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Factors Related to Successful Implementation of an AAC Device for an Individual With Autism

Michaela Worms
wormsmi@mnstate.edu

Factors Related to Successful Implementation of an AAC Device for an Individual With Autism

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Michaela Rae Worms

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Thesis Abstract

Communication impairment is a defining characteristic of autism spectrum disorder (ASD) (American Psychiatric Association, 2013); therefore, the use of augmentative and alternative communication (AAC) has become an essential part of language intervention for children with autism that experience significant difficulties with communication (Flores et al., 2012). Assessing children's preferences for AAC options may be important with respect to AAC abandonment, which is a problem in the AAC field (Johnson, Inglebret, Jones, & Ray, 2006). This single-subject study identified factors related to successful implementation, acquisition, and usage of an AAC system. The clinician collected baseline data on the client's spontaneous production of functional and meaningful communicative attempts and subsequent sessions were used to document changes following the implementation of the participant's particular reinforcers and miscellaneous factors. When implementing factors, the number of overall successful communicative attempts increased.

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Introduction

According to the American Speech and Hearing Association (ASHA), autism spectrum disorder (ASD) is a "neurodevelopmental disorder characterized by deficits in social communication and social interaction and the presence of restricted, repetitive behaviors" (2016, para. 1). Children with ASD represent a large and growing group of pediatrics in the United States. The most recent data from the Center for Disease Control (CDC) estimates that one in 68 children have been identified with autism spectrum disorder, which is a 78 percent increase in just six years (2014). Autism is a complex developmental disorder that generally presents in early childhood. Autism impacts a person's ability to successfully access and participate in life activities at home, in educational settings, workplace settings, and community activities (Trembath, Iacano, Lyon, & Johnson, 2014). Characteristics of autism include atypical development in several areas such as socialization, communication, and restricted and repetitive behaviors. Communication impairment is a defining characteristic of autism (American Psychiatric Association, 2013). The acquisition of effective communication skills is therefore an important intervention priority for individuals with autism spectrum disorder and severe communication impairments. Intervention may focus on the establishment of a viable augmentative and alternative communication system (Waddington, 2014).

The use of augmentative and alternative communication (AAC) has become an essential part of language intervention for children with developmental disabilities, including autism, who experience significant difficulties with communication and social skills (Flores et al., 2012). AAC includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. All individuals use

AAC when making facial expressions or gestures, use symbols, pictures, or write. People with speech and language deficits depend on AAC to supplement their existing speech or replace the speech they have that is not functional (ASHA, 2015).

AAC is increasingly incorporated into recommendations for children with ASD to improve communication. AAC is an area of clinical practice that accommodates for the impairment patterns of individuals with severe communication disorders (Beukelman & Mirenda, 2005). Current AAC devices address a wide variety of needs that consumers have expressed. The goal of AAC is to achieve independence for the client. AAC interventions have been shown to improve both communication and social skills in children with ASD and other developmental disorders (Wood, 2004). Implementing a means of communication for individuals with autism can help to improve their quality of life; however, little research exists regarding implementing modes of communication in a motivating manner.

AAC device abandonment appears to be a common problem in the AAC field (Johnson, Inglebret, Jones, & Ray, 2006). Motivation is an important factor when implementing augmentative and alternative communication. Motivation is a relationship between environmental variables and their effect on an individual's behaviors. Motivation plays a significant role in the development and acquisition of language in typically developing children. Like other skill acquisition programs for children with ASD, the intervention techniques try to use a child's preferences in the form of reinforcers or consequences for desirable behavior when implementing a treatment procedure for increasing conversational skills. This is typically achieved by offering preferred edible or leisure items contingent on the child's behavior (Agarwal, 2012).

Addressing motivation is important when designing interventions for children with ASD. Literature suggests that children with various intellectual and developmental disabilities are extremely unmotivated, especially in situations when demands are placed. This lack of motivation can hinder the development of communication and it becomes increasingly important to incorporate the motivation of children with autism within the design of the treatment procedure (Agarwal, 2012).

In order to add to the body of research addressing successful implementation of AAC with children who have autism, this single-subject study examined how different factors and motivators affect the acquisition and usage of AAC for an individual with autism. This project was designed to answer the following research question: "What factors facilitate the acquisition and usage of AAC for a client with autism spectrum disorder?"

Chapter 2

Literature Review

The purpose of this literature review was to view the results of previously conducted studies and published articles in the areas of autism and the implementation of augmentative and alternative communication (AAC). The literature review will help provide insight into the important factors of implementing AAC for individuals with autism.

Autism Spectrum Disorder

According to the American Speech and Hearing Association (ASHA), "Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and social interaction and the presence of restricted, repetitive behaviors" (2016, para. 1). Children with autism spectrum disorder represent a large and growing group of pediatrics in the United Sates (CDC, 2014). The most recent data from the CDC estimates that one in 68 children have been identified with autism spectrum disorder (2014), which is a 78 percent increase in just six years (CDC, 2014). Autism is a complex developmental disorder that generally presents in early childhood. Autism influences a person's ability to successfully access and participate in life activities at home, in educational settings, workplace settings, and community activities (Trembath et al., 2014). Autism is typically diagnosed on the basis of behavioral symptoms and no single cause has been identified. Data suggests that autism results from several factors such as environmental, neurobiological, and genetic. All individuals with autism are unique. Individuals with autism can have abilities ranging from significant cognitive and

communication impairments to exceptional abilities. Regardless of severity, autism impacts several aspects of an individual's life (Trembath et al., 2014).

Characteristics of autism include uncharacteristic development in several areas such as difficulties with socialization, communication, and the existence of restricted and repetitive behaviors (American Psychiatric Association, 2013). Communication impairment is a defining characteristic of autism. Communication is the process of exchanging information in different forms with different people. It is not limited to language but includes non-verbal communication and understanding of symbols. Essentially, communication is decoding a message being sent and being able to code a message for others. The process is very complex; however, it happens very quickly. Communication requires being fully engaged during the interaction, carefully listening, sharing emotions, and reciprocal exchange of information. These continued interactions with peers and adults contribute to language development (Noens & van Berckelaer-Onnes, 2004).

Individuals who have developmental disabilities, including those with autism, often present with deficits in: communication, understanding language, play, social situations, and relating to others (Lindsey-Glenn & Gentry, 2008). Deficits in language development experienced in children diagnosed with ASD include delays in saying single words, labeling or naming objects in their environment, comprehending several words and phrases spoken by conversation partners, and developing vocabulary (American Psychiatric Association, 2013). Charlop and Haymes work from 1994, as cited by Waddington et al. (2014), stated that an estimated 25 to 30 percent of individuals with autism develop sufficient speech to meet their everyday communication needs. Children

diagnosed with ASD who develop functional communication often display atypical communication styles that are not appropriate for social communication. These children often have the vocabulary and even have memorized the syntax to pass standardized language screenings, but they struggle in real world communication settings because they lack true understanding of the meaning (Tager-Flusberg et al., 2009).

The severe level of communication impairment found among individuals with ASD has been implicated in the emergence and maintenance of problem behaviors, such as self-injury, aggression, and tantrums. Behaviors can be the result of change in the environment, lack of social interaction, and repetition of particular activities in children with autism. The acquisition of effective communication skills is therefore an important intervention priority for individuals with autism spectrum disorder and severe communication impairments are often focused on the establishment of a viable augmentative and alternative communication system (Bott, Farmer, & Rohde, 1997).

Augmentative and Alternative Communication

The use of augmentative and alternative communication (AAC) has become an essential part of language intervention for children with developmental disabilities, including autism, who experience significant difficulties with communication and social skills (Flores et al., 2012). AAC includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. We all use AAC when we make facial expressions or gestures, use symbols, pictures, or write. People with speech and language deficits may depend on AAC to supplement their existing speech or replace the speech they have that is not functional (ASHA, 2015).

Augmentative and alternative communication is increasingly incorporated into recommendations for children with ASD to improve communication. AAC is an area of clinical practice that compensates for the impairment and disability patterns of individuals with severe communication disorders (Beukelman & Mirenda, 2005). The newest AAC devices address a wide variety of needs that consumers have expressed. The goal of AAC is to achieve independence for the client (Wood, 2004). In addition, AAC supports comprehension and reduces anxiety among the individuals while helping their communication partners understand and better respond to persons with speech and language impairments (Trembath et al., 2014). AAC can be an important support for inclusion and participation in school, employment, and community settings for individuals with complex communication needs, including those with ASD. It is important that individuals have access to their AAC system in all environments to best allow them to participate in conversation in their various surroundings. Augmentative and alternative communication interventions have been shown to improve both communication and social skills in children with ASD and other developmental disorders (Sennot & Bowker, 2009)

There are many different forms of AAC. Regardless of the type of AAC, individuals with ASD should have access to it at all times (Brown & Elder, 2014). Most people with ASD have the ability to walk without assistance, which means their AAC device should be portable, durable, and lightweight (Sennot & Bowker, 2008). In addition, AAC should be a familiar, fun, flexible, and structured piece of equipment that fits the individual's learning style (Checkley, Hodge, Chantler, Reidy, & Holmes, 2010). AAC can be as unsophisticated as a small chalkboard (Brown & Elder, 2014), or can be

considered high-tech with changing screens based on selections made. High-tech devices have a greater potential for personal impact. High-tech AAC devices are more able to provide the satisfaction of more than just wants and needs (Checkley et al., 2010). Advancements in technology have made AAC more available to individuals because less expensive options are available (Sennot & Bowker, 2009).

AAC has the potential to help individuals with ASD who struggle with complex problem behaviors. AAC has the capability to inform the individual when there are changes to routine and allow them to communicate their opinion about the change. In addition, individuals highlight the valuable role that AAC can play in meeting individual wants and needs, reducing frustration and anxiety, increasing independence, and enhancing social engagement and interaction with others (Bott, Farmer, & Rohde, 1997). Regardless of the type of AAC, individuals with ASD should always have access to their mode of communication to avoid tantrums, meltdowns, and problem behaviors (Brown & Elder, 2014).

There is not one augmentative and alternative communication tool that universally works for all individuals. The type of system does not affect the rate at which the client will learn to use the device; instead, students may have individual preferences for specific types of AAC systems (Flores et al., 2012). The characteristics of ASD are so varied that each individual case must be evaluated and appropriate interventions must be planned. Technology can help the student to become an independent and productive member of society (Simmons, 2013). When considering implementing AAC, it is important to first be sure the tool meets the needs of the individual (Wood, 2004). A wide range of AAC devices are used to meet the diverse needs of individuals with ASD who have difficulty

using natural speech to meet their daily communication needs (Sennot & Bowker, 2009). After considering the needs of the client, it is also important to consider how developmentally ready they are to use particular communication tools. Attention, memory, and sensory issues can impact the implementation of AAC tools (Sherlock, 2011).

Implementing Augmentative and Alternative Communication

Simply providing communication aids is not enough. Supporting communication through AAC must also occur with consideration of barriers relating to organizational policies and practices as well as the knowledge, skills, and attitudes of all key stakeholders (Trembath et al., 2014). With systematic instruction, children with ASD and severe communication impairments can learn to use a low-tech communication system or a high-tech communication system, such as an iPad-based device or dedicated device, to complete multistep communication sequences that involve requesting and social communication functions (Waddington et al., 2014). Knowledge of what strategies parents or caregivers have used successfully to manage outbursts can be useful in implementing AAC. Language used when implementing AAC should have direct and basic sentence structure without metaphors, slang, analogies, and exaggerations. It is also imperative not to assume that non-verbal children with ASD cannot understand any language; thus, individuals should attempt to communicate, even if there is no indication that the child understands. Literature exists of persons who gained communication function after many years and have shared their experience of being treated as if they could not understand language simply because they could not express themselves (Brown & Elder, 2014). The successful integration of an AAC system into a child's life requires

commitment and constant support from parents and other family members. In addition, it is important to take into account the motivation of the individual and the awareness of the perspective communication partners. Sensitive, personalized, and environment-based approaches together with positive attitudes can lead to the successful implementation of AAC systems. Children respond best to approaches that are linked to interests and a relationship to what others value. Sustained and consistent family and professional support make implementation successful (Sherlock, 2011).

Often, the first step in implementing a device is teaching how to request access to preferred items and activities. These types of requesting skills are early emerging communication functions that have a direct benefit to the individual because it enables him or her to access preferred stimuli and exert some degree of control over the environment. Teaching requesting skills is a logical starting point when first implementing AAC intervention based on developmental milestones and functional needs of the individual (Waddington et al., 2014). Different outcomes for individual participants illustrate the impact of barriers when using AAC. Outcomes may include individuals who barely use the device, individuals that access the device only in particular environments, and individuals that effectively and efficiently use their system in all environments (Trembath et al., 2014).

Schlosser and Wendt completed a systematic review aimed to determine the effects of AAC intervention on speech production in children with autism. Researchers searched for studies written between 1975 and 2007 that met strict criteria. Nine single-subject experimental design (27 participants) and two group studies (98 participants) were included. Overall, results suggested that AAC interventions do not impede speech

production. Researchers found that most studies reported an increase in speech production; however, analyses suggest that speech production increase was modest (Schlossser & Wendt, 2008).

Unaided augmentative and alternative communication. AAC systems are classified as aided or unaided. Unaided systems encompass the use of manual signs, gestures, facial expressions, natural speech, and vocalizations. A number of manual sign systems, including American Sign Language (ASL), were originally designed to be used for those with hearing impairments but have been used by people with severe communication and developmental disorders who are able to hear. Manual sign languages can provide an unlimited number of messages that can be sent and received; however, ASL is a language that requires that the communication partner also knows the language (Beukelman & Mirenda, 2005).

A study conducted by Tan et al. (2014) demonstrated the acquisition of manual signs, specifically keyword sign in three children between the ages of three and four years old with autism spectrum disorder. The study was conducted using a multiple baseline single-case experimental design to measure changes. Data was collected over the course of twelve weeks and a minimum of 13 sessions were conducted for each individual. After intervention, all participants increased their usage of signs. Some of the students did not demonstrate a significant acquisition of signs. One student acquired four signs and another individual acquired six signs. One individual learned thirty-four different signs, which is significantly more than the number used by the other clients. These results should be viewed as preliminary evidence because of the varied outcomes. All three children began using signs following intervention and generalized their use of

some signs across environments. Manual signs can support children and adults when communicating wants and needs, exchanging information, establishing social closeness, and practicing social etiquette. This study suggests that manual signs can be used successfully in individuals with autism spectrum disorder (Tan et al., 2014).

Aided augmentative and alternative communication. Aided strategies of communication require external assistance such as picture cards, electronic speech devices, or alphabet boards (Trembath et al., 2014). Although sign systems are useful AAC options for some people with communication difficulties, lack of transparency and/or speech output of these systems may limit communicative exchanges between the AAC user and speaking individuals. For people who do not have speech and who find methods of communication such as signing difficult, the provision of an aided device would appear to be useful (Sherlock, 2011). Aided devices can be as simple as a whiteboard and marker and can be as complex as an electronic system that changes when options are selected. Electronic devices can be technologically advanced to the point that pictorial symbols may be included on speech generating devices that produce digitized (pre-recorded speech of a human voice) or synthesized (computer generated) speech output (Waddington et al., 2014). The use of visual support and symbols as receptive and expressive components of an AAC system has been established as an evidence-based practice for individuals with ASD (ASHA, 2016).

Ganz et al. (2014) conducted a meta-analysis of single-case research studies related to aided AAC systems for individuals with ASD. Twenty-four single-case studies were analyzed to determine the impact of aided AAC on behavioral outcomes and overall effects of AAC. A literature search was conducted and focused on the use of AAC for

individuals with ASD. Studies conducted between 1980 and 2008 were viewed and included 122 articles. The articles were further evaluated to determine which articles matched the inclusion criteria and twenty-four studies were selected. Overall, AAC interventions had positive effects on all of the targeted behavioral outcomes in the studies selected; however, effects were greater for communication skills than other categories of skills. AAC also seems to have a positive influence on social skills, challenging behaviors, and spelling. Effects of the Picture Exchange Communication System (PECS) and speech-generating devices were larger than those for other picture-based systems, though picture-based systems did have small effects (Ganz et al., 2014).

Picture Exchange Communication System (PECS). PECS was created by the Delaware Autism Program for children with social-communication deficits. It is a tactile symbol system along with words to promote communication. It uses pictures of objects or the object itself to teach a child to associate something in his or her environment. Many PECS are implemented using Velcro sentence strips (Bondy & Frost, 2018). The use of PECS has led to improved social interactions of students with disabilities, including increased initiation of play and decreased tantrum behaviors and noncompliance (Charlop-Christy et al., 2002). To introduce PECS, children are taught to use symbols to create a sentence by selecting picture cards (e.g., The "I want" card is paired with the "juice" card to convey the message "I want juice.") and giving the cards to a communication partner (Bondy & Frost, 2018).

The PECS system has gained widespread use nationally and internationally with children with autism for several reasons. The PECS system requires few complex motor movements by the individual with autism, who can also present with poor motor skills.

In addition, the listener is not required to be familiar with an additional language. Some AAC systems, such as American Sign Language, do require the listener to know some other language. Next, the PECS system has a relatively low cost and is portable and suitable for use in many settings. Lastly, PECS can be taught relatively quickly. The PECS system is a viable option for many with autism spectrum disorder as a mode of communication. Later in life, many individuals who use PECS graduate to a more complex system that offers a wider variety of communicative functions (Flores et al., 2012).

Charlop-Christy, Carpenter, Le, LeBlanc, and Kellet (2002) conducted a multiple baseline quantitative study that demonstrated the efficacy of the PECS program as well as how the use of PECS can decrease the problem behaviors presented by individuals with autism spectrum disorder. Three boys with autism between the ages of 3 and 12 years-old were chosen to participate in the study using convenience sampling. All three children rarely spoke and needed language programming. In addition, the participants all displayed problem behaviors. The children were taught PECS during 15-minute training sessions twice per week. All three children achieved 80% accuracy of acquired PECS skills during an average of 170 minutes of training (range of 165 to 176). Spontaneous speech and imitation increased in all three individuals and problem behaviors decreased in all participants following the implementation of PECS. Overall, the study suggested that the PECS program can contribute to vocal and pictorial communication in individuals and can also decrease problem behaviors. The usage of PECS can lead to the acquisition of verbal speech in some individuals (Charlop-Christy et al., 2002).

The use of PECS has resulted in effective spoken communication that may include the support of pictures; however, the picture exchange tool is just one of many that can be implemented for individuals with autism spectrum disorder (Charlop-Christy et al., 2002). PECS require finding pictures that suit the individual's developmental level, laminating, cutting, adding Velcro, etc. This becomes time consuming. Teachers indicate a preference for the high-tech based systems over PECS because of the ease of use, less time spent in preparation, fewer materials required for implementation, and student's increased speed of communication (Flores et al., 2012). PECS can be an effective means of communication for individuals with autism spectrum disorder.

Fixed augmentative and alternative communication tools. The term fixed display refers to a display in which the symbols and items are "fixed" in a particular location. Fixed displays are usually part of a low-tech communication display and offer fewer symbols, which limits communication opportunities for an individual. Often, individuals using fixed displays use a number of displays to accommodate all of their needed vocabulary. For example, if the client was talking about their school day and wanted to switch and start talking about their next meal, they would need to change the display manually to gain access to additional vocabulary that is appropriate for the conversation (Beukelman & Mirenda, 2005).

Using a fixed display can limit the communicator in several ways, for example, the fixed displays can be less portable and efficient. Speech-language pathologists have recognized this downfall in fixed communication displays and have worked to compensate for the limited symbols. For example, communication books have been created in levels based on topics to help aid in successful communication. Examples of

fixed speech generating devices include TechTalk, TechSpeak, Cheap Talk 8, Parakeet 15, Macaw, DigiCom 2000, Easy Talk, GoTalk, and Message Mate (Beukelman & Mirenda, 2005).

Son, Sigafoos, O'Reilly, and Lancioni conducted a quantitative study that was published in 2006 that compared the acquisition and preference for a voice output communication aid (Tech/Talk 6x8) and a picture exchange system. Participants included three children (two girls and one boy) who were were recruited by Son because they were the only children in the preschool program where she volunteered that met the inclusion criteria. Participants were recruited because they were less than six years of age, had an autism or related developmental disorder diagnosis, lacked speech, and did not have a physical or sensory disorder. Following the acquisition of the systems, both systems were simultaneously available and the child could select which one of the two systems to use while requesting snacks. There was little difference between the picture exchange and Tech/Talk in terms of acquisition rates. Two children in the study demonstrated a consistent preference for the picture-exchange system and the third participant showed a preference for the Tech/Talk. It is suggested that both speed of acquisition and system preference should be considered when designing AAC interventions for children with autism and related disabilities based on the results of the present study (Son, Sigafoos, O'Reilly, & Lancioni, 2006).

Dynamic augmentative and alternative communication tools. Major advances have been made in AAC technology within the last decade including the development of voice output and dynamic displays. A dynamic display refers to a computer screen that displays symbols electronically. When the symbols are activated, the symbols

automatically change to a new selection set on the screen. The new symbols that appear would continue the conversation based on the previous symbol activated. For example, an AAC user might see a screen with several different communication topics such as sports, food, school, etc. When the sports symbol is selected, a series of symbols relating to sports would appear. A wide variety of AAC products offer dynamic displays (Beukelman & Mirenda, 2005).

Educators and families might prefer a system such as a high-tech, dynamic display system because of its convenience. Many AAC systems used today are small, portable, and have long battery lives. They rely primarily on icon-driven menus; they are very easy to use, even for young children and even individuals that are not familiar with technology (Flores, 2012).

When choosing an AAC system for an individual with autism, it is easy to find one, but choosing the one that meets the needs of the individual learner can be challenging, especially when cost is an issue. The system that is selected should be appropriate and fit the learning needs of the student. It should also be user-friendly and customizable to the particular AAC user. Some devices may be good; however, the particular device may not be appropriate for the student's need. It is also important to note that no device is perfect (Simmons, 2013). The device also must support their developmental growth. School-aged children need AAC designs to be highly appealing devices that meet multiple functions and that provide dynamic features to support social interactions with peers. While there is no evidence to support the impact of the AAC "coolness factor" for individuals with ASD, it seems obvious that most individuals would

prefer to use AAC devices that are attractive, powerful, and appealing to their peer group (Sennot & Bowker, 2009).

A quantitative study conducted by Flores et al. in 2012 aimed to compare the communication usage of a high-tech communication option on the Apple iPad and a picture based system. Five elementary students with autism and developmental disabilities who used a picture card system participated in the study. Students used the picture system described in their Individualized Education Program (IEP). The picture system was retrieved from board maker and secured to a strip of Velcro. An app called "Pick a Word" was used on the iPad to make requests and used colored photographs. The first participant was Max, a nine-year-old male with ASD who used a picture system to communicate requests at home and school. According to Max's IEP, his oral vocabulary included less than five words. Another participant, Sam, was an eleven-year-old male with multiple disabilities who communicated using up to four-word phrases with a picture system in his home and school environments and his spoken vocabulary consisted of less than ten words. Another participant, Al, was a nine-year-old boy with intellectual disability whose spoken vocabulary consisted of less than ten words and used a picture communication system to communicate short phrases. The next participant was Nick, an eight-year-old boy that was non-verbal and used a picture communication system at home and school to communicate one word at a time. The last participant, Len, was an eight-year-old boy with ASD who used a picture system at home and school to communicate phrases and had less than five words in his spoken vocabulary. All participants received special education services under the categories of autism spectrum disorders or intellectual disabilities. Data was collected during a snack procedure and

followed the same routine each day. The teacher made a positive comment about the snacks and told the students to take turns requesting snacks and drinks. Each student had five seconds to make a request before the teacher would move onto the next student's turn. When the student made a request, they would be rewarded with a small amount of food. Overall, the frequency of communication behaviors during conditions in which the high-tech device and a non-electronic picture-based system were used produced mixed results. Al clearly showed more communication behaviors when using the iPad. Nick and Max increased their use of communicative behaviors slightly when using the iPad. These findings lend limited initial support for high-tech options, such as the iPad. With regard to preference, the findings from this study are consistent with other studies because there was some increase in communication behaviors with the high-tech communication options; however, there was not a clear pattern across all students. In addition, Max demonstrated spoken language at the end of the study, using words and short phrases to request his snack. He previously communicated phrases using picture cards (Flores et al., 2012). This is consistent with previous research, in which the PECS system led to spontaneous speech (Bondy & Fros, 1994; Schwartz, Garfinkle, & Bauer, 1998).

Van Der Meer et al. conducted a quantitative alternating treatments design that was used to measure the performance of two individuals with ASD while using manual sign, picture exchange, and a high-tech communication (Proloquo2Go) option. The participants previously had been taught to use manual sign, picture exchange, and Proloquo2Go to request preferred items. With intervention, both participants learned requesting, greetings, answering questions, and social etiquette responses to varying

levels of proficiency with each communication option. One participant demonstrated preference for Proloquo2Go and the other preferred using the picture exchange system. This study suggests that assessing children's preferences for different AAC options might be important when implementing AAC with respect to the issue of abandonment (Van Der Meer et al., 2013), which is commonly seen when inappropriate systems are implemented (Johnson, Inglebret, Jones, & Ray, 2006).

In a study conducted by McLay et al., four children with autism spectrum disorder were taught to use manual sign, a picture exchange card, and a speech generating device (Proloquo2Go) to request toys. The four children were recruited from a special education school in New Zealand. They all had a diagnosis of autism, were younger than twelve years of age, demonstrated delayed expressive communication, and possessed sufficient physical and sensory abilities to use the three AAC options. The speech generating device used was an Apple iPad Mini with the Proloquo2Go application downloaded onto it. Each child was taught the New Zealand sign for *more*. A correct response was noted when a child independently produced the sign in response to a requesting opportunity. The picture exchange card included a *more* symbol that was secured to a board with Velcro. A correct response was noted when the child independently removed the *more* symbol and handed it to the instructor. The four children in the present study showed a preference for Proloquo2Go; however, the children showed comparable rates of acquisition for the three communication systems. Similar acquisition rates for each system suggested that each is a viable option for children with ASD. Maintenance and generalization were generally better for Proloquo2Go and picture exchange options.

Overall, children showed a preference for Proloquo2Go compared to systems such as manual sign and picture exchange in the present study (McLay et al., 2014).

Communicating using the Accent 1000. The Accent 1000 is known to offer a variety of advanced features. It is a dedicated speech generating device that offers great portability and a bright display. The Accent 1000 offers easy access to an extensive vocabulary and offers endless communication opportunities for the user. The device is also very durable and can withstand the aspects of daily life (Prentke Romich, 2013). The Accent 1000 offers a choice of vocabulary options, including the Unity vocabulary system. The Unity language system is an established AAC language system. It is used by tens of thousands of people and has been translated into several languages. The Unity language system is flexible and helps communicators of all skill levels learn quickly and build language skills for maximum independence. Individuals start with early forms of communication and grow to sophisticated adult communication. Individuals with apraxia, cerebral palsy, autism, Down syndrome, RETT syndrome, and other diagnoses that involve receptive or expressive language deficits are all candidates for the Unity language system. The language system gives the user the ability to produce generative language by accessing icons arranged in similar locations on the many different screens of the dynamic display. This enables individuals to learn and utilize motor planning to get to the desired message more efficiently. The patterns that the communicators learn are especially useful for many individuals with autism that strive on routines and patterns (Prentke Romich, 2017).

Motivation

Motivation is an important factor when implementing augmentative and alternative communication. Motivation is a relationship between environmental variables and their effect on an individual's behaviors. Motivation plays a significant role in the development and acquisition of language in typically developing children. Like other skill acquisition programs for children with ASD, the intervention techniques try to use a child's preferences in the form of reinforcers or consequences for a desirable behavior when implementing a treatment procedure for increasing conversational skills. This is typically achieved by offering preferred edible or leisure items contingent on the child's behavior. The reinforcers may not be related to the topic of conversation (Agarwal, 2012).

Addressing motivation is important when designing interventions for children with ASD. Literature suggests that children with various intellectual and developmental disabilities are extremely unmotivated, especially in situations when demands are placed (Agarwal, 2012). This lack of motivation can hinder the development of communication and it becomes increasingly important to incorporate the motivation of children with autism within the design of the treatment procedure. To create motivation, clinicians and typical communication partners should identify preferred stimuli or events and design a program that incorporates these stimuli or events with the ultimate goal of increasing the desired behavior. Once the reinforcers have been incorporated, an increase of the target behavior occurs (Agarwal, 2012).

A study conducted by Taylor et al. (2005) included three children with the diagnosis of autism and assessed the effect of manipulating motivation by depriving the

children of their preferred snacks. When the participant appropriately requested the snacks, the peer was prompted to deliver a small piece of the snack to the participant. This reinforcer was gradually faded. When it was faded, the researchers noted that gestures and pointing were used in place of verbal statements. The results of this study indicated that motivation significantly increased the verbal initiations and requests made by the participant towards his respective peer. Additionally, this skill was generalized to new peers and items (Taylor et al., 2005). Motivation has been used in functional communication training and for teaching requesting behavior in children with autism. More complex skills such as task performance, duration of play, social play with peers, and joint attention have also been taught by manipulating the participant's motivation (Agarwal, 2012).

Vismara and Lyons conducted a single-subject reversal design with alternating treatments with three young participants with autism. The study aimed to determine if behaviors (such as joint attention) would occur as a collateral effect of utilizing the motivational techniques of Pivotal Response Treatment (PRT) in conjunction with perseverative interest stimuli. PRT is a research-based intervention that targets pivotal areas of development, such as motivation, responsiveness to cues, self-management, and social initiations. The participants were 26, 34, and 38 months at the start of the study and had an autism diagnosis. Baseline was collected while the caregiver was interacting with the child prior to intervention. Next, intervention sessions were provided for 12 weeks and were similar across participants. Results indicated an immediate increase in the preferred behavior when highly preferred interests were incorporated in treatment. Additional findings included improvements in quality of interaction between children and

caregivers. This study suggests that increased motivation assists in the development of joint attention. While this study did not directly address motivating factors when implementing communication systems for individuals with autism, it did note an increase in the quality of interactions with caregivers and an increase in the joint attention abilities of the participants. Motivating factors may lead to an increase in communicative attempts (Vismara & Lyons, 2007).

A quantitative study conducted by Kim, Wigram, and Gold (2009) aimed to investigate motivational aspects of music interaction by measuring responsiveness. The randomized controlled study employed a single subject comparison design in two conditions (music therapy versus toy therapy). Eighteen individuals between the ages of three and five years were asked to participate in the study; however, ten participants completed the entire clinical trial. Within-subject comparison design was used; whereby, each child had toy sessions that were compared to music therapy sessions of the same duration consisting of weekly sessions for 12 consecutive weeks. Children were randomly assigned to complete music therapy sessions first and the toy play sessions later or vice versa. There was a one-week washout period between the two conditions. The results of this study suggested the value of music therapy in promoting social, emotional, and motivational development for children with autism. The results reported that music therapy has a greater effect on increasing initiation of engagement than toy play. Overall, children with autism responded positively to music and this study showed an increase in motivational aspects as a result of music therapy (Kim, Wigram, & Gold, 2009). Music therapy could be applied to the implementation of AAC for individuals with autism spectrum disorder to increase motivation.

Conclusion

The most recent data from the Center for Disease Control estimates that one in 68 children have been identified with autism spectrum disorder. Due to the prevalence of individuals with autism who fail to naturally develop speech or functional communication repertoires, it is important to use augmentative and alternative communication (AAC) to teach the individuals to communicate. AAC can include aided (communication that requires external assistance) or unaided (communication such as gestures, or sign language) tools that are used to allow individuals to successfully communicate.

Comparisons of high-tech communication systems and Picture Exchange systems have proven to be inconclusive; however, both options prove to be successful means of communication for many individuals with autism spectrum disorder, likely signifying that the preferences expressed by the client should be considered when choosing an AAC system. In the past, sign language has been used in individuals with autism spectrum disorder; however, it requires that the communication partner knows sign language, which can limit communication with a wide variety of communication partners. Lastly, motivation, support from communication partners, and developmentally appropriate instruction are important factors when implementing any AAC tool.

Chapter 3

Methodology

Purpose of the study

This study utilized quantitative methods and a single-subject design involving a child with autism spectrum disorder (ASD). The purpose of the study was to identify how caregivers and therapists can introduce and facilitate the usage of augmentative and alternative communication (AAC) for an individual with autism spectrum disorder(ASD).

Participant

The participant for this study was recruited from a speech and hearing clinic located within a Midwestern university. The participant in this study was a six-year-old male who had been given a medical diagnosis of ASD by a medical professional (e.g., psychiatrist or pediatrician). His communication diagnosis was an expressive language disorder. In addition, he had suspected congenital malformations of the brain and unspecified chromosomal abnormality. This client was non-verbal; however, he was a multimodal communicator. At the time of the study, he used American Sign Language (ASL), vocalizations, gestures, and a dedicated communication device (Accent 1000). The individual was at the beginning stages of learning to communicate using an AAC system. Overall, the client was a good candidate for the research study due to his strong support system, his near-perfect attendance at therapy, and his ability to come to the research site. Throughout the study, the client was assigned the following pseudonym to preserve confidentiality: Gabriel. The research was conducted at Speech-Language and Hearing Clinic over the course of one semester.

Research design

Prior to beginning research, all procedures were approved by the Institutional Review Board (IRB). This study followed a single-subject, quantitative design. According to Brobeck and Lubinsky (2003), "single-subject designs are well suited to answer the following question: does a given treatment work for a given client?" (p. 102). Since the purpose of this study was to determine how caregivers and therapists can introduce and facilitate usage of AAC by determining factors related to successful implementation, this design was selected.

Sampling procedure

In order to recruit Gabriel in this study, convenience sampling was used. According to Price (2013), convenience sampling is also called opportunity sampling and it "is a sample drawn without any underlying probability-based selection method" (para. 3). Convenience sampling was used in this study because Gabriel fit the participant criteria and was already receiving services at the research site. According to Maxwell and Satake (2006), "respondents who may just happen to be available at a given time" are used for convenience sampling (p. 97).

Procedures

Prior to the collection of any data, the clinician made contact with Gabriel's mother. During this conversation, the purpose of the proposed study was explained to the mother and she was given the opportunity to ask any questions she had about the study and/or her child's role as a participant. When the mother indicated a willingness to have her child participate, a consent letter and form was provided for her to review and sign. Gabriel was scheduled to attend two 50-minute sessions per week during the semester.

Data collection for this study included a file review, very brief interviews, a completion of the Reinforcer Assessment of Individuals with Severe Disabilities (RAISD), and data collection from therapy sessions. Prior to the collection of data, the researcher reviewed Gabriel's file, including information from treatment plans, recertification documentation, progress notes, and lesson plans.

Informal interviews with Gabriel's caregiver were also conducted to obtain information about Gabriel's course of treatment and their roles in the treatment process. Additional interviews were conducted to follow-up as needed.

The RAISD was administered to Gabriel's mother. The purpose of this structured interview was to gather specific information from the caregivers as to what they believe would be useful reinforcers for Gabriel. The RAISD consists of ten questions that help to determine preferences. The caregivers first answered the questions and then identified and ranked potential reinforcers. A copy of the RAISD is in Appendix A.

The clinician used the first two sessions to collect baseline data on Gabriel's spontaneous production of functional and meaningful communicative attempts during structured activities (i.e. playing with toys, puzzles, games, snack routine, etc.). The clinician used the subsequent sessions to document changes following implementation of factors (such as Gabriel's particular reinforcers and motivators determined during interviews, observations, and RAISD results). The session plan used during the intervention period is listed in Appendix B. The clinician used the two final sessions to collect post-treatment data using the same type of structured activities that were used to collect baseline data.

The data that was collected and transferred to graphs and charts to show progress on the production of functional and meaningful communicative attempts. To increase the reliability of this study, all sessions were videotaped.

Data Collection

Data collected for this research project included Gabriel's spontaneous production as well as those produced following very minimal cues from the clinician. If Gabriel needed additional cueing or prompting, the responses were not considered spontaneous; therefore, decreasing Gabriel's accuracy. Data was collected on Gabriel's use of seven specific areas of functional and meaningful communication: requesting, commenting, asking questions, labeling, responding to questions, making choices, and greeting/departing. These terms were operationally defined as follows at the onset of the study in order to assist in consistent data collection and analysis.

- Requesting data was collected anytime that the client used his Accent 1000, ASL, or gestures to request an object, food item, attention, more of something, to begin or end an activity, etc.
- Commenting data was collected anytime that the client used his Accent 1000, ASL, or gestures to express interest, inform communication partners, or make an observation about something.
- Data regarding asking questions was collected anytime that the client used his Accent 1000 to ask questions regarding a variety of topics. An example included, "What's next?" when reading a book.
- Labeling data was collected anytime that the client used his Accent 1000, ASL, or gestures to label, for example, labeling colors, numbers, animals, and objects.

- Responding data was collected anytime that the client used his Accent 1000, ASL, or gestures to respond to a series of questions posed by the clinician, such as, "Did you go outside for recess today?"
- Data regarding making choices was collected anytime that the client used his Accent 1000, ASL, or gestures to choose an activity, item, or game piece.
- Data regarding greetings and departures were collected each time the client used his Accent 1000, ASL, or gestures to say hi or goodbye to the clinician or other individuals, such as staff, at conversationally appropriate times.

Finally, prior to the beginning of data collection, working definitions of the different levels of conversation (spontaneous communication, modeling, cueing, and prompting) were functionally defined in order to assist in consistent data collection and analysis.

- Spontaneous communicative exchanges were any type of verbal or nonverbal communication that was not elicited through prompts or substantial cues.
- Modeling communicative exchanges was completed by the clinician to show the client how to accurately use multimodal communication. The clinician did exactly what was expected of the client. The clinician provides a model when the client does not have adequate knowledge to complete a task. The clinician provided an accurate model to the client of an expected communicative attempt. When a model was necessary, the communicative attempt was not considered spontaneous for the sake of this research study.
- Cueing communicative exchanges were defined as a signal, such as pointing or a short phrase, to the client to begin a specific speech action. When more than

minimal cues were necessary, the communicative attempt was not considered spontaneous for the sake of this research.

- Prompting communicative exchanges was defined as assistance to complete a specific task. For example, hand-over-hand prompting was physical assistance provided by the clinician in which they would physically put their hands over the client's hand to activate a cell within the Accent 1000 or make a choice using pointing. When a prompt was necessary, the communicative attempt is not considered spontaneous for the sake of this research study.

Reliability

To increase the reliability of this study, all sessions were videotaped. The data retrieved while watching the recording was then compared to the data entered into the electronic medical record used at the university speech and hearing clinic.

Data Analysis

According to Maxwell and Satake (2006), descriptive statistics are defined as mathematical procedures that are used for "classifying, organizing, and summarizing a particular set of observations… for evaluating the attributes of available data" (p. 280). Descriptive statistics are used to help describe the data that was collected (Maxwell & Satake, 2006). This study used descriptive statistics to summarize factors related to successful implementation of AAC.

This study used descriptive statistics to review all treatment sessions and create a comparison of pre-treatment and post-treatment data in tables and graphic displays. The data displayed several factors determined in the RAISD and how they influenced communicative attempts using AAC or verbal output. The graphic displays show that

there is an increase in Gabriel's communicative attempts from pre-treatment to post-treatment.

Confidentiality

All sessions were recorded during this research project. All recorded DVD files of Gabriel's sessions were kept in a locked storage compartment on campus at the university speech and hearing clinic within the speech-language pathology department when they were not being used. When they were being used, the clinician went into a private room, with the door closed and locked. Gabriel's identity was not disclosed to anyone and his information was only discussed with the clinical supervisor who observed sessions. The client is identified in this study with a pseudonym (Gabriel) to further ensure his privacy.

Chapter 4

Results

At the time of this study, Gabriel was a 6-year old male who had been given a medical diagnosis of ASD by a medical professional. His communication diagnosis was an expressive language disorder. He had suspected congenital malformations of the brain and unspecified chromosomal abnormalities. Gabriel's receptive language skills were assessed during the research study using the *Receptive One Word Picture Vocabulary Test*. Results indicate that Gabriel has receptive language skills below the first percentile for his age. He was non-verbal; however, he was a multimodal communicator. He used American Sign Language (ASL), vocalizations, gestures, and a dedicated communication device (Accent 1000). Gabriel was considered a beginning communicator at the beginning of the research. At the conclusion of this study, Gabriel was communicating using several functions of communication, including requesting, making choices, labeling, responding, commenting, greeting or departing, and asking questions.

This project was designed to answer the following research question: "What factors facilitate the acquisition and usage of AAC for a client with autism spectrum disorder?" The following figures provide a summary of results of pretreatment data compared to post-treatment data and the progression seen during the treatment implementation with a variety of different factors. Figure 1 provides a summary of the number of successful spontaneous communication attempts of pretreatment data compared to post-treatment data. Figure 2 provides a summary of the growth in the number of successful spontaneous communication attempts. Figure 3 provides a summary of changes in random, non-meaningful activations.

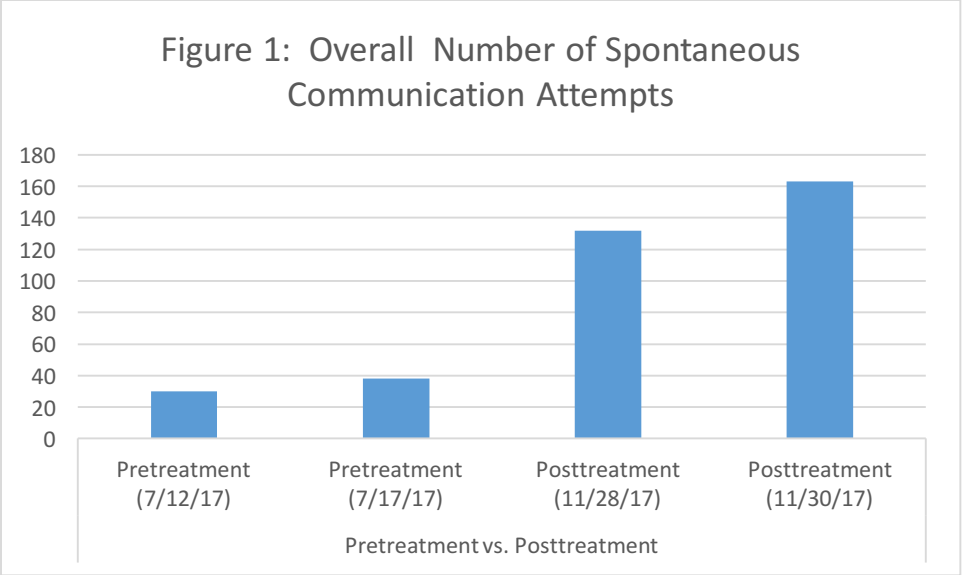
Figure 1: Overall Number of Spontaneous Communication Attempts
180
160
140
120
100
80
60
40
20
0
Pretreatment (7/12/17)
Pretreatment (7/17/17)
Posttreatment (11/28/17)
Posttreatment (11/30/17)
Pretreatment vs. Posttreatment

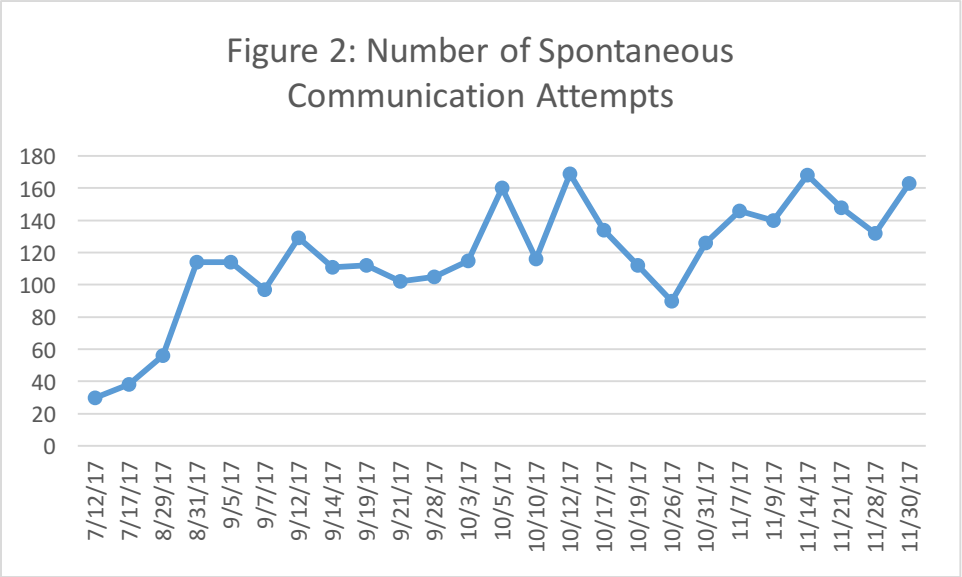
Figure 2: Number of Spontaneous Communication Attempts
180
160
140
120
100
80
60
40
20
0
7/12/17
7/17/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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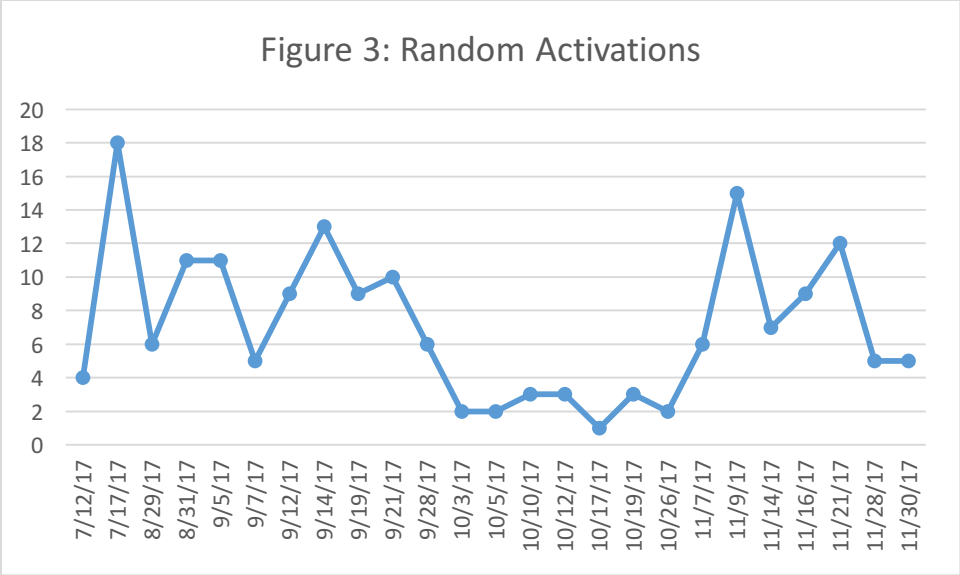
11/28/17
11/30/17



Descriptive Statistical Analysis

A comparison of pretreatment data to post-treatment data and the growth during intervention implementation was the focus of Figures 1 and 2. To compare the data, descriptive statistics were used. Overall, Gabriel's successful spontaneous communication attempts using his Accent 1000 increased from pretreatment data to post-treatment data. During pretreatment data collection, Gabriel made an average of 34 successful communication attempts. He increased his ability to successfully communicate to an average of 148 communication attempts during post-treatment data collection (ranging from 132 to 163), which is a 335% increase. During the intervention period, an average of 122 successful communication attempts were completed, with values ranging from 56 to 169 successful communication attempts.

The number of non-meaningful or seemingly random activations of communication was the focus of Figure 3. This data helps to understand the operational competence that Gabriel developed. Random activations were activations of seemingly non-meaningful messages, such as '7', when completing an activity or having a

conversation and the activation had no relation to the task. To evaluate the data, descriptive statistics were used. Overall, Gabriel's random activations declined for a large portion of the data collection period; however, later increased. The average of the pretreatment data showed that eleven random activations were made. The average of the post-treatment data shows that five random activations were made. This data shows a 55% decrease in random activations. During the intervention period, an average of 7 random activations were made throughout the duration of a session, ranging from one to eighteen per session.

Figures 4-10 provide a summary of results for each of the seven functions of communication investigated in this study.

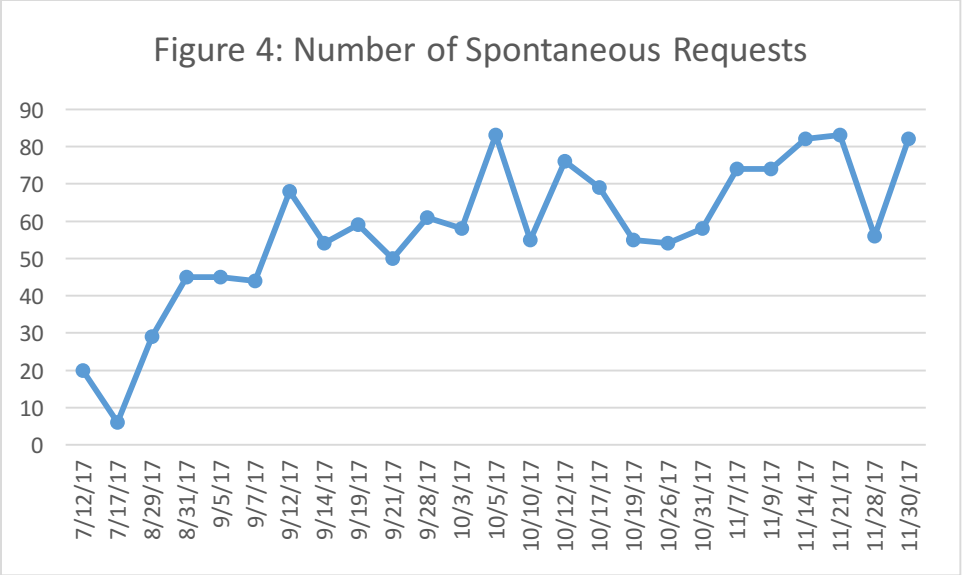


Figure 4: Number of Spontaneous Requests
90
80
70
60
50
40
30
20
10
0
7/12/17
7/17/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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11/7/17
11/9/17
11/14/17
11/21/17
11/28/17
11/30/17

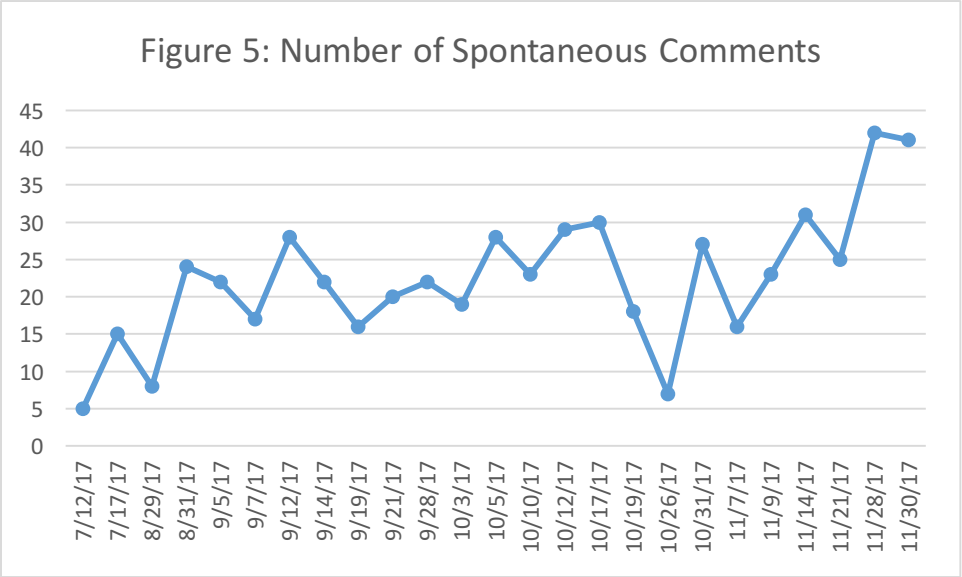
Figure 5: Number of Spontaneous Comments
45
40
35
30
25
20
15
10
5
0
7/12/17
7/17/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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11/7/17
11/9/17
11/14/17
11/21/17
11/28/17
11/30/17

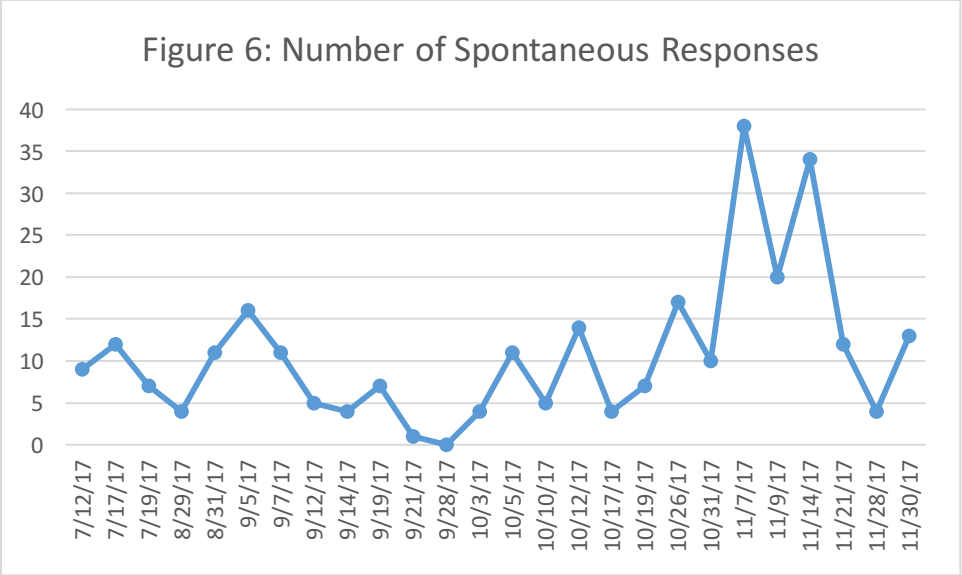
Figure 6: Number of Spontaneous Responses
40
35
30
25
20
15
10
5
0
7/12/17
7/17/17
7/19/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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11/14/17
11/21/17
11/28/17
11/30/17

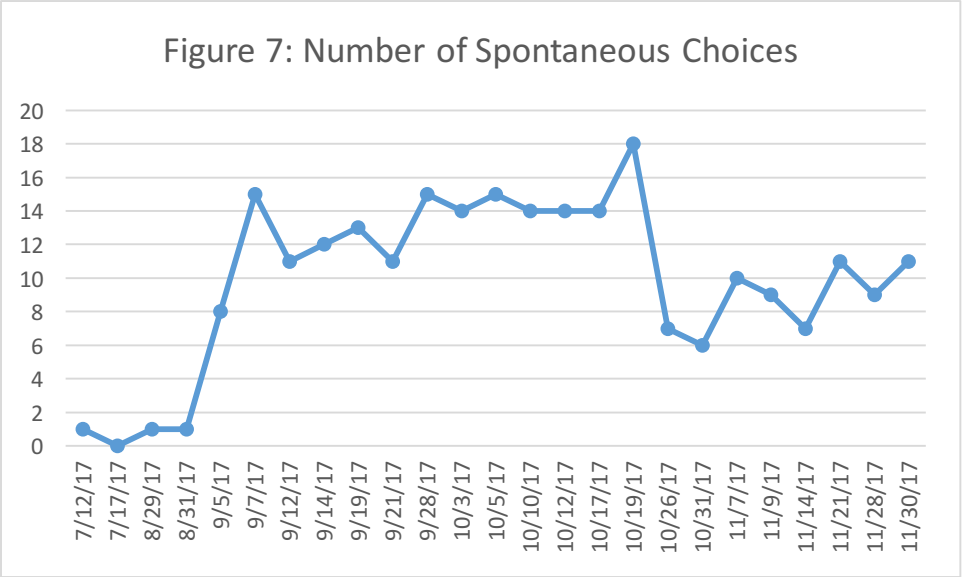
Figure 7: Number of Spontaneous Choices
20
18
16
14
12
10
8
6
4
2
0
7/12/17
7/17/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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11/7/17
11/9/17
11/14/17
11/21/17
11/28/17
11/30/17

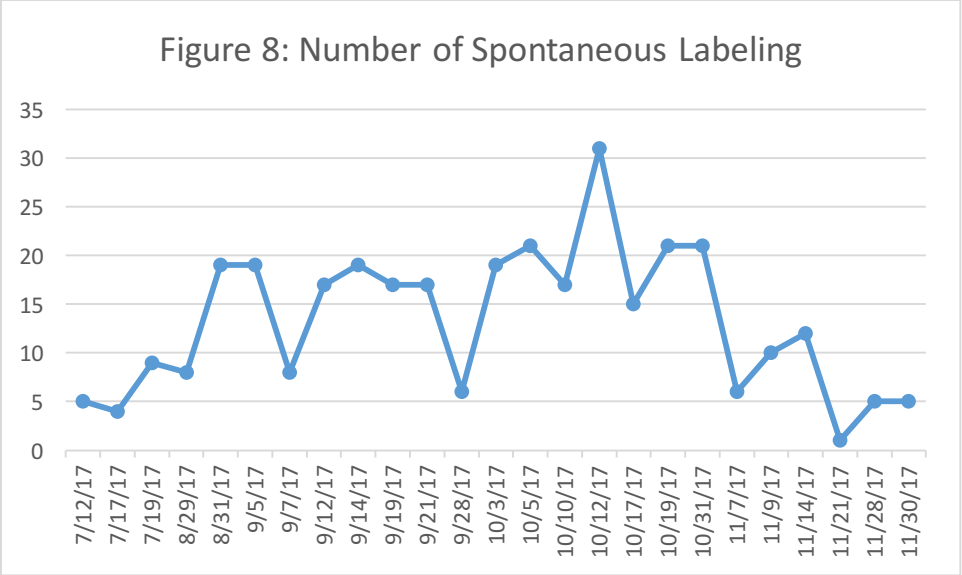
Figure 8: Number of Spontaneous Labeling
35
30
25
20
15
10
5
0
7/12/17
7/17/17
7/19/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
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11/7/17
11/9/17
11/14/17
11/21/17
11/28/17
11/30/17

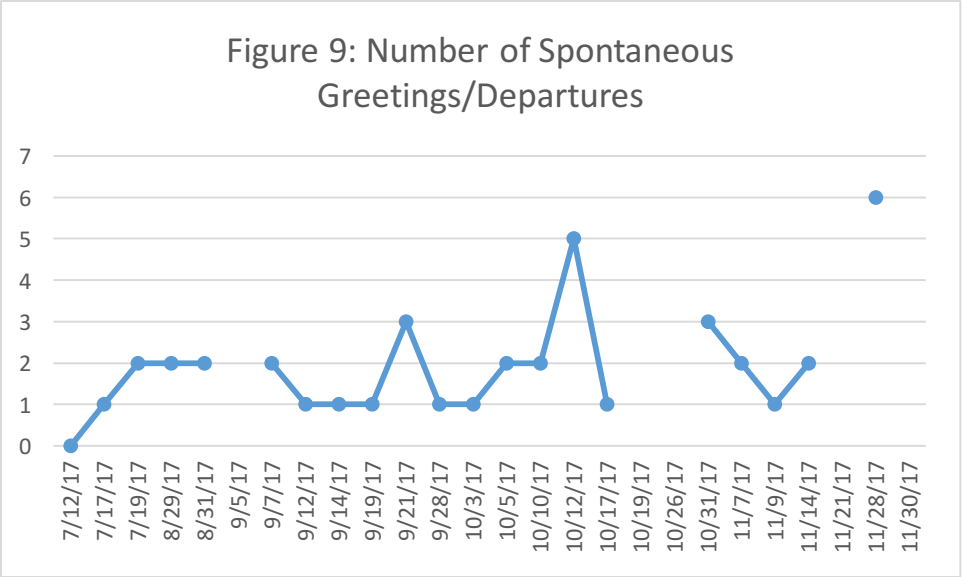
Figure 9: Number of Spontaneous Greetings/Departures
7
6
5
4
3
2
1
0
7/12/17
7/17/17
7/19/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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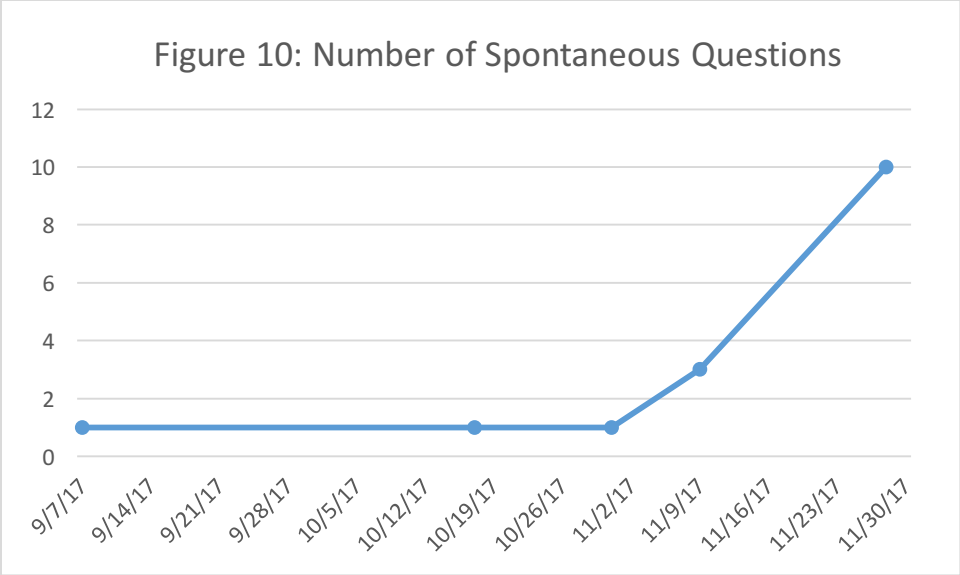
11/28/17
11/30/17



Descriptive Statistical Analysis

The growth during intervention implementation was the focus of Figures 4-10. To compare the data, descriptive statistics were used. Overall, Gabriel's successful spontaneous communication attempts using his Accent 1000 changed from pretreatment data to post-treatment data.

Figure 4 shows that Gabriel's ability to request increased from an average of 13 in pretreatment data to an average of 69 in post-treatment data. Intervention data revealed an average of 61 requests, with values ranging from 29 to 83 requests.

Figure 5 shows that Gabriel's use of commenting increased from an average of 10 in pretreatment data to an average of 41 in post-treatment data. Intervention data revealed an average of 22 comments, with values ranging from 7 to 31 comments.

Figure 6 presents the data related to the communicative function of responding to questions posed by the clinician and the caregiver/staff. Gabriel decreased from an average of 11 responses in pretreatment data to an average of nine responses in post-

treatment data. Intervention data revealed an average of 12 responses, with values ranging from zero to 38 responses.

Figure 7 shows Gabriel's use of choice making. Gabriel increased the number of choices from an average of one choice in pretreatment data to an average of ten choices in post-treatment data. Intervention data revealed an average of 11 choices per session, with values ranging from one to 18 choices per session.

Figure 8 shows Gabriel's ability to label colors, numbers, and objects. Gabriel went from an average of 5 labels in pretreatment data to an average of 5 labels in post-treatment data. Intervention data reveals an average of 15 labels per session, with values ranging from one to 31 labels per session.

Figure 9 shows Gabriel's use of communicating greetings and departures. Gabriel went from an average of one greeting and departure in pretreatment data to an average of three greetings and departures in post-treatment data. Gabriel achieved up to 6 greetings and departures in post-treatment data.

Figure 10 shows Gabriel's use of asking questions. Gabriel did not ask questions in pretreatment data and only asked questions in one session within post-treatment data at a level of 10 questions.

Figures 11-17 show overall successful communication attempts when completing therapy activities consisting of motivating factors in order from most motivating to least motivating according to the RAISD completed by Gabriel's mother at the beginning of the research study.

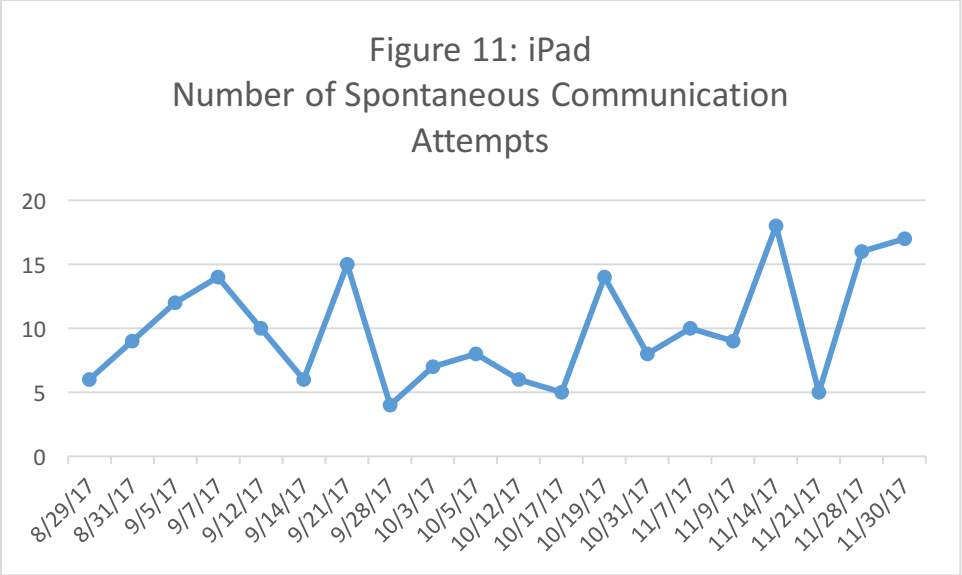


Figure 11: iPad
Number of Spontaneous Communication Attempts
20
15
10
5
0
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/21/17
9/28/17
10/3/17
10/5/17
10/12/17
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11/30/17

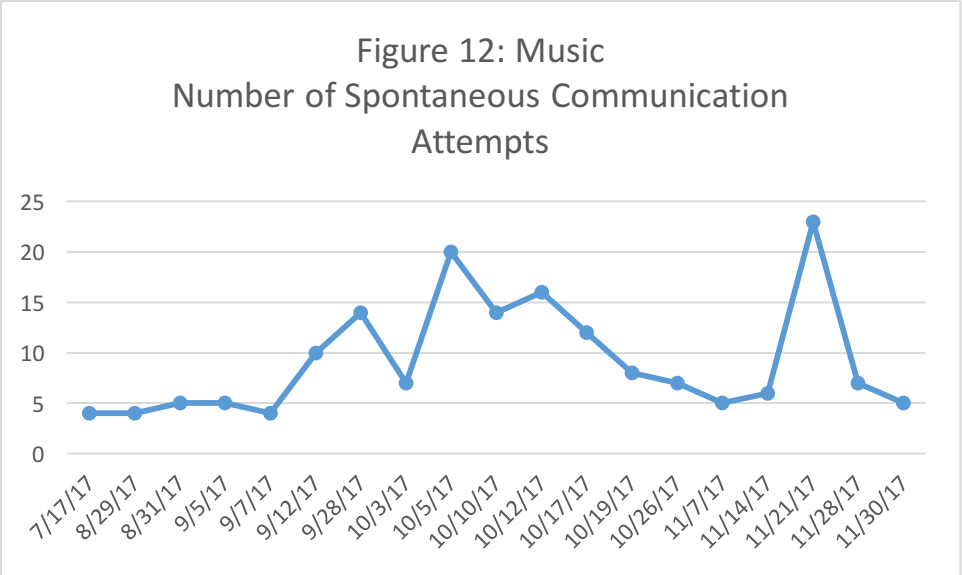
Figure 12: Music
Number of Spontaneous Communication Attempts
25
20
15
10
5
0
7/17/17
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/28/17
10/3/17
10/5/17
10/10/17
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11/14/17
11/21/17
11/28/17
11/30/17

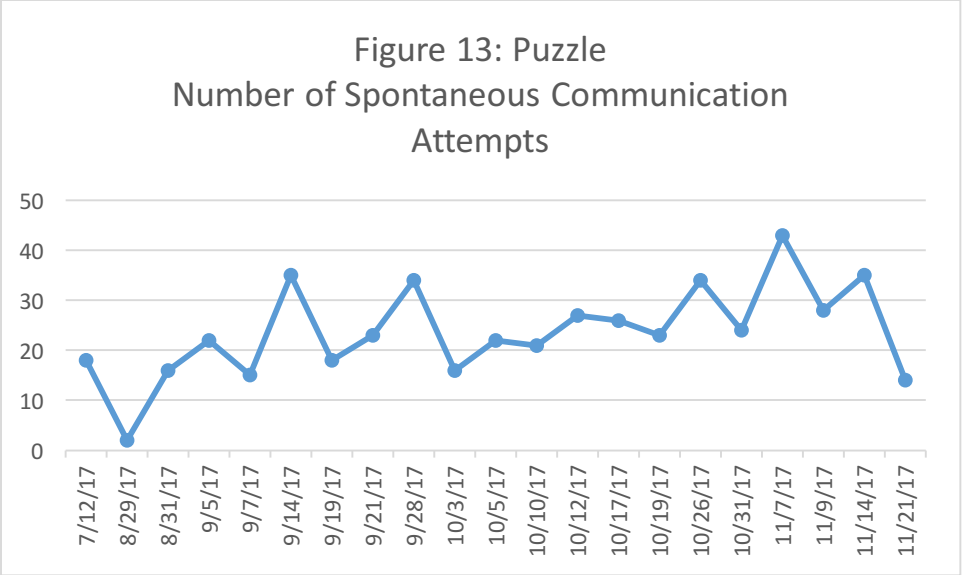
Figure 13: Puzzle
Number of Spontaneous Communication Attempts
50
40
30
20
10
0
7/12/17
8/29/17
8/31/17
9/5/17
9/7/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
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11/7/17
11/9/17
11/14/17
11/21/17

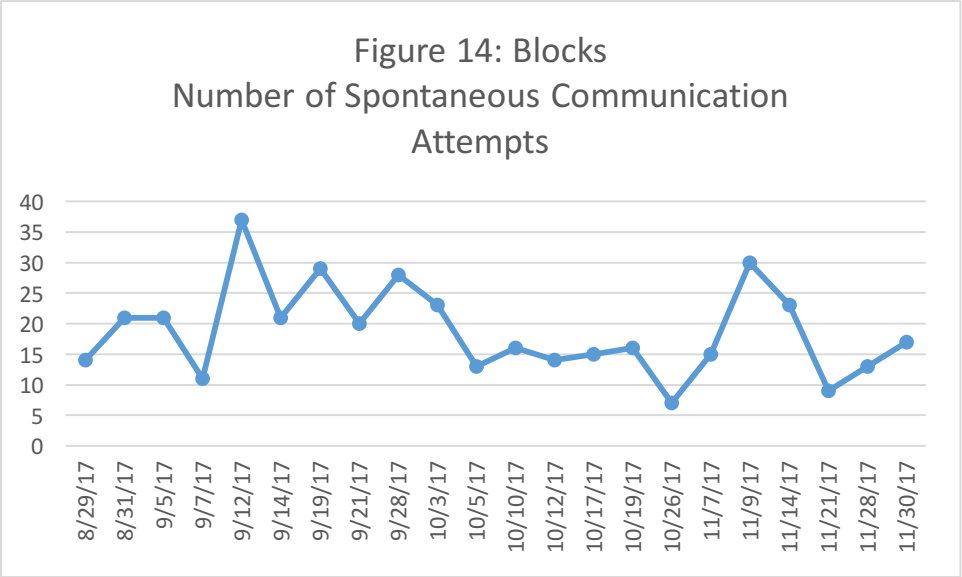
Figure 14: Blocks
Number of Spontaneous Communication Attempts
40
35
30
25
20
15
10
5
0
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
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11/7/17
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11/21/17
11/28/17
11/30/17

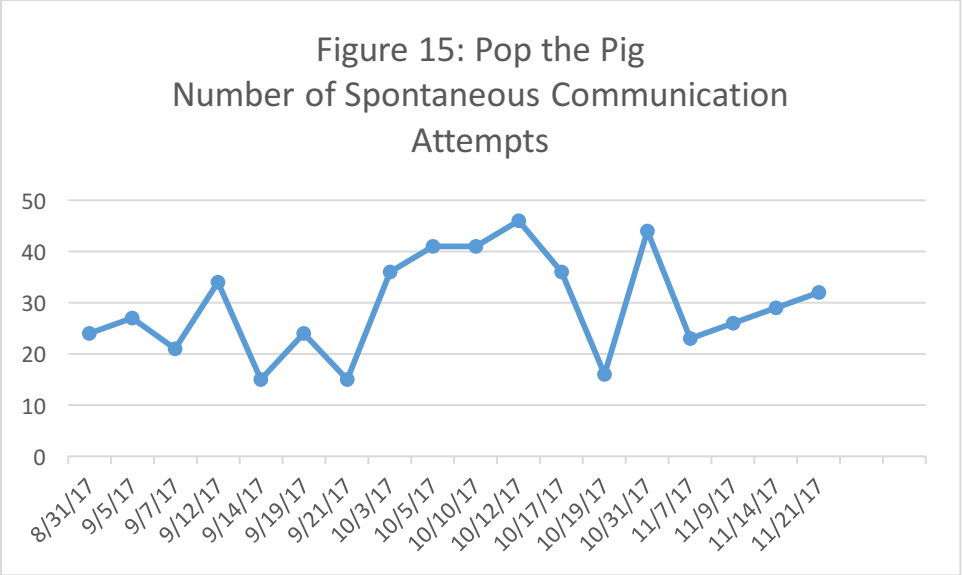
Figure 15: Pop the Pig
Number of Spontaneous Communication Attempts
50
40
30
20
10
0
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
10/3/17
10/5/17
10/10/17
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10/19/17
10/31/17
11/7/17
11/9/17
11/14/17
11/21/17

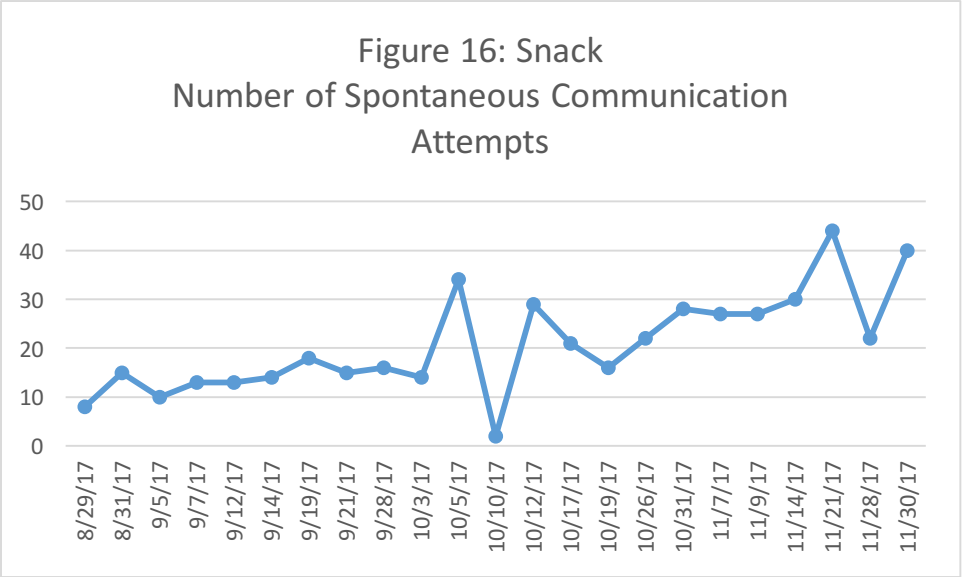
Figure 16: Snack
Number of Spontaneous Communication Attempts
50
40
30
20
10
0
8/29/17
8/31/17
9/5/17
9/7/17
9/12/17
9/14/17
9/19/17
9/21/17
9/28/17
10/3/17
10/5/17
10/10/17
10/12/17
10/17/17
10/19/17
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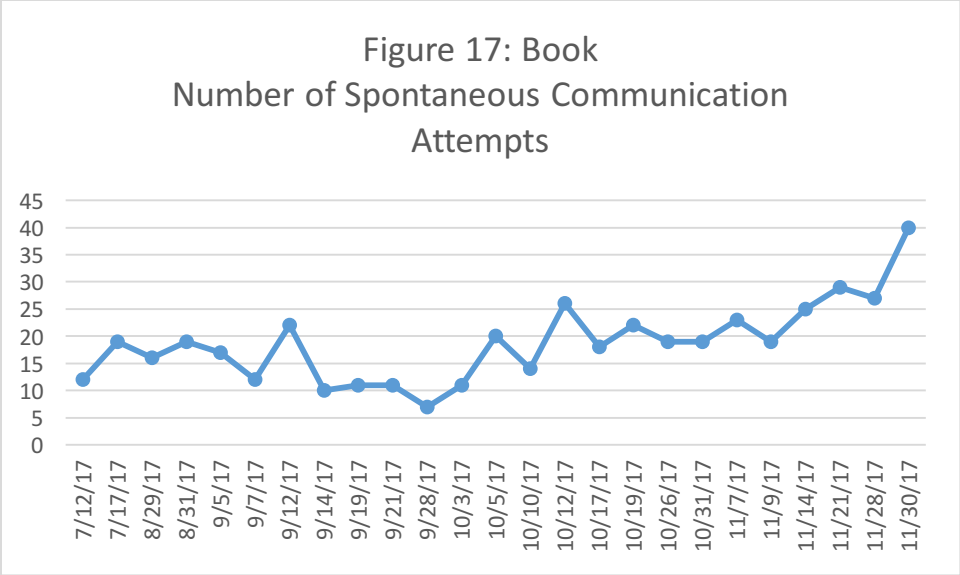
10/31/17
11/7/17
11/9/17
11/14/17
11/21/17
11/28/17
11/30/17



Descriptive Statistical Analysis

The growth during intervention implementation was the focus of Figures 11-17. To compare the data, descriptive statistics were used. Overall, Gabriel's successful spontaneous communication attempts using his Accent 1000 changed from pretreatment data to post-treatment data. The following data is presented in order from most motivating to least motivating as determined by Gabriel's mother when completing the RAISD.

Figure 11 shows changes in overall communication while completing iPad-based therapy activities, which his mother rated as his most motivating factor while completing the RAISD. During pretreatment data, an average of eight spontaneous communication attempts were recorded while completing iPad-based therapy activities. During post-treatment data collection, an average of 17 spontaneous communication attempts were recorded while completing iPad-based therapy activities. During the intervention period, an average of nine successful communication attempts were recorded while completing

iPad-based therapy activities within a therapy session, ranging from four to 18 communication attempts.

Figure 12 shows changes in overall communication while completing music activities. During pre-intervention data collection, an average of four successful, spontaneous communication attempts were recorded while completing music activities. During post-treatment data collection, an average of six successful, spontaneous communication attempts were recorded when completing music activities. During the intervention period, Gabriel made an average of 10 successful communication attempts while completing music activities within a session, ranging from four to 23.

Figure 13 shows changes in overall communication while completing puzzles. During pre-intervention data collection, an average of 10 overall spontaneous communication attempts were recorded while completing puzzles within a therapy session. During post-treatment data collection, an average of 25 overall communication attempts were recorded while completing puzzles within a therapy session. During the intervention period, an average of 25 successful communication attempts were made while completing a puzzle within each session, ranging from two to 43.

Figure 14 shows changes in overall communication while building with blocks. During pretreatment data collection, an average of 18 successful communication attempts were recorded while building with blocks. During post-treatment data collection, an average of 15 successful communication attempts were recorded while building with blocks. During the intervention period, data revealed that Gabriel achieved an average of 19 successful communication attempts while building with blocks, ranging from seven to 37.

Figure 15 shows changes in overall communication while playing a game called *Pop the Pig*. During pretreatment data collection, an average of 26 successful communication attempts were recorded while playing *Pop the Pig*. During post-treatment data collection, an average of 31 successful communication attempts were recorded while playing *Pop the Pig*. Data revealed that during the intervention period, an average of 29 successful communication attempts were recorded while playing *Pop the Pig*, ranging from 15 to 46 successful communication attempts.

Figure 16 shows changes in overall communication while completing a snack routine. During pretreatment data collection, an average of 13 successful communication attempts were recorded while completing a snack routine. During post-treatment data collection, an average of 31 successful communication attempts were recorded while completing a snack routine. During the intervention period, an average of 21 successful communication attempts were recorded while completing a snack routine, ranging from two to 44 successful communication attempts.

Figure 17 shows changes in overall communication while reading a book, which was a non-preferred activity. During pretreatment data collection, an average of 16 successful communication attempts were recorded while reading a book. During post-treatment data collection, an average of 34 successful communication attempts were recorded while reading a book. During the intervention period, an average of 18 successful communication attempts were recorded while reading a book, ranging from seven to 29 successful communication attempts.

During informal parent interviews and parent conversations, it was noted that Gabriel had increased his communication abilities in several environments, including at

home. Gabriel had family support, as noted when they stated that he is communicating more in several communication activities at home and his communication system was not stored in his backpack for extended periods of time. His mother was also very familiar with the device and was able to program messages and troubleshoot any problems. In addition, Gabriel had good therapy attendance, only missing two sessions throughout the duration of the research study due to illness and other appointments.

Chapter 5

Discussion

The research question addressed in this study was "what factors facilitate the acquisition and usage of AAC for a client with autism spectrum disorder?". The results of this study supported the use of several factors when implementing AAC.

Interpretation of Results

As illustrated in figures 1 and 2, Gabriel demonstrated an increase in his successful, spontaneous communication attempts. Initially, Gabriel made 30 and 38 successful and spontaneous communication attempts during the pre-intervention data collection. Gabriel's participation increased throughout the research. Overall, the data shows an increase in overall successful, spontaneous communication attempts. The increase occurred following the implementation of reinforcers determined by Gabriel's mother while completing the RAISD. Data shows a decrease in spontaneous communication attempts later in the research, most notably on October 26, 2017. This is potentially due to toilet training that was occurring at the time and technical difficulties with the device. At this point, Gabriel had learned to enter the edit mode of the device and was deleting important messages that were essential in his daily life. Significant time was used during these sessions programming and troubleshooting lost messages. When technical difficulties were resolved in later treatment sessions, successful, spontaneous communication attempts increased.

As can be seen from the data presented in figure 3, Gabriel demonstrated a decrease in the number of non-meaningful or seemingly random activations. The decrease in random activations indicates that Gabriel developed operational competence.

Operational competence refers to the ability of the user to operate their AAC system. This includes the access to the device and the ability to navigate within the device. Overall, Gabriel decreased his number of random activations across the research study during the intervention implementation period. The cause for this is unknown; however, the increase in random activations occurred alongside an increase in spontaneous, successful communication attempts. Gabriel may have been 'burnt out' on therapy activities that were used throughout the research study. During post-intervention data collection, in which novel therapy activities were implemented, non-meaningful or seemingly random activations decreased. Figure 3 shows that when implementing factors, such as reinforcers, children with autism spectrum disorder have the potential to decrease non-meaningful or seemingly random activations.

Figures 4-10 show Gabriel's use of several functions of communication and his increased linguistic competence. Linguistic competence refers to the ability to use vocabulary. Gabriel learned to use vocabulary to request, comment, respond to questions, make choices, label, greet others, and ask questions.

Gabriel's use of requesting within a treatment session increased from a total of six and 20 in the pre-intervention data collection sessions to a total of 56 and 82 in the post-treatment data. Gabriel had many opportunities during each treatment session to request items from the researcher or caregiver present in the treatment room. Prior to the beginning of the research study, Gabriel had the opportunity to request; however, the requests were made inconsistently. He also did not appear motivated to make requests prior to the implementation of reinforcers. It was apparent throughout this study that Gabriel was intentionally requesting an item/activity, as evidenced by his body language,

facial expression, and mood. As the research continued, he often looked at his communication partner after making a request using his Accent 1000 in anticipation of a response, such as giving him the snack, blocks, puzzle pieces, etc. that he requested. Patterns in the number of requests made in treatment sessions correlated with patterns in the number of successful, spontaneous communication attempts made throughout the duration of a treatment session. In several instances, a decrease in requests correlated with an increase in other functions of communication. For example, on September 21 and November 28, 2017, Gabriel decreased the number of requests that he made throughout the duration of the session; however, he increased the number of comments that he made throughout the duration of the session. Another example is on September 14, 2017. Gabriel decreased the number of requests made; however, he increased the number of choices and labels that he made throughout the duration of the session.

Gabriel's use of commenting within a therapy session increased from a total of five and 15 in the pre-intervention data collection period to a total of 42 and 41 in the post-treatment data. Gabriel had many opportunities each session to comment on activities and items throughout the study. Gabriel commented very little across a variety of settings prior to the implementation of a variety of factors (e.g., reinforcers, increased communication opportunities, and support from family and caregivers). During the intervention period, Gabriel increased his use of commenting. Patterns in the number of comments made in treatment sessions often correlated with patterns in the number of overall successful, spontaneous communication attempts made throughout a treatment session. In several instances, a decrease in comments correlated with an increase in other functions of communication. For example, on August 28, September 19, November 7,

and November 21, 2017, Gabriel decreased the number of comments that he made throughout the session; however, he increased the number of requests that he made throughout the session. Other examples were evident on September 19, October 3, October 10, October 26, and November 7, 2017. In these sessions, Gabriel decreased the number of comments made throughout the session; however, he increased the number of responses. The most notable increases in responses that correlated with decreases in comments were on October 26 and November 7, 2017. Gabriel's mother stated that he is also commenting more at home and the commenting has become more purposeful and meaningful. An example of this occurred during post-treatment data collection. Gabriel was completing a craft, which was a non-preferred activity. The clinician informed Gabriel that he should show the artwork to his mom and brothers when he gets home. Gabriel turned to his Accent 1000 and activated the following message: "Dad." This successful and spontaneous comment conveyed that Gabriel wanted to show his dad the artwork. This comment was very meaningful to his family. During the exit interview, Gabriel's mother was informed about this communicative exchange, to which she responded, "That is so awesome, he is making so much progress."

Gabriel's use of responding to questions posed by the clinician or the caregiver varied drastically across the research study. Gabriel had many opportunities within the research study to respond to questions. The data shows that Gabriel has the ability to respond to communication partners; however, reinforcers and factors may have less impact on an individual's use of responses to simple yes/no questions compared to requesting or commenting. Instead, the number of charted opportunities to respond

within a session or within a reinforcing activity likely has more influence on the number of successful responses to yes/no questions.

Gabriel's use of choice-making within a therapy session increased from a total of one and zero in the pre-treatment data collection period to a total of nine and eleven in the post-treatment data. Gabriel had many opportunities each session to make choices on activities and items throughout the study. Initially, Gabriel exponentially increased his ability to make choices; however, he decreased the number of choices made later in the intervention period. This data shows that Gabriel has established the ability to make choices; however, reinforcers may have less impact on the individual's use of the choice making communication function compared to other functions of communication. Instead, the number of charted opportunities to respond within a therapy session or reinforcing activity likely has more influence on the number of successful choices made.

Gabriel's ability to label colors, numbers, and objects varied drastically across the research study. Gabriel had many opportunities each session to label colors, numbers, and objects. The data shows that Gabriel has the ability to label successfully; however, due to the variable nature of the data, the reinforcers implemented are likely not the sole influence on the number of labels made within a session. Likely, some therapy sessions and reinforcing activities offered less charted opportunities to label colors, numbers, and objects than other sessions and activities.

Gabriel's use of questioning increased across the duration of the study; however, he did not ask questions during every therapy session and the consistency of his use of this communicative function cannot be determined. All questions were asked while reading a book, which is not a reinforcing activity according to the RAISD completed by

his mother. The reinforcers implemented likely do not influence Gabriel's usage of questions.

Throughout the research, Gabriel increased the number of successful communication attempts across all communicative functions studied. At the start of the research, Gabriel was a beginning communicator. A beginning communicator is an individual of any age that has limited communication skills. These individuals typically rely on gestures, vocalizations, eye gaze, and body language. These individuals may not exhibit communicative intentionality and they may be only beginning to utilize symbols to represent basic messages. Often, requesting is the first step when implementing AAC because it gives the user what they want and need. It is important not to restrict the AAC user to just one function of communication. Requesting is only a small portion of communication. For example, when having a conversation around the dinner table, communication partners do request for the different foods on the table; however, most of the conversation is talking and commenting about the day, asking questions, responding to questions, and other functions of communication. As can be seen in figures 4-10, Gabriel increased the number of successful communication attempts across several functions of communication. While Gabriel is still considered a beginning communicator, he has increased the functionality of his communication across several activities and environments.

As can be seen in figures 11-17, several reinforcers and motivating factors were implemented as therapy activities. These motivators were listed in order from most motivating to least motivating by Gabriel's mother: iPad, music, puzzles, blocks, *Pop the Pig*, and snacks. Books were not listed as a reinforcer on the RAISD and were therefore

used as a non-preferred activity within the research study. Each activity yielded different numbers of successful, spontaneous communication attempts. Gabriel's mother ranked his iPad as the most motivating reinforcer; however, when implementing iPad-based applications in treatment sessions, Gabriel produced the least spontaneous communication attempts compared to other reinforcers that were ranked as less reinforcing. During the intervention period, Gabriel made an average of nine successful communication attempts while completing iPad-based therapy activities within a therapy session. The highest number of successful communication attempts while using the iPad within a session is equal to 18. Music was listed as Gabriel's second most reinforcing activity; however, when using music in therapy sessions, Gabriel produced less successful communication attempts compared to other reinforcers that were ranked as less reinforcing. The activities that yielded the highest averages of successful communication attempts during the intervention period were *Pop the Pig*, puzzles, snacks, blocks, and books. The averages are equal to 29, 25, 21, 19, and 18 respectively. During the intervention period, Gabriel achieved up to 46 successful communication attempts while playing *Pop the Pig*, 44 successful communication attempts while having a snack, 43 successful communication attempts while completing a puzzle, and 40 successful communication attempts while reading a book. While using his most reinforcing item, the iPad, the highest number of successful communication attempts achieved was 18, which is considerably lower than the highest number of successful communication attempts achieved while completing other therapy tasks that were reported to be less motivating. There is a less noticeable pattern in the number of successful communication attempts when completing reinforcing activities such as the

iPad and music; however, less reinforcing activities, such as having a snack and reading a book show upward trends in successful communication attempts.

The information shown in figures 11-17 show that reinforcing factors alone do not lead to increased successful communication attempts. This is shown in the figures as the most reinforcing factors did not lead to the most successful communication attempts and the non-preferred activity did not lead to the least amount of successful communication attempts. Instead, it is believed that a variety of factors impact the successful implementation and usage of AAC systems. It is important that the activities are reinforcing for the child or that a reinforcer is built in. For Gabriel, the iPad was very motivating. Often, he would work diligently at other activities so that he could earn time on the iPad. Using a reinforcing activity, such as the iPad, helped to make therapy sessions fun and avoid 'burn out.' He also was motivated to ask for the iPad while completing other activities; however, the number of requests for the iPad was much lower than the number of requests used to complete other activities. It is believed that some activities, such as *Pop the Pig*, snacks, puzzles, books, and blocks, offer more communicative opportunities than activities, such as the iPad or listening to music. By providing adequate communication opportunities and experience to beginning communicators, communication skills can be refined and lead to more advanced communication skills. For example, when playing *Pop the Pig*, Gabriel had the opportunity to comment about whose turn it was, request the color hamburger that he wanted to feed the pig, and label the number shown on the hamburger. He did this for every turn that he took and every turn that the opponent took. This continued until the pig popped, which often was many turns later. Finally, he was able to comment on who

the winner was. When using the iPad, he was able to choose if he wanted to play games or listen to music, was able to label colors, and was able to request for more; however, he often only had to make one choice at the beginning of the activity, and only had to request for more when the iPad was taken by the clinician. There were less charted opportunities when using the iPad, even though the iPad was very reinforcing. When any individual is learning a new skill, such as communicating, they need to practice many times before they master the skill and generalize it to other activities, situations, and environments. When a child has many charted opportunities, they have more of the practice that is required to master the skill. When the child has fewer charted opportunities, they have less of the practice that is required to master that skill. Therefore, it is important that children have many charted opportunities when learning to use an AAC system and some activities offer more charted opportunities than others (Beukelman & Mirenda, 2005).

Children with autism thrive on routines and memorization. Gabriel learned the motor programming required to operate his Accent 1000. In addition, the therapy sessions were very routine and followed the same routine for each session. Gabriel was able to predict the routine of each session and he knew what communication was expected in each session.

In addition, Gabriel's mother ensured that Gabriel used the Accent 1000 at home. Gabriel's mother exhibited high levels of operational competence. She was able to operate the system, program the system, charge the system, and change settings within the system. Gabriel's whole family and all of his personal care assistants wanted the best for Gabriel and always ensured that he arrived to therapy sessions on time. Gabriel only

missed two therapy sessions throughout the duration of the research. One session was missed due to illness and the other was due to a dental appointment that lasted longer than expected. It was evident and it was reported that Gabriel was also expected to use his Accent 1000 at home. The familial support that Gabriel had allowed him to have many communication attempts across several environments and further increase his usage of several functions of communication.

Overall, this research showed that a variety of factors are important when implementing AAC systems in children with autism. Some of the factors considered in this study include reinforcers that draw individuals with autism to the activity and motivate them to communicate, the number of charted communication opportunities within an activity, routines, and a support system with adequate AAC system operational competence. A table that summarizes the factors that impacted the successful implementation of AAC for Gabriel can be found in Appendix C.

Limitations of the Current Study

Some limitations were noted during and after the conclusion of the study. One limitation was that, since the sessions were recorded, the front desk worker started and stopped the recording for the research. In some sessions, the recordings were started several minutes after the sessions began. This did not allow the researcher to collect data from the first several minutes of several sessions.

Another limitation identified has to do with other factors. For example, Gabriel was in the process of toilet training. Since he was in this process, he had a few accidents, which led to challenging behaviors or his need to miss several minutes of the session to change into dry clothes. Examples of sessions in which toileting accidents occurred in

correlation with decreased successful communication attempts include September 14 and October 26, 2017. In addition, Gabriel had accidentally removed some of the messages within his communication system; therefore, the clinician had to troubleshoot the system. Troubleshooting the system took several minutes and decreased the overall number of communication opportunities within a session. Technical difficulties were noted on October 26 and October 31, 2017.

The next limitation identified was that Gabriel was almost always brought to sessions by a different caregiver, generally, it was a personal care assistant that spent only a few hours with Gabriel after school and before his mother came home from work. The researcher was not able to ask Gabriel's mother, who was his most common communication partner at home, questions about the generalization of skills to the home setting.

The last limitation is that this was a single-subject design study. The research was conducted on only one individual; therefore, it is difficult to empirically show with the experiment's data that the findings will generalize out to larger populations. A single-subject design cannot examine any between-subject effects.

Recommendations for Future Research

If this exact study were replicated, a few changes should be implemented. First, inter-rater reliability should be implemented. Each recorded therapy session should be watched by the researcher and at least one additional individual. The current study only used intra-rater reliability, in which the researcher ensured that data collected while watching the recorded therapy sessions matched the data that was inputted into the electronic medical record system used in the MSUM Speech & Hearing Clinic. Second,

clear home programming instructions should be implemented to ensure that skills are being generalized to other settings. A communication notebook could be used for the client's family and personal care assistants to indicate progress and document what is happening at home. Third, this study should be completed in a group research design to allow for generalization across a larger population.

Future research for increasing functional and meaningful communicative attempts for children with ASD that use AAC is necessary. Specific recommendations to fulfill this task would be to investigate longer trial periods, to implement home programming, and to use a group research design to allow for generalization.

Conclusion

Speech-language pathologists frequently work with children with ASD who have a communication disorder. The use of AAC has become an essential part of language intervention for children with developmental disabilities, including autism, who experience significant difficulties with communication and social skills. Individuals with speech and language deficits may depend on AAC to supplement their existing speech or replace the speech they have that is not functional; therefore, AAC is increasingly incorporated into recommendations for children with ASD to improve communication (ASHA, 2015). AAC interventions have been shown to improve both communication and social skills in children with ASD and other developmental disorders. Simply providing communication aids is not enough. Successfully implementing and supporting the usage of AAC must also occur. Systematic instructions and a variety of factors can help individuals with developmental disabilities, such as autism, become functional communicators (Trembath et al., 2014). The results from studies such as this one may

assist speech-language pathologists in providing an evidence-based implementation of AAC systems for individuals. The combination of several factors, such as motivation, communication opportunities, and familial support can be useful when implementing and promoting the usage of AAC systems. The combination of these factors increased the number of successful communication attempts in this single-subject design research study.

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Appendix A

Reinforcer Assessment for Individuals with Severe Disability (RAISD)

Student's Name: _____ Date: _____
Name of Reporter: _____

The purpose of this structured interview is to get as much specific information as possible from the informant (e.g., teacher, parent, or caregiver) as to what they believe would be useful reinforcers for the student. Therefore, this survey asks about various categories of stimuli. After the informant has generated a list of preferred stimuli, ask additional probe questions to get more specific information on the student's preferences and the stimulus conditions under which the object or activity is most preferred (e.g., What specific TV shows are his favorite? What does she do when she plays with a mirror? Does she prefer to do this alone or with another person?).

We would like to get some information on _____'s preferences for different items and activities.

1. Some children really enjoy looking at things such as a mirror, bright lights, shiny objects, spinning objects, TV, etc. What are the things you think _____ most likes to watch?

   _____

   Response to probe questions:

   _____

2. Some children really enjoy different sounds such as listening to music, car sounds, whistles, beep, sirens, clapping, people singing, etc. What are the things you think _____ most likes to listen to?

   _____

   Response to probe questions:

   _____

3. Some children really enjoy different smells such as perfume, flowers, coffee, pine trees, etc. What are the things you think _____ most like to smell?

   _____

   Response to probe questions:

4. Some children really enjoy certain food or snacks such as ice cream, pizza, juice, graham crackers, McDonald's hamburgers, etc. What are the things you think _____ most likes to eat?

   _____

   Response to probe questions:

   _____

5. Some children really enjoy physical play or movement such as being tickled, wrestling, running, dancing, swinging, being pulled on a scooter board, etc. What activities like this do you think _____ most enjoys?

   _____

   Response to probe questions:

   _____

6. Some children really enjoy touching things of different temperatures, cold things like snow or an ice pack, or warm things like a hand warmer or cup containing hot tea or coffee. What activities like this do you think _____ most enjoys?

   _____

   Response to probe questions:

   _____

7. Some children really enjoy feeling different sensations such as splashing water in a sink, a vibrator against the skin, or the feel of air blown on the face from a fan. What activities like this do you think _____ most enjoys?

   _____

   Response to probe questions:

   _____

8. Some children really enjoy it when others give them attention such as a hug, a pat on the back, clapping, saying "Good Job," etc. What forms of attention do you think _____ most enjoys?

   _____

   Response to probe questions:

   _____

9. Some children really enjoy certain toys or objects such as puzzles, toy cars, balloons, comic books, flashlight, bubbles, etc. What are _____'s favorite toys or objects?

   _____

   Response to probe questions:

   _____

10. What are some other items or activities that _____ really enjoys?

    _____

    Response to probe questions:

    _____

After completion of the survey, select all the stimuli which could be presented or withdrawn contingent on target behaviors during a session or classroom activity (e.g., a toy could be presented or withdrawn, a walk in the park could not). Write down all of the specific information about each selected stimulus on an index card (e.g., "Having an adult female read him the Three Little Pigs story"). Then have the informant select the top 16 stimuli and rank order them using the cards. Then list the ranked stimuli below.

1.	_____	9.	_____
2.	_____	10.	_____
3.	_____	11.	_____
4.	_____	12.	_____
5.	_____	13.	_____
6.	_____	14.	_____
7.	_____	15.	_____
8.	_____	16.	_____

Are there any items (from the above list) that you would not want to use?

_____

Are there any items (from the above list) you would not want to limit _____'s access?

_____

Appendix B

Session Plan

1. Snack
    a. Gabriel was expected to complete a snack routine. Gabriel had the opportunity to request, comment, respond, make choices, and label. Snack choices for the activity were Mini Oreo Cookies and potato chips. Gabriel's mother reported that he was highly motivated by potato chips when completing the Reinforcer Assessment of Individuals With Severe Disabilities (RAISD).
2. Blocks
    a. Gabriel was expected to build with blocks. Gabriel had the opportunity to request, comment, respond, make choices, and label.
3. Book
    a. Gabriel and the clinician read a book. Prior to reading a book, Gabriel had the choice between two different books. During this task, Gabriel had the opportunity to request, comment, make choices, label, and ask questions.
4. Puzzle
    a. Gabriel was expected to complete a puzzle. Prior to completing the puzzle, Gabriel had the choice between two different puzzles. During this task, Gabriel had the opportunity to request, comment, respond, make choices, and label.

5. *Pop the Pig*
    a. Gabriel was expected to play *Pop the Pig* with a staff member or caregiver. During this task, Gabriel had the opportunity to request, comment, respond, make choices, and label.
6. Music
    a. Gabriel was expected to listen to music. During this activity, Gabriel had the opportunity to request, respond, and make choices.
7. iPad
    a. Gabriel was expected to play several applications on the iPad. His favorite was the Animal Piano application. During this activity, Gabriel had the opportunity to request, comment, respond, make choices, and label.

Appendix C

Summary of Important Factors That Impacted AAC Implementation

Motivating Factors/Reinforcers	It is important that the activities are reinforcing for the child or that a reinforcer is built in when completing therapy tasks. For Gabriel, the iPad was very motivating. Often, he would work diligently at other activities so that he could earn time on the iPad. Using a reinforcing activity, such as the iPad, helped to make therapy sessions fun and avoid 'burnout.' Reinforcing factors alone do not lead to increased successful communication attempts. This was evident as the most reinforcing factors did not lead to the most successful communication attempts and the non-preferred activity did not lead to the least amount of successful communication attempts. Instead, it is believed that a variety of factors impact the successful implementation and usage of AAC systems.
Communication Opportunities	By providing adequate communication opportunities and experience to beginning communicators, communication skills can be refined and lead to more advanced communication skills. When any individual is learning a new skill, such as communicating, they need to practice many times before they master the skill and generalize it to other activities, situations, and environments. When a child has many charted opportunities, they have more of the practice that is required to master the skill. When the child has fewer charted opportunities, they have less of the practice that is required to master that skill. Therefore, it is important that children have many charted opportunities when

	learning to use an AAC system and some activities offer more charted opportunities than others (Beukelman & Mirenda, 2005). It is believed that some activities, such as *Pop the Pig*, snacks, puzzles, books, and blocks, offer more communicative opportunities than activities such as the iPad or listening to music.
Routine and Memorization	Children with autism thrive on routines and memorization. Gabriel learned the motor programming required to operate his Accent 1000. In addition, the therapy sessions were very routine and followed the same routine for each session. Gabriel was able to predict the routine of each session and he knew what communication was expected in each session.
Support System with Operational Competence	Gabriel's whole family and all of his personal care assistants wanted the best for Gabriel and always ensured that he arrived to therapy sessions on time. In addition, Gabriel's mother ensured that Gabriel used the Accent 1000 at home. Gabriel's mother exhibited high levels of operational competence. She was able to operate the system, program the system, charge the system, and change settings within the system. The familial support that Gabriel had allowed him to have many communication attempts across several environments and further increase his usage of several functions of communication.

Appendix D

Instructional Review Board

MINNESOTA STATE UNIVERSITY MOORHEAD

Consent Form

Please read this consent agreement carefully before agreeing to participate in this study.

Title of study: Factors Related to Successful Implementation of an AAC Device for an Individual With Autism

Purpose of the study: The purpose of the study was to identify how caregivers and therapists can introduce and facilitate the usage of augmentative and alternative communication (AAC) for an individual with ASD. Research will determine factors related to successful implementation of an AAC system for a child with autism spectrum disorder.

What will your child do in this study: Your child will participate in therapy focusing on the implementation of AAC. Your child will be presented with a variety of functional and age-appropriate activities. The clinician will document communicative attempts and factors (such as your child's particular reinforcers and motivators determined during interviews and observations) will be implemented.

Time required: It will be suggested that the participant in this study attends the Minnesota State University Moorhead Speech and Hearing Clinic for speech device intervention two times per week during regular clinic hours. The data will be collected through December 2017. At this point, your child may have the opportunity to continue receiving services at the Minnesota State University Moorhead Speech and Hearing Clinic; however, data for the current research project will not be collected.

Risks: There are not anticipated risks associated with participating in this study.

Benefits: The research subject benefits by receiving services to implement an augmentative and alternative communication to improve communicative competence and quality of life.

Confidentiality: Your child will be assigned a pseudonym to preserve confidentiality. In addition, audio recordings, video recordings, and data collected during research will be stored in a locked cabinet in the MSUM Speech-Language Pathology Department.

Participation and withdrawal: Your participation in this experiment is completely voluntary, and you may withdraw from the experiment at any time without penalty. You may withdraw by informing the experimenter that you no longer wish to participate (no questions will be asked).

Contact: If you have questions about this study, please contact Dr. Kris Vossler, kris.vossler@msntate.edu, Phone: 218-477-4200.
Whom to contact about your rights in this experiment: Dr. Vossler, kris.vossler@msntate.edu, Phone: 218-477-4200, or else you may contact Dr. Lisa I. Karch, Chair of MSUM Institutional Research Board, at lisa.karch@mnstate.edu or 218-477-2699.

Agreement: The purpose and nature of this research have been sufficiently explained and I agree to participate in this study. I understand that I am free to withdraw at any time without incurring any penalty.

Signature: _____Date: _____

Name
(print):_____

Appendix E

Instructional Review Board

Debriefing Form

Title of Study: Factors Related to Successful Implementation of an AAC Device for an Individual With Autism

Summary of Study: Communication impairment is a defining characteristic of autism spectrum disorder (ASD) (Brown & Elder, 2014); therefore, the use of augmentative and alternative communication (AAC) has become an essential part of language intervention for children with autism that experience significant difficulties with communication (Flores et al., 2012). Assessing children's preferences for AAC options may be important with respect to AAC abandonment, which is a problem in the AAC field (Johnson, Inglebret, Jones, & Ray, 2006).

This study dealt with how caregivers and therapists can introduce and facilitate the usage of AAC for an individual with ASD. Research determined factors related to successful implementation of an AAC system for a child with ASD.

Whom to contact for more information: If you have questions about this study, or if you would like to receive a summary report of this research when it is completed, please contact Dr. Kris Vossler, kris.vossler@msntate.edu, Phone: 218-477-4200 or Michaela Worms, wormsmi@mnstate.edu, Phone: 320-241-3989.

Whom to contact about your rights in this experiment: Dr. Lisa I. Karch, Chair of MSUM Institutional Research Board, lisa.karch@mnstate.edu, phone: 218-477-2699.

If you feel that you are experiencing adverse consequences from this study: Please contact Dr. Kris Vossler, kris.vossler@msntate.edu, Phone: 218-477-4200 or Michaela Worms, wormsmi@mnstate.edu, Phone: 320-241-3989 and referrals will be made to the respective professional.

If you are interested in learning more about the research topic, you may want to consult:

Thank you again for your participation!

Dr. Kris Vossler and Michaela Worms