still working on Mathematics activities. Some learners still encountered behavioral challenges while working with the iPads and had to retire to the sensory room,
though their overall behaviors were more manageable. Patrick, for instance, was anxious and tense during the iPad activity but managed to complete all of the problems while maintaining control of his behaviors, unlike during the Paper-based Activity, when he expressed his frustration verbally and had to refer to the *Zones of Regulation* breathing technique to calm down. The more controlled behaviors and positive interactive energy there were, the more motivated they seemed. This suggests that the sensory features of the iPad may assist them control their levels of anxiety and tense behaviors.

(3) *The learners’ behavioral changes resulting from change in classroom routine* were apparent during observation. The tablet device was used to conduct a full mathematics activity for 30 minutes for this study when normally it is used for eight minutes for lesson reviews, practices, and reward incentives. The change in its usage did not align with their perception of what it is typically used for in the classroom, resulting in behavior changes. Abel, being a low conceptual learner as revealed during the impromptu conversation with the teacher, requires a strict and structured routine. He expressed intense behaviors during my presence and even prior to my arrival, the teacher shared. Abel was anxious when he was informed of the minor changes to the schedule to accommodate the "special activity," as the teacher referred to it. The anticipation resulted in severe agitation the day before I arrived and during the paper-based activity. In the teacher’s words, “*he did pretty well considering how he typically behaves to change.*”

Abel’s desired structure and after being accustomed to the same structured schedule for twelve months, the changes on these two days resulted in agitation, tension, anxiety, and a loss of confidence due to being outside of his element. His loss of confidence was evident and he expressed his aggression verbally by shouting, “I’m a
"loser" and "I lost" when he turned in an incomplete activity. Thus, having to readjust to a different routine on a short notice, after having adjusted to a structured program, presents challenges and rejection from some learners and can result in uncontrollable behaviors, lack of interest, focus, and motivation, as Abel demonstrated.

The teacher’s motivational strategy features the use of the iPad as a reward mechanism. The mathematics activity featured the four basic operations, which aligns deliberately with the school math curriculum. Their curriculum is based on the state Common Core and the Core Plus More. The Core Plus More allows the teacher to integrate additional teaching strategies, such as visual learning and individual goals, while maintaining the same content as in the general education classes. The teacher’s overall teaching method is designed for the “concrete” learners, who communicate and learn best through the use of objects, pictures, and other tangible methods and for the “abstract” learners, who find spoken and written language and other symbolic content meaningful (Mesibov & Shea, 2010). His overall structured educational and teaching strategies are based on the comprehensive principles of the “culture of Autism rather than a specific curriculum, manual, or set of intervention techniques” (Mesibov & Shea, 2010, p. 576).

The teacher’s motivational strategy is supported by Keller’s ARCS motivational model and systematic approach that guides the design of appropriate motivational strategies for learners (Keller, 2008; Gabrielle, 2003). As stated previously, Keller’s ARCS model is based on a synthesis of motivational concepts and has three distinguishing features: (1) it represents sets of strategies to improve the motivational instruction appeal, (2) it incorporates a systematic motivational design process, and (3) it
is comprised of the four principal conditions that typify human motivation. These conditions are: Attention (A), Relevance (R), Confidence (C), and Satisfaction (S) (Keller & Suzuki, 2004; Song & Keller, 2001; Wongwiwatthanakanit & Popovich, 2000; Keller 1987). In this case study, the teacher uses reward mechanisms as a strategy to motivate the students to have a perfect IP goal sheet and to completed assignments. Using the iPad as a motivational reward for completing in-class activities grabs the five participants’ attention, in the case of this particular classroom. The educational games chosen by the teacher and provided on the iPads are relevant to the lessons and curriculum determined by the school curriculum and taught in class. The personal control the teacher gives to learners through playing any activity of their choice on the iPad boosts their confidence in applying new and existing skills. Such confidence has the potential to increase their success in completing the games, daily life activities, and classroom activities, resulting in personal satisfaction leading to improved academic and personal performance. Hence, the teacher is implementing strategically an electronic device in the classroom to encourage learners to participate and complete their curriculum activity.

Although the existing studies support the findings in this case study, in that the tablet device has sensory features that can impact the learning of the student with autism and can be implemented as an instructional and motivational teaching techniques, the question remains if this increasingly more affordable technology is a “miracle device” (Johnson, 2011), as deemed by popular press. The DEECD (2011, para. 5) claims: “it is quality teaching and support that makes positive outcomes possible, not just the device,” which supports the findings in this study. Based on the observations of the five learners, while conducting the activity over both days with the paper-based, educational
technology-based activity and the insights from the interview with the teacher, the tablet device’s sensory features are not the only characteristics making it effective for their learning, as previous research shows. It is also the characteristics of the applications being used and most importantly, its implementation strategy in the classroom as an instructional, entertaining, and reward tool that can impact learners' motivation to be engaged in their learning, interact with their classmates, and participate in the activities to better comprehend the concepts being taught.

Implications of this Study

The first implication of this study concerns the way society reckons a technology tool to be effective based on insufficient data and a lack of in-depth, large scale scientific studies with consistent results. This study suggests that there are technologies with sensory features that benefit children with autism and the applications and the manner they are used can influence their impact on the users. The possibility of conducting a study where the children are playing with games such as Wii and handheld Nintendo can add more insights on the ways iPads are superior to these other devices or not.

The second implication of this study concerns the way we as a society understand and deal with children with autism. Society’s general perception of autism is damaging at times to the children, due to our ignorance of the disorder, the levels and the spectrum. We perceive it as a disability hindering the ability of these children to improve and advance. As the teacher reflected, “My kids are just like any other kid. I don’t look at them any different. Yes they have needs that require more help, guidance, and support but this is why I’m here.” It is crucial that we educate ourselves, change this perception, and recognize that they are kids and it is our duty to support them.
A final implication of this study is the underlying reality of the rise in autism diagnoses, but research remains focused on identifying the benefits and implications of the technology tools being developed to help children with autism.

Stephanie Seneff, a researcher at Massachusetts Institute of Technology, revealed in her study, “at today’s rate, by 2025, one in two children will be autistic” (“At Today’s Rate,” 2014, para. 2). She argues that this would happen due to the increase of chemicals used on crops. Our society is changing and advancing rapidly, with the proliferation of tools to provide students with autism with the proper education to equip them with the needed social, academic, and occupational skills to adjust to their surroundings and to succeed. As researchers, we need to be aware of the changes and widen our research spectrum.

Limitations and Delimitations of this Study

The following are the limitations identified in this study.

Learners may not be able to participate in both or either, paper-based and app-based math activities due to unanticipated scheduled events, appointments outside the classroom, or illness. The student may also choose to withdraw in the midst of the activity and observation. Moreover, the interpretations are based on a short time period of observation and immersion, and in the context of research.

Additional factors could have contributed to the learners’ motivations other than the conditions of this study. They are: outside school experiences on using iPads, characteristics of the activity, the 5-minute break structure, and the possibility of outside factors (such as the case with Abel who was working hard to achieve his academic goals to earn an iPad for his Christmas gift). Such factors might have an impact on how
participants responded to the paper-based and educational app versions of the classroom activities.

Four of the five participants have been part of this teacher’s class for at least one year, therefore having adjusted to the same classroom environment and to the teacher’s method of teaching and utilization of the electronic tools such as the whiteboard, laptops, and TV could also have influenced the way the learners responded to the study activities. Lastly, students’ differences in ages, grade levels, spectrum level, and maturity level, in conjunction with the level of the activities and completion rate, might have influenced the findings.

According to Baskas (2013), “the delimitations of a study are the restrictions and/or boundaries the researcher imposes prior to the study’s inception” (p. 119). Delimitations allow the researcher to ensure that the scope of the study is manageable. The delimitations of this study are outlined below:

1. The study allowed only learners between 5 and 12 years of age who were on the autism spectrum and attended public schools.
2. Only students’ whose parents or guardians consented to their child’s participation participated in this study.
3. Only students’ who signed and/or printed their names on the assent participated.
4. Only a classroom whose teacher signed the consent participated in the study.

Recommendations for Future Research

While the phenomenon of using table devices in the classroom and the potential increase in autism in children in the U.S. is rising, there remains a lack of in-depth
research on the overall effectiveness of tablet devices for learning and teaching and on how their integration within the curriculum as an essential instructional tool should be approached. The following are recommendations for future research:

- Expand the study timeline over one month to collect more data to determine if the behaviors observed are common or happened to occur on the two days the researcher was present.
- Further research to determine if an increase on the sample size would provide validation to the findings of this study.
- Further research in multiple classrooms with different autism and social behavior programs to identify the different types of behaviors generated from learners on different levels of the spectrum and with different special needs.
- Further research to classify the motivations of learners with autism in classrooms where tablet devices are integrated as an instructional tool versus where they are used as reward mechanism or entertaining strategy.
- Further research to interview the participants’ parents to determine learners’ usage of the table devices and the ways this technology would impact their child’s development.

Conclusions

Although research supports the findings, in that technology tools such as iPads hold promise for children with autism in terms of improving communication and developing social skills behaviors, other factors are also important to motivate children with autism to engage and participate. They are: (1) emotional and academic support, (2) teachers who are well trained in working with children with special needs, (3) proper use
of the technology tools aimed at these learners, along with strategic instructional planning. The combination of the iPad’s sensory, visual, and interactive features with the Math-Drills application’s tracking and instant feedback revealed a positive impact on learners’ motivation while they were attempting to finish 100 mathematics problems.

The findings from this study demonstrated motivation to be a critical element in seizing these learners’ attention and retaining it, in order to encourage engagement and participation in the learning. The findings also revealed a loss of interest in the reward upon changing the structured routine. The change in their structured routine increased anxiety, frustration, and uncontrollable social behaviors, which were lessened as a result the motivational impact of the reward on the learners.

The study revealed that technology in general and tablet devices in particular are used in the classroom as reward mechanisms and break-time strategies. The findings disclosed the use of a tablet device such as the iPad to be a motivational reward and break time tool. Based on the data analyzed, one can say that the outcome of the study would have been different had the learners been more motivated, had the iPad been an essential instructional tool element rather than a reward mechanism, had the students had longer attention spans to focus and remain motivated, and had they been more accustomed to doing all the activities (including instructional activities) on the iPad, using an educational app.

The findings raise awareness concerning the impact the teacher has on the students’ perception of the technology device as an instructional tool and to motivate learners grounded on how it is implemented in the classroom. The teacher’s strategy sets the expectations and creates students’ perceptions of it as an entertaining reward.
Moreover, this study provides a valuable depiction of the learners’ reactions to the change in their daily structured schedule, in their social skills behaviors, and of their practices to control and manage their behaviors. One of these practices is expressing their feelings and emotions by identifying with the codes on the Zones of Regulation poster found throughout the classroom. It helps students by showing the steps they need to take, such as deep breaths to regain control of their behaviors. Another practice is spending time in the sensory room to regain their tranquility and release the tension.

The overall study provided an important insight into the motivational impact that tablet devices have on learners on the autism spectrum related to motivation and participation in learning activities contingent on the strategic instructional or reward mechanism implementation in the curriculum. It also exposed the variety of interactions ranging from high self-confidence in the ability to complete the activity, to boredom due to their short attention span, to the loss of all confidence resulting in feelings of self-disappointment. Moreover, it described how learners interacted with technology when it was integrated in the curriculum as a reward mechanism to seek and retain their attention, and how it is an entertaining strategy for the teacher to use to motivate and excite the students to help grab their attention.
REFERENCES


Ellis, S. (2011). Teaching the future: How iPads are being used to engage learners with special needs. Screen Education, (63), 60-64.


Gibbs, J. W. a quote from the Mathematical Association of America, retrieved from http://www.maa.org/quote_alphabetical/g?page=1


First Approval Letter
Second Approval Letter - First Modification Request

Date: 9/15/2014
To: Andrea Lynn Halabi
1607 NW Prairie Lakes Dr, Apt 201
Ankeny, IA 50023

CC: Dr. Ana-Paula Correia
N165B Lagomarcino Hall
Larysa Nadolny
N164 Lagomarcino Hall

From: Office for Responsible Research

Title: The Social Learning Interaction Changes on Children with Autism Following the Use of Readily Available Educational Applications on Technology Tablets in the Classroom

IRB ID: 14-328

Approval Date: 9/15/2014
Date for Continuing Review: 7/14/2016

Submission Type: Modification
Review Type: Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- Use only the approved study materials in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.

- Retain signed informed consent documents for 3 years after the close of the study, when documented consent is required.

- Obtain IRB approval prior to implementing any changes to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.

- Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences involving risks to subjects or others; and (2) any other unanticipated problems involving risks to subjects or others.

- Stop all research activity if IRB approval lapses, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.

- Complete a new continuing review form at least three to four weeks prior to the date for continuing review as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. Approval from other entities may also be needed. For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. IRB approval in no way implies or guarantees that permission from these other entities will be granted.
Third Approval Letter - Second Modification Request

The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

IRB ID: 14-328

Approval Date: 10/21/2014  Date for Continuing Review: 7/14/2016
Submission Type: Modification  Review Type: Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- Use only the approved study materials in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.
- Retain signed informed consent documents for 3 years after the close of the study, when documented consent is required.
- Obtain IRB approval prior to implementing any changes to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences involving risks to subjects or others; and (2) any other unanticipated problems involving risks to subjects or others.
- Stop all research activity if IRB approval lapses, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
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APPENDIX B.

INSTITUTIONAL REVIEW BOARD BACKGROUND CHECK

August 25, 2014

Dear Andrea Halabi,

The Office of Risk Management has completed the National Sex Offender Registry (NSOR) background check screening on yourself that you provided to us on August 21, 2014 on the Iowa State University background screening request form for the IRB Research Project, The Social Learning Interaction Changes on Children with Autism Following the Use of Readily Available Educational Applications. You have successfully passed your background check and are approved to interact with minors in this IRB research project. If you have any questions do not hesitate to contact me.

Steve

Steve Wieneke
Risk Specialist
Office of Risk Management
3618 Administrative Services Building
Iowa State University
Ames, Iowa 50011-3616
Phone: 515-294-6849
Fax: 515-294-3105
Email: swieneke@iastate.edu
Dear Teachers (Teacher’s name),

I, Andrea Halabi, am a graduate student at Iowa State University pursuing my Master of Science in Curriculum & Instructional Technology (CIT). CIT provides the opportunities to explore the intersection of curriculum and instructional design in cutting-edge, technology-infused 21st century teaching and learning environments. It further emphasizes appropriate and effective applications of technology in teacher education.

I am conducting a research study for my Master of Science thesis to learn if the use of mobile technology and especially tablets such iPads is associated with improved social interaction, participation, and classroom engagement in children with autism in public school environments. If this relationship is identified, it has the potential to inform educators and improve outcomes for students with autism leading to an increase in participation and engagement in the classroom.

My particular interest in the use of tablets such as the iPads is due to the increase of use and availability in the classroom. iPads have swept through almost every industry, especially education and their proliferation in the classroom continues to increase (Wainwright, 2013). Studies have shown these devices are providing a plethora of educational apps that are engaging and improving education. For instance:

- A 2012 research study, conducted in Auburn, Maine showed that Kindergarten students using iPads scored much higher on literacy tests than students that didn’t use the device (Schramm, 2012).

- At Northdale Middle School in Coon Rapids, MN, iPads in the classroom have led to increased engagement among students with disability and have accelerated and improved their learning and comprehension (Baca, 2012).

- In another study done by Houghton Mifflin Harcourt in California conducted from Spring 2010 to Spring 2011 showed that students using iPads saw their math test scores increase 20% in one year compared to students using traditional textbooks (Bonnington, 2012).

I have enclosed a consent form for your review. Please read the form and feel free to contact me if you have any questions about the study. If you choose to participate, please print your name, sign, and date the consent form. You may email me the signed copy or hand-deliver it during my visit to your classroom to obtain the students’ consent.
Dear (Teacher’s Name),

My name is Andrea L. Halabi. I am a graduate student in the School of Education at Iowa State University. I am conducting a research study as part of the requirements of my degree in Curriculum & Instructional Technology and I would like to invite you to participate.

The purpose of my study is to learn how the use of readily available educational applications accessible on technology tablets such as iPads can help children with autism understand and communicate their needs to teachers and fellow students and to learn if these tools can increase their social interaction in the classroom leading to higher participation and engagement.

Overview of the Activity

Should you decide to participate, I will ask you to confirm the math activity to ensure it meets the academic standards and the students’ grade level and distribute the parental informed consent forms to the parents/legal guardians.

The following is a description of the activity:

*The educational activity will be based off of the Math Drills application. The application features basic math skills in addition, subtraction, multiplication, and division. The application allows the students to explore solutions to problems using number lines, wooden blocks, facts, and hints. This particular application will allow me to implement the same activity on paper helping me compare the results.*

*The lesson is a math activity based on the students (participants) grade and academic level, and this is where the teachers will have to confirm whether it meets the skill level and the academic core standards. The activity for the 5 - 6 years old will be based on adding simple numbers such as $1 + 1 = 2$, the activity for the 7 – 9 years old will feature addition and subtraction math problems, and the activity for the 10 – 12 years old will feature multiplication and division math problems.*
**Process and Duration**
The activity is divided into two steps. Each step will be done on a different day.
1. The first step, the participants will be asked to complete the activity on paper.
2. The second step requires the same participants to complete the same activity on the provided technology tablet.

The entire process will last approximately 3 hours or less within a total of 3 visits.
1. Visit 1 – 30 minutes: I will visit your classroom prior to conducting the activity to obtain the children’s verbal and/or printed/signed consent to partake in the study. This visit will consist of explaining my study verbally, describing the activity, and answer any questions.
2. Visit 2 – 30 – 45 minutes: the participants will be completing the activity on paper.
3. Visit 3 – 30 – 45 minutes: the participants will be completing the activity using the technology tablet.

I will also be present in the classroom when the technology tablets get distributed, activated, and shown what buttons to press to begin. An approximate hour is scheduled to ensure proper activation before starting the activity.

While the students are completing the activity, I will be present in the classroom observing. Using my observational protocol for both steps, I will note behaviors and reactions while the students are conducting the activity.

**Follow up Interview**
Following the activity, I will request an interview from you and record your perception as a teacher and transcribe the interview sessions, which will be used while analyzing the data. In particular, I will ask questions about the students’ behaviors and attitudes toward the activity, your feedback regarding benefits and drawbacks of having them use a technology tablet, and your overall observation, experience, and point of views.

The meeting will take place at a mutually agreed upon time and place and should last an hour. The interview will be audio taped so that I can accurately reflect on what is discussed. I will be the sole person who will review the tapes to transcribe and analyze them. They will then be destroyed. You may feel uncomfortable answering some of the questions. Hence, you do not have to answer any questions that you do not wish to.

**Benefits from the study**
Although you probably won’t benefit directly from participating in this study, we hope that others in the community/society in general will benefit by making teachers aware of the available tools and applications to implement and provide for students with autism so that they are able to help the students get the best out of their classroom experience.
Privacy and Confidentiality
No personally identifiable information (like the name of the participants, teachers, families, schools) will be collected through the use of field observation. Any instrument that might have inadvertently included names or other identifying information will be immediately destroyed. Once the audio interviews with teachers have been transcribed, the audio files will be destroyed.

Participation is confidential. Study information including your name will be kept in a secure location at Iowa State University. The results of the study may be published or presented at professional meetings, but the school’s identity and all of the participants’ identities will not be revealed. Participation is unidentified and undisclosed.

Cost and Compensation
You will not have any costs from participating in this study and will not be compensated for participating in this study.

Your rights
Taking part in the study is your decision. You don’t have to be in this study if you do not want it to. You may also ask to quit the study at any time. Should you allow me to conduct my study in your class with your students, I will ask you to sign the attached Permission Form, share the study with the students’ parents/legal guardians in person or electronically, and distribute physically and/or electronically the parental informed consent and assent forms.

Dr. Ana-Paula Correia and I will be happy to answer any questions you have about the study. If you have any questions about the rights of research subjects, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Contact information:
Dr. Ana-Paula Correia
acorreia@iastate.edu
515-294-9376
N147 Lagomarcino Hall

Andrea Lynn Halabi
alhalabi@iastate.edu
319-899-4879

Thank you for your consideration. If you would like to participate, please sign the attached Teacher Permission Form and return it electronically to alhalabi@iastate.edu or in the return envelope.

With kind regards,

(Signature) Andrea L. Halabi
Teacher Permission Form

**Study Title:** The social learning interaction changes on children with autism from the use of readily available educational applications on electronic tablets in the classroom.

**Researcher:** Andrea L. Halabi

I have read the information contained in the document about the above titled study, which describes what I will be asked to do if I choose to participate in the study; and,

- □ Yes – I give permission for the researcher to conduct the study in my classroom.

  -OR-

- □ No – I do not give permission for the researcher to conduct the study in my classroom.

_____________________________________________
Teacher’s Name (printed)

______________________________________________   __ ______________
Teacher’s Signature       Date

You may sign and hand the signed consent or email a scanned document to alhalabi@iastate.edu.

You may retain copy for your records.
APPENDIX D.

PARENTAL INFORMED CONSENT DOCUMENT

Parental Informed Consent Document

Dear Parents/Legal Guardians,

I, Andrea Halabi, am a graduate student at Iowa State University pursuing my Master of Science in Curriculum & Instructional Technology (CIT). CIT provides the opportunities to explore the intersection of curriculum and instructional design in cutting-edge, technology-infused 21st century teaching and learning environments. It further emphasizes appropriate and effective applications of technology in teacher education.

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- A 2012 research study, conducted in Auburn, Maine showed that Kindergartner students using iPads scored much higher on literacy tests than students that didn’t use the device (Schramm, 2012).

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- In another study done by Houghton Mifflin Harcourt in California conducted from Spring 2010 to Spring 2011 showed that students using iPads saw their math test scores increase 20% in one year compared to students using traditional textbooks ((Bonnington, 2012).

I have enclosed a consent form for your review. Please read the form and feel free to contact me if you have any questions about the study. If you choose to participate, please print your child’s name, your name, sign, and date the consent form. You may email me the signed copy or drop it off with your child’s teacher to collect it.

Your participation is greatly appreciated.
Sincerely,

Andrea L. Halabi
Iowa State University
(319) 899 – 4879
alhalabi@iastate.edu

Parental Informed Consent Document

Title of Study: The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

Investigator: Andrea L. Halabi

This is a research study that your child is invited to take part in. Please take your time in deciding if you will grant permission for him or her to participate. Please feel free to ask questions at any time.

Introduction

The purpose of this study is to learn how the use of readily available educational applications accessible on technology tablets such as iPads can help children with autism understand and communicate their needs to teachers and fellow students and to learn if these tools can increase their social interaction in the classroom leading to higher participation and engagement.

Description of Procedures

If you allow your child to participate, your child will be asked to complete a math activity based on their grade level in their classroom. The teachers will confirm the activity that will be obtained from a readily available educational application called Math Drill. The teacher’s confirmation ensures the activity meets the standards and academic level of the grade.

The activity is divided in two steps. Each step will be done on a different day.

3. The first step, your child will be asked to complete the activity on paper.
4. The second step requires your child to complete the same activity on the provided technology tablet.

The approximate completion time for the activity is 30 to 45 minutes.

While your child is completing the activity, I will observe their attitudes towards it, their behaviors, the completion rate, and the teacher’s involvement if any. The observation will be noted and saved in my password-protected laptop. There will not be any audio and/or video recordings.
The entire process will last approximately 3 hours or less within a total of 3 visits.

4. Visit 1 – 30 minutes: I will visit their classrooms prior to conducting the activity to obtain their verbal and/or printed/signed consent to partake in the study. This visit will consist of explaining my study verbally, describing the activity, and answer any questions.

5. Visit 2 – 30 – 45 minutes: the participants will be completing the activity on paper.

6. Visit 3 – 30 – 45 minutes: the participants will be completing the activity using the technology tablet.

I will also be present in the classroom when the technology tablets get distributed, activated, and shown what buttons to press to begin. An approximate hour is scheduled to ensure proper activation before starting the activity.

Risks or Discomforts

While participating in this study your child may experience the following risks or discomforts: The psychological risks can include discomfort and frustration from conducting the same activity twice and possible stress from using a technology tablet if the child is not familiar with the tool.

Benefits

If you allow your child to participate in this study, there may be or may not be direct benefit to you or your child. Your child could benefit from utilizing and experimenting with technology tool while conducting an educational activity. It is hoped that the information gained in this study will benefit society by making teachers aware of the available tools and applications to implement and provide for students with autism so that they are able to help the students get the best out of their classroom experience.

Costs and Compensation

You and your child will not have any costs from participating in this study. Your child will not be compensated for participating in this study.

Participant Rights

Your child’s participation in this study is completely voluntary. You may choose not to give consent or you can withdraw consent at any time without any penalties or negative consequences. Your child may also choose not to participate or withdraw from the study at any time during the without any penalties or negative consequences.

If you have any questions about the rights of research subjects, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.
Confidentiality

Records identifying your child will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, auditing departments of Iowa State University and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information.

To ensure your child’s confidentiality to the extent permitted by law, the following measures will be taken: Every necessary step will be taken to ensure the identity of all participants involved is protected. No personally identifiable information will be collected through the use of field observation. Any data whether study related or personal characteristics/traits regarding the participants that could lead to identifying them will be completely omitted from the analysis and reporting. All documents and records will be kept secure. Any instrument that might have inadvertently included names or other identifying information will be immediately destroyed.

You and your child are encouraged to ask questions at any time during this study. For further information about the study, contact Andrea L. Halabi at (319) 899-4879 or alhalabi@iastate.edu or Dr. Ana-Paula Correia at (515) 451-1851 or acorreia@iastate.edu.

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to allow your child to participate in this study, their participation is voluntary and there are no academic and/or social consequences for withdrawing from the study, that the study has been explained to you, that you have been given the time to read the document.

Child’s Name (printed) ________________________________________________

Printed Name of Parent/Guardian or Legally Authorized Representative

_________________________________________ ______________

Signature of Parent/Legal Guardian Date

Upon signing this form, you may drop it off with the teacher for me to collect or scan the document and email it to me directly at alhalabi@iastate.edu. Please retain a copy for your records.
Assent Document (1 of 3) - Children 5 to 6 years of age

**Study Title:** The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

**Script**
Hi. My name is Andrea Halabi. I’m also a student like you who goes to school and learns new things. I’m trying to learn a new thing by doing a study.

**What is a study?**
A study helps us learn new things. We can test new ideas. First, we have to ask a question so we know what to study and then we try to find the answer.

**Why am I doing this study?**
I’m doing this work to learn if students like you choose to do fun school activities on paper or on a little computer screen that you get to carry everywhere just like the iPad.

**What would happen if you decide to help me?**
I will come and visit you two more times in your classroom. The first time I come, I will give you a paper with simple math activity such as 1+1, etc.. The second time I come, I will show you how to use the little computer/tablet like an iPad and have you do that same activity you did the first time on it. Every time I come visit you, I will be with you in the classroom for less than an hour (30-45 minutes) until you are done working on it.

**What do you need to know?**
- Your mom/dad says it’s okay for you to do the math activity.
- You get to decide if you want to help and do the activity.
- You can say ‘No’ or you can say ‘Yes’.
- If you say ‘Yes’, you can always say ‘No’ later or during the study.
- You can say ‘No’ at anytime.

Do you have any questions for me?

Would you like to help me and do the math activity on paper and on the tablet?
Child’s Name: __________________________________________

Parental Permission on File: □ Yes □ No
(If “No”, child may not participate)

Child’s Voluntary Response to Participation: □ Yes □ No

Signature of researcher: ________________________________

Date: _________
Assent Document (2 of 3) - Children 7 to 9 years of age

Study Title: The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

Script
Hi. My name is Andrea Halabi. I’m a student at Iowa State University in Ames. Right now, I’m trying to learn how using tablets like an iPad to do homework can help students just like you do better in school and if students your age prefer to do school activities on paper or iPads/tablets.

I would like to ask you to help me by being in a study, but before I do, I want to explain what will happen if you decide to help me. I will come to your school two other times. The first time I come; I will give you the math activity on paper to complete. During my second visit, which will be on a different day, I will have the tablets for you to use to do that same math activity. Each visit will last between 30 and 45 minutes.

Your mom/dad says it’s okay for you to do the math activity. But if you don’t want to be in the study, you don’t have to be. Your decision will not make any difference with your grades and about how people like your teachers and friends think about you.

Your parents, teachers, and friends will not know what you have written. When I tell other people about what I’m doing, I will not use your name and no one will be able to tell whom I’m talking about.

Also, you can ask questions about this study at any time and if you don’t want to do the activity, you will not get into trouble. You can say okay now and change your mind later. You can stop participating at any time.

Do you have any questions for me now? If you have a question later that you can’t think of now, you can ask your mom/dad to call me or email me so I can explain it to you.

Would you like to be in my study and do the math activity on paper and on the tablet?

________________________________________________________________________

Child’s Name: __________________________________________

(Optional) Child’s Name: _________________________________(Printed or Signed)

Parental Permission on File: ☐ Yes ☐ No
(If “No”, child may not participate)
Child’s Voluntary Response to Participation: □ Yes □ No

Signature of researcher: __________________________________

Date: __________
Assent Document (3 of 3) - Children 10 to 12 years of age

Study Title: The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

Why am I here?
Hi. My name is Andrea Halabi. I’m a student at Iowa State University in Ames. Right now, I’m doing a research study to learn how using tablets like an iPad to do homework can help students just like you do better in school and if students your age prefer to do school activities on paper or iPads/tablets.

What is a research study?
A research study is a way to learn more about something. I have a question on how students like you would respond to doing school activities such as homework on paper compare to tablets such as iPads. Your participation will help answer the question.

What will you be doing?
I would like to ask you to help me by being in a study, but before I do, I want to explain what will happen if you decide to help me. I will come to your school two other times. The first time I come; I will give you the math activity on paper to complete. During my second visit, which will be on a different day, I will have the tablets for you to use to do that same math activity. Each visit will last between 30 and 45 minutes.

Do you have to be in the study?
Your mom/dad says it’s okay for you to do the math activity and we wanted to ask you. You do not have to join this study. It is up to you. If you don’t want to be in the study, you don’t have to be. Your decision will not make any difference with your grades and about how people like your teachers and friends think about you. You can say ‘Yes’ and change your mind later even during the activity. You can also say ‘No’ at anytime and you will not get in trouble.

Will other people know your results?
Your parents, teachers, and friends will not know the results of doing the activity. When I tell other people about what I’m doing, I will not use your name and no one will be able to tell whom I’m talking about. The activity will not change your grades at all.

When can you ask questions?
You can ask questions about this study at any time before and during the activity. If you have a question later that you can’t think of now, you can ask your mom/dad to call me or email me so I can explain it to you.

Do you have any questions for me now?
Would you like to be in my study and do the math activity on paper and on the tablet? If yes, please print or sign your name on the second page.

AGREEMENT TO PARTICIPATE

Child’s Name: __________________________________________

Child’s Name: __________________________________________ (Printed or Signed)

Parental Permission on File: □ Yes □ No
(If “No”, child may not participate)

Child’s Voluntary Response to Participation: □ Yes □ No

Signature of researcher: ________________________________

Date: __________
APPENDIX F.

TEACHER INTERVIEW GUIDE

Teacher Interview Guide

Study Title: The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

Interview Script

Welcome and thank you for your participation today. My name is Andrea L. Halabi and I am a graduate student in the School of Education at Iowa State University conducting a study to learn how the use of readily available educational applications accessible on electronic tablets such as iPads can help children with autism understand and communicate their needs to teachers and fellow students and to learn if these tools can increase their social interaction in the classroom leading to higher participation and engagement.

This interview will take about 60 minutes and will include 16 questions regarding the class, the curriculum, the participants’ involvement in the classroom, the participants’ social interaction with classmates, and your feedback on the study and their reaction to the use of technology.

I would like your permission to audio record this interview so I may accurately document the information you convey. If at any time during the interview you wish to discontinue the use of the recorder or the interview itself, please feel free to let me know and we will stop. All of your responses are confidential. Your responses will remain confidential and will be used only for analysis and reporting purposes.

At this time I would like to ask for your verbal consent and also inform you that your participation in this interview also implies your consent. Your participation in this interview is completely voluntary. If at any time you need to stop, take a break, or return a page, please let me know. You may also withdraw your participation at any time without consequence. Do you have any questions or concerns before we begin? Then with your permission we will begin the interview.

Interview Questions
1. We’ve talked when we met about your classes and the activities you hold; tell me how is your class structured or what does your daily schedule look like?

2. How is the curriculum for students with autism different?

3. What educational standards must you follow when creating their curriculum?
4. Tell me about the types of activities conducted daily and who is involved in designing them and selecting them.

5. Tell me how the students react to your daily activities?
   a. Do you provide assistance and how often?
   b. Do they raise their hands to ask questions?
   c. Do they refer to their classmates for help?
   d. What is the class activity’s rate of completion?

6. How do their classmates react to the difference in curriculum, their progress, and participation?

7. What seems to encourage them the most in the classroom to participate and engage?

8. Explain how your classroom activities are evaluated.

9. How often are the students evaluated and based on what evaluation scale do you analyze your results?

10. Can you share how the evaluation results impact the structure of the curriculum? What is the outcome of the evaluations?

11. Are the evaluation results communicated to the parents/legal guardians?

12. What are your expectations from students by the end of every school day?

13. Elaborate on how this activity is different from what you implement on a daily basis.

14. How do you compare the level of difficulty between their daily activities to this particular activity?

15. If you would to implement the use of educational applications via electronic tablets, how would you do it different than in this study? What would change?

16. Share your last thoughts on the educational application, use of technology, this study, and any recommendation to the researcher.
APPENDIX G.

OBSERVATIONAL PROTOCOL FORM

Observation Protocol

**Study Title:** The social learning interaction changes on children with autism following the use of readily available educational applications on technology tablets in the classroom.

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<thead>
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APPENDIX H.

PAPER-BASED ACTIVITIES

Paper-based Activity (1 of 6)

YOUR FIRST NAME:

Christmas Math-Drill
Let's practice!

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<td>( <em>6-</em>=7 )</td>
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Christmas Math-Drill

Watch for the operation signs!

7 × 17
25 - 13
10 × 5
11 - 5
10 + 16
15 × 15

9 + 19
3 × 13
6 - 3
10 × 7
6 + 11
2 × 13

10 × 20
17 - 15
6 + 6
19 × 14
6 + 17
20 × 13

11 + 9
20 - 10
21 - 5
14 + 1
7 - 3
18 - 1

3 + 18
2 × 11
2 + 13
14 + 20
33 - 20
4 × 6

9 × 17
1 × 6
14 × 14
15 + 6
21 - 3
7 × 2

9 + 2
28 - 20
30 - 10
6 × 5
4 + 3
9 × 20
**Christmas Math-Drill**

Find each sum, difference, & product!

1. \[4912 - 2314 = \] 
2. \[1639 + 7917 = \] 
3. \[6854 - 5763 = \] 
4. \[8743 + 2397 = \] 

5. \[9926 - 7569 = \] 
6. \[3568 + 9464 = \] 
7. \[5212 - 3659 = \] 
8. \[6349 + 7543 = \] 

9. \[6569 \times 763 = \] 
10. \[5113 \times 919 = \] 
11. \[7201 \times 653 = \] 
12. \[2198 \times 397 = \] 

13. \[3611 \times 759 = \] 
14. \[9756 \times 465 = \] 
15. \[4326 \times 659 = \] 
16. \[3197 \times 743 = \]
### Christmas Math-Drill

**Addition Table**

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### Christmas Math-Drill

**Multiplication Chart**

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APPENDIX I

EDUCATIONAL APPLICATION-BASED ACTIVITIES

Educational Application-based Activity (1 of 3)
Educational Application-based Activity (2 of 3)
Educational Application-based Activity (3 of 3)

Not all problems were answered correctly. Would you like to correct the missed problems?

Cancel  OK

You had: 3 + 8 = 12

3 + 8 ? 1 2

Practice  Mixed drills  1/3