ABSTRACT

A Case Study: The Effects of the AutisMate
Application on a 12 year-old boy with ASD

Natalie G. Wall, M.A.

Mentor: Julie Ivey-Hatz, Ph.D.

The study was to show if iPad application *AutisMate* is effective in promoting the modeling of social communication and social interaction skills in a 12 year-old boy with Autism Spectrum Disorder using a single-subject embedded case study. It calls attention to the use of assistive technology in school settings for students with Autism Spectrum Disorder. The themes explored are the independence of the boy, his social communication skills, and social interaction skills. A late theme was his non-compliant behavior in math class. Researchers found that many factors could have affected the difference on the two measures Gilliam Autism Rating Scale and Social Communication Questionnaire from pre to post tests, and further research is needed. There were no conclusive results that AutisMate had a relationship with the boys' social interaction and communication skills.

A Case Study: The Effects of the AutisMate Application
on a 12 year-old Boy with ASD

by

Natalie G. Wall, B.A.

A Thesis

Approved by the Department of Educational Psychology

_____
Terrill F. Saxon, Ph.D., Chairperson

Submitted to the Graduate Faculty of
Baylor University in Partial Fulfillment of the
Requirements for the Degree
of

Master of Arts

Approved by the Thesis Committee

_____
Julie Ivey-Hatz, Ph.D., Chairperson

_____
Tracey N. Sulak, Ph.D.

_____
Tony L. Talbert, Ed.D.

Accepted by the Graduate School

December 2015

_____
J. Larry Lyon, Ph.D., Dean

Page bearing signatures is kept on file in the Graduate School.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

This thesis would not have been possible without several important people who have contributed and extended their valuable time in the preparation and completion of this study.

First, I would like to thank all the special people on my committee. I would like to express my deepest thank-you to my mentor, Julie Ivey-Hatz, for her wealth of knowledge on all things related to Autism. From my first developmental disabilities class at Baylor, to now, I have learnt so much. Her patience throughout the process, with continuous edits and meetings to help produce something I have become to be very proud of is to be commended also. To Dr. Talbert for teaching me via many, many articles and books about qualitative studies and being a constant happy face to see around the building. Lastly, Dr. Sulak, thank-you for dedicating time to meetings throughout the summer and awesome constructive criticism. It helped this study be so much more than I ever expected.

DEDICATION

To God, my family, and friends, for without your constant love and support this dream
would have never become a reality.

CHAPTER ONE

Introduction

Autism Spectrum Disorder is an extremely multifaceted brain-based disorder

defined by the Individuals with Disabilities Act (2004) as a developmental disabilities

disorder that affects a person's verbal and non-verbal communication skills in

conjunction with social problems, repetitive activities, and stereotyped movements. The

newest guidelines in the DSM-V take Autistic Disorder, Asperger Syndrome and

Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) and creates one

broad name; Autism Spectrum Disorder (ASD) (Saulnier & Ventola, 2012, American

Psychological Association (APA), 2013). ASD is most frequently diagnosed before the

age of three. The lack of social skills slowly becomes more recognizable by parents and

family members between ages two and three (IDEA, 2004; Lauritsen, 2013; Autism

Speaks, 2014).

The DSM-V defines three typical problems that children with ASD face. These

problems include deficits in social-emotional reciprocity such as failure to initiate or

respond to social interactions, deficits in nonverbal communicative behaviors used for

social integration such as deficits in understanding and use of gestures and, deficits in

developing, maintaining and understanding relationships such as difficulties in making

friends or lack of interest in peers (APA, 2013). The severity of ASD (high and low

functioning) is based on both social communication impairments and restricted repetitive

patterns of behavior (APA, 2013). Children who display lesser problems or

characteristics are generally diagnosed with high functioning ASD, whereas those who

exhibit several problems are considered more severe and classified as low functioning (Boyd & Shaw, 2010). Social communication deficits can also include nonverbal aspects such as lack of hand gestures or facial expressions (Charlop, Dennis, Carpenter & Greenberg, 2010). While no two children are identical in the symptoms they present, it is clear that the defining issues of ASD include the presence of social deficits and restricted behaviors (Saulnier & Ventola, 2012).

A study by the Center for Disease Control (2014) found that one in 68 children of age 8 is diagnosed with ASD. The CDC also found that 1 in 42 boys and 1 in 189 girls were diagnosed with Autism Spectrum Disorder (Center for Disease Control, 2014). While there are many impairments children with ASD face, behavioral problems are the most common and often vary greatly between children (Kuenssberg, McKenzie, Jones, 2011). As the number of children diagnosed with ASD increases, school districts are seeing an influx of children with ASD enrolling in schools. It is believed there was approximately a 57% increase in 8-year-olds with ASD in 10 out of 12 Autism and Developmental Disability Monitoring Network sites across the Unites States between the years 2002 and 2006 alone (Center for Disease Control and Prevention, 2012).

The Individuals with Disabilities Education Act (2004) requires early intervention services for the child and also requires students to have access to a free, appropriate education. However, problems can arise when teachers are not prepared to work with children with ASD. Further, this lack of training has led to parent dissatisfaction in the classroom setting. When educators become more familiar about materials that can have proven benefits, such as class based technology for students with ASD, it can begin to improve the student's communication and social skills (Starr & Foy, 2012).

The initial study was conducted over a four-month period in a school district in Central Texas. The participants were purposeful criterion-based sampled (Creswell, 2009). The participants had previously been diagnosed, with ASD and all participants were either currently using an Apple iPad or had previous knowledge on how to use one. *AutisMate* was loaded on to the participant's iPads who were participating in the study. Formal training was provided during a one-day teacher in-service at the school district. The primary investigator was present while the creators of *AutisMate* were on a Skype video call.

The training consisted of a three-hour session guiding teachers through the installation, features, and settings. Following the initial training, the developers of *AutisMate* flew in to visit with the teachers and further assist with the application process in the classroom. The Global Positioning System (GPS) component was downloaded for each school as it depended on the location. In addition, voice recordings, pictures of the school setting and community video modeling, and social stories were added to each device. Also, throughout the study, the investigator visited classrooms twice a week to ensure the students were using the application correctly and to help guide teachers if they needed any additional support with the application.

Both the Gilliam Autism Rating Scale (GARS) (Gilliam, 2013) and the Social Communication Questionnaire (SCQ) (Rutter, Bailey & Lord, 2003) were completed by the student's teachers at the beginning (January) and end (May) of the research period to assess social communication skills and gather diagnostic information. After the implementation of *AutisMate*, there was one set of scores that changed more dramatically from the beginning of the study to the end of the study on both the GARS (Gilliam, 2013) and SCQ (Rutter, Bailey & Lord, 2003). The current study needed to be conducted

because the initial study indicated that there was one particular student that *AutisMate* seemed to have an impact on more so than the other students. This relationship needs to be further explored. Furthermore, during the initial study there was one study based off the scores that *AutisMate* seemed to have an impact, more than other students. This relationship needs to be further explored.

The following study is an embedded single subject case study looking at the maximum deviant student and exploring the relationship between *AutisMate* and scores initially found on the GARS and SCQ.

CHAPTER TWO

Literature Review

Social Communication and Social Interaction Skills

It has been found that children with ASD lack the skill to be engaged in social

situations and initiate engagement with others (Wong & Kasari, 2012). Social interaction

and social communication are two key deficits that manifest early in children with ASD

(Ghuman, Leone, Lecavalier & Landa, 2011). If he or she is considered typically

developing, the child will usually imitate the actions of others when learning how to

communicate. Children with ASD often struggle with imitating others and are less likely

to be able to engage in and keep conversation flowing (Brown & Elder, 2014). While no

two children are identical in the symptoms they present, it is clear that the key social

issues and restricted, repetitive behaviors are present (Saulnier & Ventola, 2012).

Children with ASD face several physical and mental impairments. However, behavioral

problems are the most common form of impairment and can vary greatly among each

child (Kuenssberg, McKenzie & Jones, 2011).

Research has found that children with ASD are often hopeful to engage in social

interactions with their peers; however, they can display less desire to socially interact

because it seems too demanding or complex for them (Deckers, Roelofs, Muris & Rinck,

2014). For example, empathy can be considered a relevant social skill for all children to

learn, and often, children with ASD fail to grasp this concept. Those who are able to

express empathy are more likely to engage in interactions with peers and family members

and demonstrate other pro-social behaviors (Schrandt, Townsend & Poulson, 2009). In a

study on joint attention, Wong and Kasari (2012) describe joint attention as the child being able to look back and forth between an object or event and another person.

<center>*Use of Technology and Children with Autism Spectrum Disorder*</center>

Studies have found that persons who have been diagnosed with ASD have the ability to visually process various types of technology. This is often because the technology is predictable and allows the person with ASD more processing time compared to when they interact with other people around them (Guldberg, 2015). Due to this, technology-based activities often have a strong appeal and can come in a variety of forms (Cafiero, 2012). One such activity is Augmentative and Alternative Communication (AAC), which was initially used for persons with no speech or an inability to use a keypad (Shane et. al., 2012). However, AAC, such as a Speech Generating Device (SGD) can also help generate communication, develop, and entice natural speech for those with ASD (Cafiero, 2012; Trembath, Balandin, Togher & Stancliffe, 2009). Research has found that AAC uses scaffolding via communication tools, starting with single symbols and then progressing to more complex graphic symbols to which the person points (Cafiero, 2012). When Individuals with Disabilities Education Act of 2004 was published, Special Education teachers were expected to be involved in making decisions regarding their students Assistive Technology (AT) (IDEA, 2004).

Teachers need to understand how the devices work and how they will benefit the student's Individualized Education Plan (IEP) (IDEA, 2004; Flanagan, Bouck & Richardson, 2013). AT can come in low-tech forms such as flashcards or highlighting and high-tech forms such as screen readers or speech-to-text. With the recent explosion of the use of tablets and iPads, many researchers have found them as a resource that can help

<center>6</center>

the social communication, language, and literacy skills in children with ASD (Trembath et. al., 2009; Charlop, Dennis, Carpenter & Greenberg, 2010; Flanagan, Bouck & Richardson; Shane et. al., 2012). In most cases, the technology has applications downloaded to assist in educational use (Rodriguez, Strnadova & Cumming, 2013). The devices can also increase participation in classroom activities and help students learn academic skills (King, Thomezcek, Voreis & Scott, 2014). Research has found that teachers believe training is necessary when new technology is introduced into the classroom (Flanagan, Bouck & Richardson, 2013; Rodriguez, Strnadova & Cumming, 2013) for them to see it as being an effective tool. Special Education teachers and parents believe that the technology should be available across all environments and someone should be available to assist with the technology in each of these environments (Rodriguez, Strnadova & Cumming, 2013).

Social Cognitive Theory

The current study uses Social Cognitive Theory as a framework emphasizing that learning is derived from observing behaviors and modeling them. These observations may then lead to completely new behaviors (Ormrod, 2014; Bandura, 1977). Modeling can be used to help people learn cognitive or emotional behaviors (Ormrod, 2014) and has been found to be an effective intervention on many children (Flores et. al., 2014). When children with ASD engage in video modeling, they learn to imitate communicative behaviors observed on the specific iPad applications (Shane et. al., 2012). Video modeling is a form of technology that helps target socially expressive behaviors such as verbal comments, pitch, gestures, and facial expressions. (Charlop et. al., 2010.). When video modeling is used with children who have ASD, they were more likely to use gestures and give compliments during social situations (Macpherson, Charlop &

Miltenberger, 2014). Prior to the iPad being introduced, video modeling used a video that had been pre-recorded with varying scenarios (Charlop et. al, 2010), proving it difficult to use everyday scene cues as the device was not transportable (Shane et. al., 2011).

When the iPad was initially launched in 2010, it changed the portability of this format and thus rapidly rose to popularity among educators for its use with children with ASD (Mautone, 2013; King et. al, 2014). There are currently five different generations of iPads on the market. The iPads' memory sizes ranges from 16 GB to 128 GB depending on what suits the needs of the person (Apple, 2015). The iTunes Application (App) Store offers a large range of applications created for children of different learning preferences and abilities (Kucirkova, Messer, Critten & Harwood, 2014). Apple (2015) recognizes that the built-in tool "Guided Access" allows teachers to stay on one application by disabling the home button or limiting the amount of screen that can be touched. Furthermore, iPads are light enough to be portable, and this makes it convenient to use almost anywhere (Kurcirkova et. al., 2014). However, educators should understand that, while the iPad and its apps are effective learning tools, it should not completely replace therapy (Mautone, 2013). In other words, the iPad and its applications are primarily used to support the student outside of sessions.

AutisMate

AutisMate (2013) is one technology application that aims to help boost the social skills of individuals with ASD. Jonathan Izak, whose younger brother and first cousin have been diagnosed with ASD, designed the application. It was designed for portable technology and is approximately $150 in the Apple App Store or the Play Store for Android tablets (Google, 2015; Apple, 2015). The application uses a scene-based approach to communication and is easier for several individuals to understand than the

traditional grid-based AAC platforms. Further, the application teaches individuals with ASD to communicate through learning life skills (Autism Speaks, 2015). Parents, therapists, and/or teachers can create interactive scenes of their own using pictures, videos and voice recordings. *AutisMate* allows parents to target skills at home and teachers to target skills at school. For example, if a student has a chores list, they see each picture or video of the specific chore, such as shredding paper, is on the iPad or tablet. Upon completion of the chores, the student receives reinforcement such as pistachios. This helps build independence in students with ASD using the video modeling from the *AutisMate* application (AutisMate, 2014).

As the literature shows, video modeling is important for children with ASD to acquire new communication skills whether it is on larger television screens, laptop computers, or a portable technology device such as an iPod, iPad, or tablet (Miltenberger & Charlop, 2015). More specifically, social interactions and communication with others can be modeled to those with ASD using video modeling applications (Cihak, Smith, Cornett & Coleman, 2012). In addition, *AutisMate* can promote social skills including tone, body language, and emotion recognition. Furthermore, the *AutisMate* website (2013) explains that Visual Scene Displays (VSDs) can be more powerful for accessing language and sharing experiences; the VSD does not require language skills and uses simple symbols for communication. Finally, *AutisMate* combines behavior and skills building into one visual platform which many other communication applications for students with ASD are yet to do.

Embedded Case Studies and Autism Spectrum Disorder

Autism Spectrum Disorder is a disorder that has recently become more readily diagnosed, and each child has varied symptoms (Center for Disease Control, 2014).

9

Therefore, it is critical to look at ASD on a case-by-case basis. However, there is little qualitative research that has been done within the autistic community (Bolte, 2014). By conducting a single-subject embedded case study design, our goal is to add to this minimal amount of qualitative research on ASD. While a case study is not a new form of research, it is often used to research and present detailed information about a particular individual or group in a real life context (Kurcirkova et. al, 2012, Talbert, 2014). A case study is not necessarily based on one person; it can be a group of individuals, an institution, or a local authority (Hamilton, 2011).

When looking at contemporary phenomena, case studies are a favored option (Yin, 2014). The current study focuses on technology and the relationship between *AutisMate* and social communication skills in a young boy with ASD. Case study research is not limited to qualitative evidence but also includes quantitative evidence such as descriptive statistics. Because of this, a single-subject embedded case study is relevant to use. Furthermore, an embedded case study design calls for the unit of analysis to be through other methods such as the collection and analysis of quantitative data that complements the overall study (Yin, 2014).

According to Zainal (2007), an advantage of a case study is the researcher being able to observe the subject within his or her own environment, making it more naturalistic. When using an embedded unit of analysis within a case study, it allows a more extensive analysis and allows researchers to have a deeper insight into the case at hand (Yin, 2014).

Therefore, the purpose of the current study is to further develop the theory of the relationship between assistive technology and social and communication skills in children with ASD. Specifically, video modeling, that has a GPS attached, allows the child to use

the technology in several situations that may improve the skills of children with ASD. Researchers used a case study method, as the research involves an in-depth understanding of a single student with ASD using multiple sources of information collected (Creswell, 2013).

Research Questions

What is the relationship between the use of AutisMate and the communication skills of a student with Autism Spectrum Disorder?

Given the relationship between Assistive Technology and communication skills, the research aims to investigate if *AutisMate* is an appropriate tool to help improve the communication skills of children with Autism Spectrum Disorder.

How effective is the use of iPad application AutisMate to promote modeling social skills to a specific student with Autism Spectrum Disorder?

Previous research and Social Cognitive Theory suggest that video modeling has a positive effect on students with the iPad application will affect the socialization skills of children with Autism Spectrum Disorder, and measured by the teacher interview in the narrative analysis.

CHAPTER THREE

Method

The following was a single-subject embedded case study, involving the

implementation of the application *AutisMate.* The initial study purposively sampled six

students from a local independent school district. Teachers filled out the Gilliam Autism

Rating Scale (Gilliam, 2013) and the Social Communication Questionnaire (Rutter et. al.,

2003) in January and May. They measure the Autism Index (a score of 85 or higher

shows the student is high probability of being autistic, 70-84 is probably autistic and 69

or less he or she is unlikely to be autistic), to assess the symptoms and the severity of

ASD. From these scores, researchers found a maximum deviant, that is, a student who

was found to have the most drastic change in scores across the four-month period. These

scores were embedded into the study. The case study explored the most positive changes

in scores of this student and if *AutisMate* played a role in the increase in functional

communicative behaviors.

Research Design

A qualitative research design was chosen for the study because the data was

collected in a natural setting, the classroom, and was considered sensitive to the students

and teachers involved (Creswell, 2013). The theoretical framework for this study was

based on the Social Cognitive Theory. Qualitative research is generally based on a human

or social problem. With this study, the problem was how one child out of the larger

maximum variant group scored so differently on the GARS-3 and SCQ from pre-test to

post-test. Specifically, the research design used was a single-subject embedded case study. This design integrates both qualitative and quantitative data such that the quantitative data helps enhance the overall qualitative data (Yin, 2014). A case study design helps explore and take a more in-depth look at the situation being researched (Merriam, 1998). According to Scholz and Tietje (2002) the embedded single-subject case study takes the narrative analysis of the qualitative data and has the quantitative data embedded to help enhance and support the qualitative data.

Sampling

Six students from a local independent school district in Central Texas were purposively criterion-based sampled through special education teachers. School personnel chose students who were currently using or had the ability to use an iPad. Further, the students had previously received a diagnosis of Autism Spectrum Disorder according to the DSM-V. All students were between the ages 5 and 22. They were not homogenous and were considered a maximum variant sample. This sampling approach is generally used in qualitative research as it can maximize the chance that there will be increased differences among the sample (Creswell, 2009). No additional benefits or compensation was given. Pseudonyms were used to protect the student's anonymity. The case study participant was chosen because he had access to his own iPad and was having documented behavioral problems prior to the implementation of *AutisMate*. William (the case study) was in the special education classroom for the majority of each school day and had his aide with him at all times.

Case Study Participant

Before the study began, behavior reports and William's teacher describe that his behaviors were somewhat abnormal. These behaviors were very physical, such as hitting other children, hitting and scratching his aid, and throwing a variety of items from computers to waste baskets. Some of these behaviors were so extreme he was referred to the counselor's office or time out room. William's teacher put in place a modified reward/consequence system, ranging from daily to weekly rewards/consequences. He was able to receive a proud face sticker if he did not argue with the teacher, obeyed requests, or completed all his work. He was then able to receive rewards using the number of stickers he had accumulated. However, this worked for a short amount of time and then the fascination for the intervention was weakened. William had troubles completing work set by his teacher including tasks that should be simple for him such as adding and subtracting. These tasks, were not being completed. There was a concern that William may not have been sleeping enough at home because he would fall asleep in class or on the bus home from school. Overall, William's grades were suffering and his behaviors were worrying both the teachers and administration.

Data Collection

Data was collected through a variety of measures. For the quantitative strand, the scores from the Gilliam Autism Rating Scale (Gilliam, 2013) and Social Communication Questionnaire (Rutter et. al., 2003) were gathered for both William and a comparative group. Behavior reports for the 2013-2014 school years were collected from the counselor on campus. The counselor also gave a yearly overview of participant behavior that the previous aide had written from the 2013-2014 school years. Interviews with

14

William's teacher and William were conducted approximately one year after the study ended in May 2015. The interviews took place in the special education classroom with William with his teacher and aide present. Finally, daily behavior checklists from April to June in the 2014 school year were obtained from William's special education teacher. He was expected to follow instructions given by all teachers, listen to teacher, and refrain from classroom chattering. The behavior was given an 'X' on the class period that each behavior was not completed; if he had 100% good behavior (no 'X's) then he would move to the next level the following day and receive reinforcement. The researchers considered this as qualitative data. All data was considered confidential and was stored in the appropriate manner.

Measures

AutisMate (2013) was created to help increase the social communication and social interaction skills in people who have been diagnosed with Autism Spectrum Disorder. It was designed to help the student move through developmental stages while teaching life skills (Autism Speaks, 2015) and is different from other applications on the market as it is customizable in all aspects. The application uses a scene-based approach to communication and is easier to understand than other AT and AAC platforms. It is similar to other applications on the market as it uses aspects of video modeling with the creation of interactive scenes.

The application allows students to add their own pictures, videos, and voice recordings to the application in order to create scenes that promote positive interactions. With the assistance of teachers, counselors, and parents, the application can use photos and videos from the child's own environment and can teach anything from simple routines to more complex behavior skills. The photos and videos from the students'

environment are useful as they keep the routine and familiarity in their day-to-day lives, which is usually a necessity for individuals with ASD (National Autistic Society, 2014). The GPS component on the application provides students with scenes relevant to their current location. It can be set up from within the application with over 12,000 included symbols, customized voice recordings, and synthesized voices which makes it ideal for each student's needs. Multiple phrases were recorded to communicate the same idea in order to promote generalization.

Autism Spectrum Disorder. In order to measure severity of the children's behaviors and overall Autism Index score the Gilliam Autism Rating Scale-3 (GARS-3) was used. In 2013, the GARS-3 was re-created to reflect the current perspectives on Autism Spectrum Disorder (ASD) in the DSM-V. It is used for people between the ages 3 and 22. The GARS-3 was developed by Gilliam (2013) in order to, (a) help identify persons who have ASD, (b) assess severity of ASD symptoms, (c) document progress as a consequence of intervention program, (d) target goals for change and intervention on a student's Individualized Education Plan, and (e) serve as a research tool. The tool consists of 58 items over six subscales. Each item allows respondents to make a selection on a 4-point Likert-type scale with no option for a neutral response. Responses include "Not at all like the individual", "not much like the individual", "somewhat like the individual", and "very much like the individual". The scores from all subscales are combined and provide a score called the Autism Index. Once the Autism Index has been calculated, it can show the likelihood and severity of the person having ASD.

The subscales are related to the Autism Society's (2012) definition of the ASD and describe specific, observable, and measurable behaviors. The subscales are: Restrictive/Repetitive Behaviors (measures stereotypical behaviors, routines, or rituals),

Social Interaction (measures social behaviors), Social Communication (measures individual's responses to social situations and attempts to understand the intent of social interaction and communication), Emotional Responses (measures extreme emotional responses to everyday situations), Cognitive Style (measures fixated interests, characteristics, cognitive ability), and Maladaptive Speech (measures deficits and peculiarities in verbal communication) (Gilliam, 2013). Furthermore, while the subscales aim to measure different characteristics of a person with ASD, they also aim to measure all aspects of behavior to help determine if a person shows signs of ASD. Inter-rater reliability for the GARS-3 exceeded .80 for the intraclass coefficients and .84 for the Autism Indexes. Test-retest reliability coefficients exceeded .80 for the subscales and .90 for the Autism Indexes. According to the Pro-Ed website, new validity studies show that the rest results are valid for a variety of subgroups and general population (Pro-Ed, 2014)

Social Interaction and Communication Behaviors. In order to evaluate the communication skills and social functioning in children who have or may have ASD, the Social Communication Questionnaire (previously known as the *Autism Screening Questionnaire)* was used (Rutter, et. al., 2003). The tool was originally designed to screen children and find out whether they needed further evaluation for ASD (Interactive Autism Network, n.d). The current SCQ helps assess the intervention in place across intervals to ensure that the intervention was working properly. The scale is a 40-item tool usually completed by a parent, caregiver or, teacher in less than 10 minutes. The scale is used for children ages four and above (Rutter et. al., 2003). The first item on the measure is used to find whether or not the child is verbal or non-verbal. If the child is non-verbal, six items are omitted. When the combined scores are greater than 22, one would consider the child to receive a diagnosis of Autism. If the score is greater than 15, the child would be

diagnosed with ASD (Oosterling et. al., 2010). However, the SCQ was designed before the most recent DSM was published and does not reflect ASD as one diagnosis. No psychometric data could be found for the Social Communication Questionnaire.

Data Analysis

All students' scores from the GARS-3 (Gilliam, 2013) and the Social Communication Questionnaire (Rutter, et. al., 2003) were entered into Microsoft Excel to find the averages and compare scores. These were the scores initially documented in the pilot study. The data entry found that William was the maximum deviant case. His scores on the GARS-3 (Gilliam, 2013) and SCQ (Rutter et. al., 2003) were compared to the overall group and embedded in the narrative analysis to help explain and support the phenomena.

A narrative analysis was completed for the interview with Ms. R (William's teacher), William, and his aide, Mr. S, which was recorded approximately one year after the study had ended in May 2015. According to Merriam (1998) narrative analysis from interviews is generally in first person and is analyzed via a particular discipline or perspective. In this case, researchers were looking at it from the discipline of special education using the Social Cognitive Theory and the idea of learning new behaviors through modeling. Questions to Ms. R covered topics such as William's behavior up until the time of interview, any behavioral problems that had arisen, and asked whether the application would be used again if it were needed to help increase positive behaviors. Questions to William were conversational and answered with the help of his aide and Ms. R. Interview questions to William involved the topics of his family, technology, as well as likes and dislikes in the classroom. The reports on behavior were input into a line

18

graph by researchers to see change in William's behavior over time and were also

discussed in the narrative format

CHAPTER FOUR

Results

Context

William is a white male who, at the start of this research, was in the 5th grade at a local public school in Central Texas. In the 2012-2013 school year, his aide explained that he had a good year after the first month and until the last month of the school year. At the beginning of the 2013-2014 school year, his aide recalls he was compliant and obedient. However, in October of 2013, there is documentation of William's first incident report. The report was from the school bus driver and aide, and stated that William had disobeyed his aide's instruction. Following this, there were three other incident reports documented; the last was in February 2014. Two of these reports were a refusal to do work in math. The last report was of physical aggression toward another student in Physical Education. In April 2014, William was placed in the behavioral classroom with Ms. R. In May 2015, the follow up interview was recorded. William was in the 6th grade and preparing to move to the local middle school. His behavior had dramatically improved from the previous year, according to his Special Education teacher, and he was in majority General Education classes.

Method for Analysis

The initial analysis of the data was conducted by reading through the information that had been gathered, and the interview with Mr. S and Ms. R was replayed in a private setting. The process allowed any potential themes to stand out and be used at a later point

in the data analysis. The guiding question throughout the study was: Why William's scores on the Gilliam Autism Rating Scale (Gilliam, 2014) and Social Communication Questionnaire (Rutter, Bailey & Lord, 2003) change so drastically? Did *AutisMate* play a role in this? There were two possible factors that could have had an impact on the scores: *AutisMate* and the campus. These factors helped guide the narrative analysis and a framework for analyzing the archival data. The main themes that were discussed throughout the interview with Ms. R and Mr. S centered on William's independence, social communication skills, and social interaction skills. Furthermore, how had these themes developed since the beginning of 2014 when *AutisMate* had been introduced?

According to Creswell (2013), "Case study research is a qualitative approach that the researcher explores a real-life, contemporary case over time, through in-depth data collection using multiple sources of information" (p. 97). The data was collected from two primary sources, archival information and the interviews with William, his aide, and special education teacher. Archival information included referral feedback forms, 2013-2014 overviews from William's aide at the time, and daily checklists. To assist with assessing the quality and rigor of the research analysis researchers the criteria Lincoln and Guba (1985) proposed: Credibility, Transferability, Dependability, and Confirmability.

Creswell and Miller (2000) further built on these four criteria and created eight procedures that are employed for different types of qualitative research. The verification procedures are: prolonged engagement and persistent observation, triangulation, peer-review, negative case analysis, clarifying researcher bias, member checks, thick description, and external audits. When writing case studies, triangulation and member checking are the two procedures recommended (Anfara. Jr, Brown, Mangione, 2002).

Triangulation involves the researcher finding a theme in the different sources of data and using it as evidence to prove validity in their findings (Creswell, 2013). To assess credibility and confirmability, prolonged engagement was employed, as this study was ongoing since 2013. Findings are triangulated; shown through multiple sources of data, including interviews, daily behavior checklists, discipline reports, and behavior overview. For transferability, researchers used purposeful sampling and provided a thick description of the data. Dependability also relies on triangulation and peer examination. To help with the analysis of the data, it was organized by research question.

Case Study: William

The first research question focused on the relationship between *AutisMate* and William's communication skills. There was a common theme that developed throughout all of the qualitative data gathered. William was the most disruptive in math class. In fact, out of the four incident reports between October 2013 and February 2014, 50% were from math class. Ms. R explained she believed William was "feeling frustrated because he was unable to communicate."

The behavior checklists started three months after the implementation of *AutisMate*. They were created to document whether he was meeting his goals for each class period and make any comments on behavior. The goals were: follow instructions given by all teachers, listen to teacher, and refrain from classroom chattering. William would receive an 'X' if the goal was not met; a percentage was then created at the end of the day to show the amount of good behavior for that day. Figure 1 below shows that William's behavior slowly became better toward the end of May and the beginning of June. However, it was still erratic during the middle of May, and at the end of the *AutisMate* implementation period. Figure 1 also shows that William was following

22

directions 50% or more of the time for 23 days out of the 38 days he was in the behavior classroom.
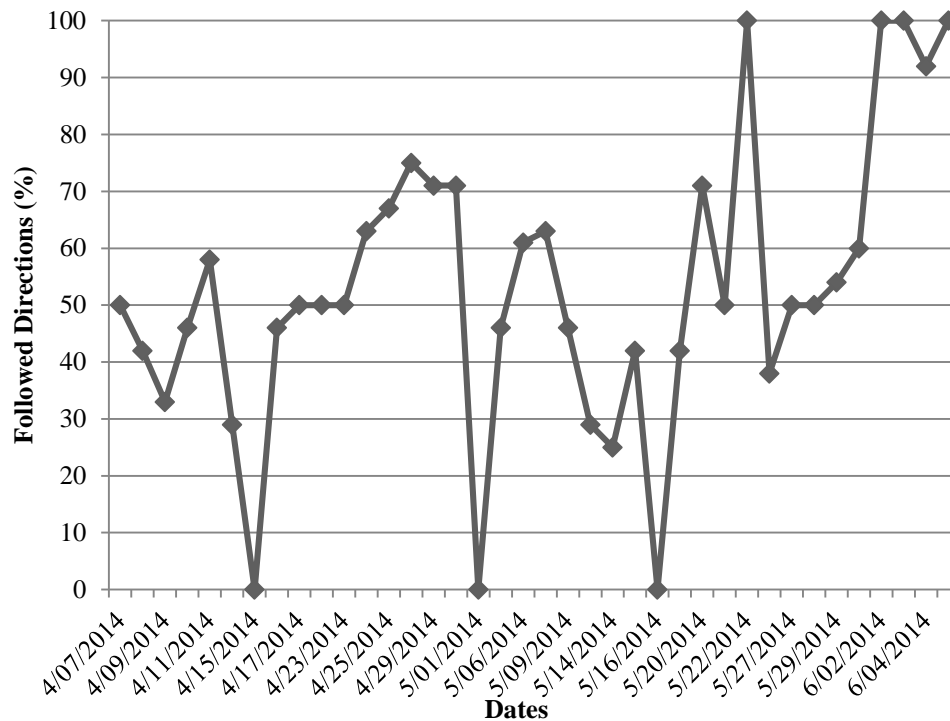

Figure 1. Percentage (%) of Directions Followed Between April and June, 2014

When the researchers asked Ms. R semi-structured interview questions to help initiate the conversation about William's communicative behavior prior to *AutisMate* being introduced, Ms. R explained, "If he did use his words they were not so nice… They were cuss words… [He was] frustrated… Not being able to communicate what he wanted to say." Since *AutisMate* was introduced in the 2013-2014 school years, the researchers asked what had changed. Ms. R revealed that he asked to go to the restroom and his behavior was more independent. She also mentioned that "*AutisMate* helped breakdown [William's day] and create a routine that he could check off." Another common theme throughout the interview was the routine that William was able to abide by and check off, depending on where his location was.

23

The researchers wanted to know how William was with initiating conversations after the implementation of *AutisMate*. This produced further information regarding his communication skills in 2015. William's aide revealed William would only initiate conversation when he needed something. However, as the discussion continued, his Special Education teacher mentioned that William would ask a question with the intention that you will pair it back with a question so he can initiate the conversation or give the answer. The researchers noticed this when he asked "What is a goal?" Ms. R replied, "What is a goal?" To Which William replied "It is a thing that soccer balls go in." Throughout the interview William was sitting by the researchers, his aide, and his teacher. He was initiating conversation about how Ms. R had previously explained and told the researchers information about games he liked on the iPad and the Air Buddy Disney movies.

Table 1 shows that William's Social Communication decreased in the post test compared to the overall group as did Maladaptive Speech. Researcher's view these as positive improvements for William as it shows his responses to social situations had increased. In Table 2, it shows again that William's scores on the Social Communication Questionnaire post-test decreased more in comparison to the overall group. Researchers also view this as a positive improvement because it implied the intervention was working.

Table 1

Pre and Post Scores from the Gilliam Autism Rating Scale

	R.B		S.I		S.C		E.R		C.S		M.S		Autism Index		Percentile Ranking	
Name	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Cole	14	15	12	13	12	12	13	8	11	5	13	10	122	105	93	63
Joe	13	14	14	12	12	12	13	14	5	5	10	11	111	112	77	79
Mark	7	8	9	8	8	8	7	10	11	11	12	11	92	94	30	35
Taylor	7	5	5	3	7	8	5	4	13	14	9	9	80	75	9	5
Tom	11	8	13	13	12	12	13	10	0	0	0	0	116	106	86	65
William	14	7	13	10	11	9	12	8	13	11	17	13	130	97	98	42
Average	10.4	10	10.6	9.8	10.2	10.4	10.2	9.2	8	7	8.8	8.2	104.2	98.4	59	59

Note: R.B – Restricted Behavior, S.I – Social Interaction, S.C – Social Communication,
E.R – Emotional Responses, C.S – Cognitive Style, M.S – Maladaptive Speech

The second research question focused on the application and how it helped promote social skills for William. When the researchers asked about friendship groups or anyone specifically that William was friends with, Mr. S, William's aide explained he has one person who William would consider a friend. The individual "knows how to communicate with William, and [the individual] works well with him." When the researchers wanted to know more about how specifically the application had helped William with his socialization skills, Ms. R described that "*AutisMate* showed the picture of what to do and he was able to check it off [upon completion]." Mr. S added to that, explaining William's behavior had become more independent, even requesting to go to the restroom and going alone.

Table 2

Pre and Post Scores from the Social Communication Questionnaire

Name	Pre	Post
Cole	28	30
Joe	23	16
Mark	19	11
Taylor	0	8
Tom	25	23
William	28	18
Average	19	17.6

William had also shown improvement through taking initiative when joining others for group work. "He doesn't need to be prompted to join groups for group work", explained Mr. S. As the discussion continued, Ms. R told the researchers how William would join the other 6th graders for lunch. Mr. S mentioned that William had recently been walking between two teachers and knew to say "pardon me" when walking by them.

Ms. R said that *AutisMate* helped with the routine of William's day and creating independence. Furthermore, William's score for Social Interaction shown in Table 1 above decreased the most in comparison to the overall group, and in Table 2, his score on the Social Communication Questionnaire decreased more than the overall group.

In addition to the two research questions, analysis of the data led to a serendipitous finding. One theme that emerged was the relationship between William's non-compliant behavior and math. Evidence came from the interview, behavior overview from the aide, and daily behavior checklists. While the researchers did find that William had shown improvement with both his social communication and social interaction skills, the relationship between *AutisMate* and these social skills is not clear. Furthermore, there are many variables to consider besides *AutisMate*. These variables include the aide from the 2013-2014 school years left, William was moved into the behavior classroom in April 2014, many of his non-compliant behaviors were from Math class, and possibly, the beginning stages of puberty.

CHAPTER FIVE

Discussion

The first research question focused on Assistive Technology (AT) and if there was a relationship between *AutisMate* and William's social communication skills. Throughout the interview with Ms. R and Mr. S, researchers found that *AutisMate* helped William become more independent. Ms. R mentioned "[*AutisMate*] helped [William] with his routine… it broke down the routine and he was able to check off the activities." While this is not necessarily a social communication skill, it does allow William to function more easily in the general education classroom as he is less reliant on his teacher and aide. At the time of the interview, William was using his iPad as a reinforcer throughout the day, but Ms. R explained, "He has no scheduling or reward system in place, he knows his own schedule." Both Ms. R and Mr. S saw the lack of scheduling or reward schedule a positive in comparison to where William had been the year prior. William still needed help with his social communication initiation skills. Therefore, there were no conclusive results from the interview showing that *AutisMate* and social communication skills had a relationship.

The second research question looked at whether *AutisMate* promoted modeling social skills to William. Both Ms. R and Mr. S discussed how in the current school year, William had become more open to joining groups. Mr. S said "he is not prompted to participate and has become more social in his [general education] classes." The researchers also found that William will eat with the other 6th grade students on a daily basis in the cafeteria, and has one student whom he would call a friend. However, neither

28

seemed to be linked to *AutisMate,* Both Mr. S and Ms. R believed that it was because he had started to join more general education classes. Mr. S explained, in William's classes, he "raises his hand if he has a question." However, it is also unknown if *AutisMate* played a role in helping this behavior begin or if he had modeled it from other students in the class. While there did seem to be an improvement in behavior overall, the results show that there was no functional relationship between the application and social communication or social interaction skills.

The researchers found no conclusive results to why William's scores changed on both the GARS and SCQ even though there was a difference between his scores and the overall group. Researchers could assume that it was due to varying factors. These being: the campus, such as the school context, relationship with the aide, and amount of time spent in the general education classroom, *AutisMate* such as the tasks William was required to complete or the videos and pictures that had been used to teach William, and puberty. William was placed in the behavior classroom in April, close to the end of the research period. Therefore, when his teacher first completed the Gilliam Autism Rating Scale and Social Communication Questionnaire in January, she could have been basing it off his non-compliant behaviors within that particular time period. Close to 5 months later, William had been in the behavior classroom for over a month, this could have affected his scores on the final GARS and SCQ.

Furthermore, many of William's non-compliant behaviors that were recorded came from his math class. Ms. R and Mr. S both mentioned that "math is the most challenging" however, there was no mention that William had received extra help in this area with regard to tutoring or using *AutisMate* to help increase compliant behaviors in the class. Another factor that could have played a large role in William's behavior change

29

from the 2013-2014 school years to the current school year was that his 2013-2014 aide left. He was disrespectful toward the aide, showing physical aggression multiple times, and was noncompliant when she asked him to complete particular tasks. *AutisMate* was not used in this situation either to help decrease the noncompliant behavior.

Research has shown that video modeling on tablets and iPads can lead to independence as it teaches skills that focus directly on the relevant information the student with ASD should learn. Furthermore, when the student is engaged with the video that is usually modeled by a professional or peer, there is little need for adult prompting and interaction (Hume, Loftinm & Lantz, 2009). Ms. R. explained in the interview that William "got the hang of [his routine], and stopped using [the application]." It has been found that visual schedules on iPods allow predictability and sequence day-to-day tasks (Milley & Machailicek, 2012). However, while the ultimate goal is to have the student be less reliant on prompts from the teacher, video modeling on such applications like *AutisMate* can continually be used to help target other behaviors such as task engagement or challenging behaviors.

Ms. R felt the *AutisMate* application is excellent for students who may be non-verbal or need help with their communication skills such as William did. Ms. R appreciated how the pictures and videos were of "real things" in the student's environment, and were "not generic, like the Board Maker application". However, after William "got the hang of it [his schedule]" they stopped using the application. Instead of stopping use of the application, Ms. R could have helped William work on his social interaction or social communication skills, such as how he initiates conversation.

AutisMate is similar to other applications on the market such as Our Story. It is open-ended in a way that allows it to be used in many different circumstances, and target

specific behaviors (Kucirkova et al., 2014). Teachers can use the video modeling technology to follow the students' sequence of events throughout the day with a specific focus on helping increase social skills and communication (Cafiero, 2012).

Puberty is a smaller factor that could have played another role in the non-compliant behavior. According to Zacharin (2009) the onset of puberty in normal developing boys is between 9 to 14 years old. Often, when there is a disturbance of brain function puberty can start earlier, however it is less likely to occur in boys. William was 12 years old while the study was being conducted, and that age would have put him right in the midst of starting stages of puberty. Research shows that co-morbid behaviors such as irritability and hyperactivity are usually evident in people with ASD during adolescence but have been found to decrease in adulthood (Anderson, Maye & Lord, 2011). Furthermore, the development of social skills do increase in youths with ASD however, they may be slower when compared to typically developing children of the same age (Anderson, Maye, & Lord, 2011). This is why applications such as *AutisMate* are important tools for providing continual support for the social interaction and social communication skills development in students with ASD.

Last, the research conducted both in the initial study and the follow-up case study would help lead a larger project for future research. An example could be using *AutisMate* for targeting specific behaviors, using Applied Behavioral Analysts in a controlled home or school environment. The limitations such as the relationship between William and his aide, his move to the behavior classroom toward the end of the study, and puberty are all elements that are often difficult to control. However, William's lack of compliant behavior in math and the lack of behavioral checklists early on in the study could have been controlled for.

The findings of this study were context-dependent; it is difficult to generalize the findings to a larger group when the sample size was small. Case studies are used to when studying a new or contemporary issue in a real life context (Yin, 2003) which is what this study aimed to look at. The researchers offered evidence that applications such as *AutisMate* can be a valuable part of helping students with ASD become more independent when transitioning to a general education classroom.

REFERENCES

10 Things to Know About New Autism Data. (2014, March 31). Retrieved April 17, 2015, from http://www.cdc.gov/features/dsautismdata/index.html

Anderson, D., Maye, M., & Lord, C. (2011). Changes in Maladaptive Behaviors From Midchildhood to Young Adulthood in Autism Spectrum Disorder. *American Journal on Intellectual and Developmental Disabilities,* 381-397.

Anfara, V., Brown, K., & Mangione, T. (2002). Qualitative Analysis on Stage: Making the Research Process More Public. *Educational Researcher,* 28-38.

Apple. (n.d.). Retrieved April 25, 2015, from https://support.apple.com/en-us/HT202612

AutisMate365 a comprehensive app for autism. (n.d.). Retrieved April 17, 2015, from http://autismate.com/AutisMate-Comprehensive-App-For-Autism/

AutisMate 365. (2015). Retrieved June 4, 2015, from https://itunes.apple.com/us/app/autismate-365/id891057952?mt=8

AutisMate. (2015). Retrieved June 4, 2015, from https://play.google.com/store/apps/details?id=com.specialneedsware.autismate365&hl=en

AutisMate: The iPad App for Autism. (2015). Retrieved June 5, 2015, from https://www.autismspeaks.org/autism-apps/autismate-ipad-app-autism

AutisMate. (2015, January 6). *AutisMate Success Story: "T" Is Building Independence with AutisMate.* [Video file]. Retrieved from http://www.youtube.com/watch?v=XU108CH3sH4

Autism, Routines and Resistance to Change. (2014). Retrieved June 5, 2015, from http://www.autism.org.uk/Living-with-autism/Understanding-behaviour/Obsessions-repetitive-behaviours-and-routines/Routines-and-resistance-to-change.aspx

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Boyd, B., & Shaw, E. (2010). Autism in the Classroom: A Group Of Students Changing In Population And Presentation. *Preventing School Failure: Alternative Education for Children and Youth, 54*(4), 211-219.

Brown, A., & Elder, J. (2014). Communication in Autism Spectrum Disorder: A guide for Pediatric Nurses. *Pediatric Nursing, 40*(5), 219-219.

Cafiero, J. (2012). Technology Supports for Individuals with Autism Spectrum Disorders. *Journal of Special Education Technology, 27*(1), 64-76.

Center for Disease Control and Prevention. (2012). Prevalence of Autism Spectrum Disorders — Autism and Developmental Disabilities Monitoring Network, 14 Sites, United States, 2008. *Surveillance Summaries, 61*(3), 1-24.

Charlop, M., Dennis, B., Carpenter, M., & Greenberg, A. (2010). Teaching Socially Expressive Behaviors To Children With Autism Through Video Modeling. *Education and Treatment of Children, 33*(3), 371-393.

Cihak, D., Smith, C., Cornett, A., & Coleman, M. (2012). The Use of Video Modeling With the Picture Exchange Communication System to Increase Independent Communicative Initiations in Preschoolers With Autism and Developmental Delays. *Focus on Autism and Other Developmental Disabilities, 27*(1), 3-11. doi:10.1177/1088357611428426

Creswell, J. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.). Thousand Oaks, California: Sage Publications.

Creswell, J., & Miller, D. (2000). Determining Validity in Qualitative Inquiry. *Theory Into Practice, 39*(3), 124-130.

Deckers, A., Roelofs, J., Muris, P., & Rinck, M. (2014). Desire for Social Interaction in Children with Autism Spectrum Disorders. *Research in Autism Spectrum Disorders, 8*(4), 449-453.

Diagnostic and statistical manual of mental disorders: DSM-5. (5th ed.). (2013). Washington, D.C.: American Psychiatric Association.

Flanagan, S., Bouck, E., & Richardson, J. (2013). Middle School Special Education Teachers' Perceptions and Use of Assistive Technology in Literacy Instruction. *Assistive Technology, 25*, 24-30.

Flores, M., Faciane, L., Edwards, M., Tapley, S., & Dowling, S. (2014). The Apple iPad as Assistive Technology for Story-based Interventions. *Journal of Special Education Technology, 29*(2), 27-37.

Ghuman, J., Leone, S., Lecavalier, L., & Landa, R. (2011). The screen for social interaction (SSI): A screening measure for autism spectrum disorders in preschoolers. *Research in Developmental Disabilities, 32*, 2519-2529.

Gilliam, J. (2014). *Gilliam autism rating scale: Examiner's Manual* (3rd ed.). Austin, TX: Pro-Ed.

Guldberg, K. *Technology Enhanced Learning for Pupils with Autism* [PDF document]. Retrieved from Open Education Blackboard Web site: https://commons.swinburne.edu.au/file/9d8b1fbb-66b1-4275-8adc-965f78ea11b5/1/autism-mooc-tech-enhanced-learning.pdf

Hamilton, L. (2011) Case studies in educational research. *British Educational Research Association on-line resource*. Available on-line at [file:///C:/Users/Nat/Downloads/Cha%201%20-%20Case%20studies%20in%20educational%20research.pdf] Last accessed [5/28/2015]

Hume, K., Loftin, R., & Lantz, J. (2009). Increasing Independence in Autism Spectrum Disorders: A Review of Three Focused Interventions. *Journal of Autism and Developmental Disorders,* 1329-1338.

IDEA - Building the Legacy of IDEA 2004. (n.d.). Retrieved April 17, 2015, from http://idea.ed.gov/explore/home

King, A., Thomescek, M., Voreis, G., & Scott, V. (2014). IPad use in children and young adults with Autism Spectrum Disorder: An Observational Study. *Child Language Teaching and Therapy, 30*(2), 159-173.

Kuenssberg, R., Mckenzie, K., & Jones, J. (2011). The association between the social and communication elements of autism, and repetitive/restrictive behaviors and activities: A review of the literature. *Research in Developmental Disabilities, 32*, 2183-2192.

Kucirkova, N., Messer, D., Critten, V., & Harwood, J. (2014). Story-Making on the iPad When Children Have Complex Needs: Two Case Studies. *Communication Disorders Quarterly, 36*(1), 44-54. doi:10.1177/1525740114525226

Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry*. Beverly Hills, Calif.: Sage Publications.

Macpherson, K., Charlop, M., & Miltenberger, C. (2014). Using Portable Video Modeling Technology to Increase the Compliment Behaviors of Children with Autism during Athletic Group Play. *Journal of Autism and Developmental Disorders*.

Mautone, M. (2013). Integrating the iPad into the ASD Classroom. *New Jersey Education Association Review, 86*, 28-29.

Merriam, S. (1998). *Qualitative Research and Case Study Applications in Education*. San Francisco, California: Jossey-Bass.

Hume, K., Loftin, R., & Lantz, J. (2009). Increasing Independence in Autism Spectrum Disorders: A Review of Three Focused Interventions. *J Autism Dev Disord Journal of Autism and Developmental Disorders,* 1329-1338.

Miltenberger, C., & Charlop, M. (2014). Increasing the Athletic Group Play of Children with Autism. *Journal of Autism and Developmental Disorders, 44*(1), 41-54. doi:10.1007/s10803-013-1850-7

Oosterling, I., Rommelse, N., Jonge, M., Gaag, R., Swinkels, S., Roos, S., . . . Buitelaar, J. (2010). How useful is the Social Communication Questionnaire in toddlers at risk of autism spectrum disorder? *Journal of Child Psychology and Psychiatry, 51*(11), 1260-1268. doi:10.1111/j.1469-7610.2010.02246.x

Ormrod, J. (2014). Social Cognitive Theory. In *Human Learning* (7th ed.). Pearson.

Rodríguez, C., Strnadová, I., & Cumming, T. (2014). Using iPads With Students with Disabilities: Lessons Learned from Students, Teachers, and Parents. *Intervention in School and Clinic, 49*(4), 244-250.

Rutter, M., Bailey, A., & Lord, C. (2003). *The Social Communication Questionnaire: Manual*. Los Angeles, CA: Western Psychological Services.

Schrandt, J., Townsend, D., & Poulson, C. (2009). Teaching Empathy Skills to Children with Autism. *Journal of Applied Behavior Analysis, 42*(1), 17-32.

Shane, H., Laubscher, E., Schlosser, R., Flynn, S., Sorce, J., & Abramson, J. (2012). Applying Technology to Visually Support Language and Communication in Individuals with Autism Spectrum Disorders. *Journal of Autism Development Disorders, 42*, 1228-1235.

Scholz, R., & Tietje, O. (2002). Types of Case Studies. In *Embedded case study methods: Integrating quantitative and qualitative knowledge* (pp. 9-15). Thousand Oaks, California: Sage Publications.

The Social Communication Questionnaire (SCQ). (n.d.). Retrieved June 6, 2015, from http://iancommunity.org/cs/ian_research_questions/social_communication_questionnaire_scq

Starr, E., & Foy, J. (2012). In Parents' Voices: The Education of Children with Autism Spectrum Disorders. *Remedial and Special Education, 33*, 207-216.

Talbert, T. (Director) (2014, January 1). In-depth Discussion on Case Study Design. Lecture conducted from, Waco.

Trembath, D., Balandin, S., Togher, L., & Stancliffe, R. (2009). Peer-mediated Teaching And Augmentative And Alternative Communication For Preschool-aged Children with Autism*. *Journal of Intellectual and Developmental Disability, 34*(2), 173-186.

What Is Autism? (n.d.). Retrieved April 25, 2015, from https://www.autismspeaks.org/what-autism

Wong, C., & Kasari, C. (2012). Play and Joint Attention of Children with Autism in the Preschool Special Education Classroom. *Journal of Autism and Developmental Disorders, 42*, 2152-2161.

Yin, R. (2014). *Case Study Research: Design and Methods* (5th ed.). Thousand Oaks, California: SAGE Publications.

Zacharin, M. (200). Puberty, Contraception, and Hormonal Management for Young People With Disabilities. *Clinical Pediatrics,* 149-155.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan, 9*, 2-6.