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

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Abstract

The study examines the effectiveness of the iPad application *AutisMate* in promoting the modeling of social communication and social interaction skills in a 12 year-old boy with Autism Spectrum Disorder (ASD). The study uses a single-subject, embedded, case study design. It calls attention to the use of assistive technology in school settings for students with Autism Spectrum Disorder. The themes explored are the participant's independence, his social communication skills, and social interaction skills. A late theme was the participant's 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 boy's social interaction and communication skills.

Keywords: assistive technology, autism, ASD, *AutisMate*, social communication

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

Autism Spectrum Disorder (ASD) is an extremely multifaceted brain-based disorder defined by the Individuals with Disabilities Education Act (2004) as a developmental disability 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, 2013). ASD is most frequently diagnosed before the age of three. 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, difficulty with social communication, and restricted behaviors (Saulnier & Ventola, 2012).

Use of Technology and Children with Autism Spectrum Disorder

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). For this reason, technology-based activities often have a

strong appeal to persons with ASD and can come in a variety of forms (Cafiero, 2012). Assistive Technology (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 marked increase in the use of tablets and iPads, many researchers have found them as a resource that can help the social communication, language, and literacy skills in children with ASD (Trembath. al., 2009; Charlop, Dennis, Carpenter, & Greenberg, 2010; Flanagan, Bouck, & Richardson; Shane et al., 2012). In most cases, the technology has applications that can be downloaded to assist in education (Rodriguez, Strnadova & Cumming, 2013). The devices can also increase participation in classroom activities and help students learn academic skills (King, Thomezcek, Voreis, & Scott, 2014).

Literature shows that 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).

AutisMate

AutisMate (2013) is one technology application that aims to help boost the social skills of individuals with ASD. 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 list of chores, he or she sees that 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. The *AutisMate* application cueing helps the student gain independence as they complete tasks with no adult cueing or prompting (*AutisMate*, 2014). 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 using large 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 VSDs do not require language skills and use simple symbols for communication.

AutisMate is similar to other applications on the market such as *Our Story*. *AutisMate* 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).

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. The photos and videos from the students' environment are useful as they help maintain 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.

Qualitative research analyzes information conveyed through verbal and behavioral content in natural settings (Lincoln & Guba, 1985). It can capture information about beliefs, feelings, and motivations that underlie behaviors (Crabtree & Miller (1992). 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. The current study focuses on technology and the relationship between *AutisMate* and social communication skills in a young boy with ASD. The purpose of this study was to examine the use and effectiveness of the *AutisMate* application. 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).

Methodology

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. In order to protect the identities of the participants, the names have been changed. The case study participant has been given the pseudonym William. Teachers completed the Gilliam Autism Rating Scale, 3rd edition (Gilliam, 2013) and the Social Communication Questionnaire (Rutter et al., 2003) in January and May. From these scores, researchers located the student with 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 whether *AutisMate* played a role in the increase in functional communicative behaviors.

Research Design

Qualitative research seeks to gain a deeper understanding of a situation or event by using observation in a natural setting (Creswell, 2013). In accordance with the authors' desire to gain insight into the potential benefits of *AutisMate*, the data were collected in a natural setting, the classroom, and was considered sensitive to the students and teachers involved. 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 an independent school district in Central Texas were enrolled using purposive criterion-based sampling with referrals from special education teachers. School personnel chose students who had previously been diagnosed with ASD and who were currently using or had the ability to use an iPad. All students were between the ages 5 and 22 years of age. 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 benefit 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 an aide with him at all times.

Case Study Participant

Before the study began, the subject's behavior was examined using behavior reports completed by the previous aide. His behavior was characterized as somewhat abnormal. These behaviors were very physical, such as hitting other children, hitting and scratching his aide, and throwing a variety of items from computers to waste baskets. Some of these behaviors were so extreme that 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 met expectations including: a) not arguing with the teacher, b) obeying requests, or c) completing all his work. He was then able to receive rewards using the number of stickers he had accumulated. This strategy worked for a short amount of time and then the fascination for the intervention 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. Overall, William's grades were suffering, and his behaviors were worrying both the teachers and administration.

Data Collection

Data were collected through a variety of measures. For the quantitative strand, the scores from the Gilliam Autism Rating Scale, GARS-3 (Gilliam, 2013) and Social Communication Questionnaire, SCQ (Rutter et al., 2003) were gathered for both William and a comparative group. Behavior reports for the previous school year were collected from the counselor on campus. The counselor also gave a yearly overview of participant behavior that the former aide had written from the previous year. Interviews with William's teacher and William were conducted approximately one year after the study ended. The interviews took place in the special education classroom with William with his teacher and aide present. Finally, daily behavior checklists from the current school year were obtained from William's special education teacher. He was expected to follow instructions given by all teachers, listen to his 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. All data were considered confidential and were stored in the appropriate manner.

Measures

GARS-3. 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 ASD in the DSM-V. It is used for people between the ages 3 and 22 years. 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 the 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. 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 of America's (2012) definition of 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)

SCQ. 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 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 and is not scored. If the child is non-verbal, six items are omitted. When the combined scores are 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 that the current DSM V does. The Social Communication Questionnaire has internal consistency scores ranging from .85 to .93 (Rutter, Bailey, & Lord, 2003). Findings of psychometric analyses (Rutter, Bailey, & Lord, 2003) indicate that individual children are reliably measured by the SCQ Total Score and that as a screening questionnaire, the SCQ provides a reasonable index of symptom severity.

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.

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 most 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.

Results

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 early school years, his aide recalls that he was compliant and obedient. However, in the current year, there is documentation of William's first incident report. The report was from the school bus driver and aide, who stated that William had disobeyed his aide's instruction. Following this, there were three other incident reports documented. 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. William was placed in the behavioral classroom. A follow up interview was recorded. In the 6th grade, the student was 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.

Analysis

The initial analysis of the data was conducted by reading through the information that had been gathered, and the interviews with the teachers and aides. 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 did 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? The main themes that were discussed throughout the interviews centered on William's independence, social communication skills, and social interaction skills. Furthermore, how had these themes developed since *AutisMate* was introduced?

The data were collected from two primary sources, archival information and the interviews with William, his aide, and special education teacher. Archival information included referral feedback forms, previous overviews from William's aide at the time, and daily checklists. To assist with assessing the quality and rigor of the research analysis, Lincoln and Guba (1985) proposed an emphasis on: 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 include: 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 over a few years. 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.

There was a common theme that developed throughout the qualitative data gathered. William was most disruptive in math class. In fact, out of the four incident reports of the year prior to data collection, 50% were from math class. The aide explained she believed William was "feeling frustrated because he was unable to communicate."

The behavior checklists were introduced three months after the implementation of *AutisMate*. They were created to document whether William was meeting his goals for each class period and to document specifics of behavioral observations. Some examples of 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 number of good behaviors 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 directions 50% or more of the time for 23 days out of the 38 days he was in the behavior classroom.

Figure 1

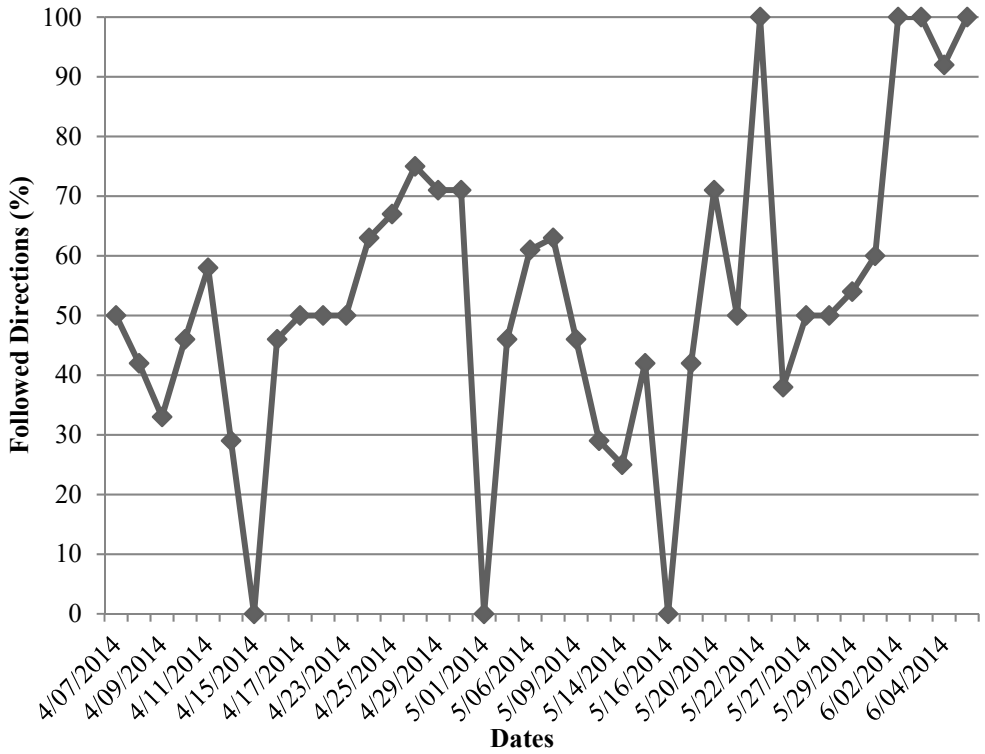

Figure 1. Percentage (%) of Directions Followed Between April and June, 2014

When the researchers asked semi-structured interview questions to help initiate the conversation about William's communicative behavior prior to *AutisMate* being introduced, the interviewee 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, the researchers asked what had changed. It was revealed that he asked to go to the restroom and his behavior was more independent. In addition, the interviewee stated "*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 was not dependent upon being in the classroom. *AutisMate* helped William in other locations as well. For example, on the bus or in the cafeteria at lunch.

The researchers wanted to determine 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?" the aide 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 his teacher 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 and Maladaptive Speech decreased in the post-test compared to the overall group. Researchers view these as positive improvements for William as it shows his responses to social situations had increased. Table 2 shows that William's scores on the Social Communication Questionnaire post-test decreased more in comparison to the overall group. This indicates that William responded in a positive way and the intervention was effective.

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 with whom William is a friend, William's aide explained he has one person whom 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, his teacher described that "*AutisMate* showed the picture of what to do and he was able to check it off [upon completion]." The aide added to that, explaining William's behavior had become more independent, even requesting to go to the restroom and going alone.

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 the teacher. As the discussion continued, the aide told the researchers how William would join the other 6th graders for lunch. The teacher mentioned that William had recently been walking between two teachers and knew to say, "Pardon me" when walking by them. The aide said that *AutisMate* helped with the routine of William's day. William's independence increased as he relied less on adult prompting and cueing and more on the *AutisMate* cueing. Furthermore, William's score for Social Interaction shown in Table 1 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.

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

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 improvements 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 previous school years left, the fact that 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. *AutismMate* appeared to improve his social and communication skills and was considered an effective intervention for William.

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 interviews, researchers found that *AutisMate* helped William become more independent. Comments included: "[*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 the aide explained, "He has no scheduling or reward system in place, he knows his own schedule." Both interviewees saw the lack of scheduling or reward schedule to be 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 interviewees discussed how in the current school year, William had become more open to joining groups. The teacher 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 seemed to be linked to *AutisMate*. Both teacher and aide believed that it was because he had started to join more general education classes. The teacher 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 the SCQ even though there was a difference between his scores and the overall group. Researchers could assume that it was due to varying factors which might include the following: 1) the campus and school context, 2) William's relationship with the aide, 3) the amount of time spent in general education classrooms, 4) *AutisMate* and the tasks William was required to complete or the videos and pictures that had

been used to teach William, and 5) 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 GARS and SCQ 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. Those interviewed 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 increase compliant behaviors in class. William 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 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. Video based instruction has been shown to be effective and is frequently used with additional response prompting systems (Bennett et al., 2017). William's aide 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.

Findings in this study do not necessarily indicate that *AutisMate* might change verbal behavior. However, the teacher's aide felt the *AutisMate* application is excellent for students who may be non-verbal or need help with their communication skills such as William did. The aide appreciated how the pictures and videos were of "real things" in the student's environment, and were "not generic, like the Board Maker application".

Puberty is a 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 increases in youth with ASD however, youth with ASD may be slower when compared to typically developing children of the same age (Anderson, Maye, & Lord, 2011). This is why further research is needed on how we can help provide support for social communication skill development in children 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 Behavior Analysis 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 were 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 when studying a new or contemporary issue in a real life context (Yin, 2003). 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. Future research is needed to control conditions where the application is used to help determine if it could help in a specific situation. Furthermore, future research should focus on a larger group of special education students to see how the app helps students who have transitioned

This study examined the effectiveness of the iPad application *AutisMate* in promoting the modeling of social communication and social interaction skills. It used a single-subject, embedded, case study design. Assistive technology in school settings for students with Autism Spectrum Disorder can be effective. However, there were no conclusive results that *AutisMate* had a relationship with William's social interaction and communication skills in this particular case. The themes explored are the participant's independence, his social communication skills, and social interaction skills. A late theme was the participant's 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. Utilizing applications on IPads and other forms of technology may not lead to what the application claims, however, further research on a large sample size is needed to ensure that William is not the outlier for the use of this particular application.

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

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

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

Crabtree, B.F. & Miller, W.L. (1992) *Doing Qualitative Research.* Newbury Park, CA: Sage Publications.

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.

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.

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

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. (2008). Puberty, contraception, and hormonal management for young people with disabilities. *Clinical Pediatrics, (48)*2, 149-155.
Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan, 9*, 2-6.

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