COMMUNICATIVE FUNCTIONS, AUTISM, AND AAC

BY

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Abstract

The purpose of this study was to compare the effects of a speech generating device with a dynamic display and a picture board on the communicative functions of children with autism spectrum disorders (ASD) as the children participated in theme based play activities. Two preschoolers with autism spectrum disorder who were minimally verbal participated in this study. This study used an alternating treatment design in which the communication systems were alternated between sessions. Each participant participated in five sessions. The first session was without either treatment option followed by four treatments sessions in which the speech generating device and picture board were alternated by session. Each child participated in two sessions with the speech generating device and two with the picture board. Fourteen theme based vocabulary words were chosen to target for each session. Seven of these were constant and seven changed each session. The icons were the same on the SGD and picture board. The results of this study were inconclusive. Neither condition affected communicative functions used by the participants. However, both participants did learn, with a limited amount of teaching, to use both devices. One participant communicated more frequently with the picture board and one with the SGD.

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Introduction

Chapter I

Autism

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder described in terms of a pattern of deficits in social behavior and communication accompanied by restricted and repetitive behaviors and interests as well as an onset prior to 36 months (Wetherby & Prizant, 2000). In the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition-Text Revision (DSM IV-TR), autism is defined as a pervasive developmental disorder (American Psychiatric Association, 2000). The challenges in ASD are evidenced by impairment in the use of nonverbal behavior, lack of spontaneous sharing, lack of socioemotional reciprocity, and/or failure to develop peer relationships. The impairment in communication is evidenced by a delay in or lack of development of spoken language and gestures, impairment in the ability to initiate or maintain conversation, repetitive and idiosyncratic use of language, and/or lack of pretend play. The restricted repertoire of activities and interests is evidenced in preoccupation with restricted patterns of interest, rigid adherence to routines, repetitive movements and/or preoccupation with parts of objects (Wetherby & Prizant, 2000). New prevalence data from the Centers for Disease Control (2007) indicates that 1 in 150 children in the United States have an ASD, making it the second most common serious developmental disability. Currently, it is suspected that both biological and environmental factors play a role in the cause of autism (CDC, 2007).

Biological factors include neurochemical and neurological differences. Some biomedical research has defined autism as a genetic disorder. One genetic study identified the TRIP8 and REEP3 genes on chromosome 10q21.3 as candidate genes for autism (Castermans et al., 2007). Further biomedical research is needed to identify why this genetic anomaly occurs.

Environmental causes are being investigated. The most commonly proposed environmental cause of autism is mercury exposure. There are several types of mercury exposure; the type theorized to have an impact on children concerning autism is organomercury poisoning. Ethlmercury is an organomercury dissociated from thimerosal a preservative in vaccines. Termination of the use of thimerosal began in the 1990s (NG, 2007). NG, Chan, Soo, & Lee (2007) performed a meta-analysis on mercury exposure in children and presented epidemiological evidence that low-level mercury poisoning is not a cause of autism. While the cause is still under investigation, the challenges continue for people with autism and their families. One of the primary challenges is in communication.

Communication in Autism

Communication challenges are a core deficit in ASD. Individuals with autism experience a wide range of difficulty with the form, content, and use of language (ASHA, 2006b). These difficulties affect their ability to communicative clearly and effectively with others. Many individuals with autism spectrum disorders experience substantial difficulties with receptive language skills as well as expressive language. This difficulty with language is leading to increased use of augmentative and

alternative communication (AAC) systems for individuals with ASD to augment language input as well as output (Light, Roberts, Dimarco, & Greiner, 1998). The challenges in communication for individuals with ASD include difficulties with non-verbal communication, verbal communication, social communication, and communicative forms and functions.

Non-verbal communication. Children with autism often have limited understanding of non-verbal communication including conventional gestures. This affects their ability to understand subtle information given by communication partners, which in turn affects the understanding of sarcasm and other nonliteral meanings. Individuals may also use challenging behaviors to signal communication intent. Joint attention is also often impaired. All of these challenges limit the individual with ASD's ability to infer the emotional state of others. (American Speech-Language -Hearing Association [ASHA], 2006b)

Verbal Communication. Some individuals with ASD have significant difficulty using speech as a functional form of communication. This may be due to the difficulty producing a variety of consonant sounds and complex syllable sounds (ASHA, 2006b). Individuals with autism may use a high proportion of formulaic expressive language in which well formed phrases may be learned or used as unanalyzed chunks, or echolalia. The semantic impairments in autism include using words and phrases in narrow, context-bound ways, and having difficulty with abstract terms. It is estimated that one third to one half of children and adults with autism do not use speech functionally (National Research Council, 2001). The wide range

estimated is thought to be due to the criteria used to determine what is considered "spoken language."

Social Communication. Children with ASD often have poor pragmatic abilities having problems with both linguistic and non-linguistic pragmatic skills (ASHA, 2006b). Pragmatic language encompasses the conventions and rules of social knowledge or socio-cognitive understanding as well as the linguistic devices used to structure coherent discourse and disambiguate meaning (Boucher, 2003). Problems with attention are another core deficit for individuals with autism (McDuffie, Yoder, & Stone, 2005). Attention following is a child's ability to change the direction of head and eyes in response to a change in the focus of another individual. This deficit in attentional focus interrupts the child's ability to learn new words as their typical peers might learn them. Therefore, children with ASD who are unable to follow the speaker's referential focus may make inaccurate word-object pairings or not make the connection at all (McDuffie, Yoder, & Stone, 2005). This can negatively affect the social interactions with peers.

Communicative Forms and Functions. The functions of communication are the purposes or reasons for communicating (Quill, 2000). This includes request for objects, social interaction and affection, protests, declarations, and comments (Wetherby & Prizant, 2000). Communicative functions are important because children with autism primarily use communication as a way to request objects or to regulate the behavior of others. Children with ASD appear to develop some communicative functions in a sequential fashion as opposed to a concurrent fashion

as occurs in children who are developing typically (Calloway, Myles, & Earles, 1999). Without a conventional means of communication, children with autism may use nonconventional and less recognizable means to express themselves. These behaviors can serve different communicative functions including to protest, gain attention, or to escape from a situation. Potentional Communicative Acts (PCA) is a term that has been used to describe any behavior that is interpreted as a form of communication (Sigafoos et al., 2000). PCA can be any means of communication that the child may be using in place of functional communication, such as speech, which can include undesirable behaviors (Sigafoos et al., 2000). Children may be using forms to communicate that are unclear to others, thus limiting the response received from the communication attempt. Houghton, Bronicki & Guess (1987) studied the responses of teachers to the communication attempts of children with severe disabilities. They found that teacher response rates were low when a student's communication behaviors were unclear or subtle. Children who are using unclear forms of communication could benefit from a system such as AAC to clarify their communication attempts.

Calloway, Myles, & Earlses (1999) investigated the acquisition of communicative functions in children with autism. To collect data they used the Checklist of Communicative Functions and Means (Prizant, Wetherby, & Roberts, 1993). The checklist was completed a year apart by teachers. The results of this investigation indicated that over a one year time period during which 13 of the 15 children received speech language intervention, children with ASD showed a significant change in 41

of 204 variables associated with communicative functions. These changes included an increase in facial expression to request an object, proximity to call, proximity to request, and facial expression to show off. Along with these increases, there were some decreases in variables such as aggression, tantrums and crying/ whining. It seemed that as the more primitive communication skills decreased, an increase occurred in more advanced skills. Development of communicative functions appears to follow a pattern of acquisition from behavior regulation, to social interaction, to joint attention (Calloway, Myles, & Earles, 1999). Communicative functions for behavior regulation, such as requesting, is commonly the primary communicative function used by children with ASD. Other communicative functions such as social interaction and commenting/ labeling are important however; these are often more difficult for children with ASD to acquire due to the fact that they require joint attention (ASHA, 2006b).

Three important pragmatic functions for intentional communication include initiating, joint attention, and turn taking. These behaviors have been linked to important developmental outcomes for children with ASD (Yoder & Stone, 2006). Facilitating prelinguistic skills such as joint attention helps to establish a strong foundation of intentional communication on which linguistic skills can be built (Sevcik, Romski, & Adamson, 2004). Due to the difficulties in acquisition of effective communication skills in children with autism, AAC has been recently been considered a viable support. ASHA (2006a) has stated that:

> The use of both unaided and aided AAC approaches with individuals with ASD has been associated with improvements in behavior and emotional regulation, improvements in speech, expressive language, and social communication, and improvements in receptive language development and comprehension (p. 27).

AAC and Autism

AAC is defined by the American-Speech-Language-Hearing Association (2002) as:

> …a set of procedures and processes by which an individual's communication skills (i.e., production as well as comprehension) can be maximized for functional and effective communication. It involves supplementing or replacing natural speech and/or writing with aided (e.g., picture communication symbols, line drawings, Blissymbols, and tangible objects) and/or unaided symbols (e.g., manual signs, gestures, and finger spelling) (p. 2).

Aided communication incorporates devices that are external to the individual while unaided communication does not require any equipment that is external to the body (Mirenda, 2003). An example of aided communication would be a speech generating device (SGD) while an example of unaided communication would be sign language.

AAC should not be viewed as a last resort but instead as the first line of intervention that provides a firm foundation for the development of spoken language

comprehension and production (Sevcik, Romski, & Adamson, 2004). The use of AAC techniques may facilitate speech development and production with evidence showing the effectiveness of aided techniques including communication boards with pictures and words, tangible symbols, PECS, and SGDs (Mirenda, 2003). A reduction in pressure for speech production may allow individuals to bypass the motor and cognitive demands of speech, focusing on communication. For individuals with developmental disabilities, AAC may also provide a more immediate and consistent model from which to learn. In a meta-analysis of research investigating the effect of AAC on speech production, Millar, Light, and Schlosser (2006) found that 89% of the cases in the investigations included in the analyses demonstrated increased speech production of words or word approximations during or following at least one intervention. The cases included individuals with autism

Tetzchner et al. (2004) found that it is possible for an individual to lack comprehension of spoken or signed language and still be able to learn how to use graphic symbols to communicate. These authors provided a structured total communication intervention for a young girl with autism and cognitive impairment. During the initial session, preferred objects were placed within view but out of reach and once the child expressed interest in an item she was assisted in using a picture to obtain the desired item. It was speculated that this child did not develop spoken language because of impaired processing being for speech and because of impaired not language.

Peterson, Bondy, Vincent, and Finnegan (1995) studied the comprehension of two students with autism who were non-verbal. The students were given an object retrieval task under three conditions: (a) spoken cue, (b) spoken plus gesture/pictorial cue, and (c) gesture/pictorial cues only. The students performed better when a pictorial cue was provided with or without spoken input. The authors suggested that spoken cue only is insufficient input for some children with autism and that augmented communication should be used with these individuals.

To obtain functional AAC use, most people use a combination of unaided and aided communication depending on the context and communication partner. A meta-analysis of AAC research by Schlosser and Lee (2000) indicated that across all age groups and participant populations, unaided AAC approaches were significantly more effective than aided with regard to acquisition but there was no difference found with generalization and maintenance. Only 10% of the studies included in this meta-analysis involved participants with autism spectrum disorders. Although some studies suggest that unaided AAC approaches may be superior, this may not be the case for children with autism. It was found that not all children performed equally well with regard to manual sign learning due to the fine motor requirement to generate the signs. This may be the reason manual signing, an unaided approach, can be difficult for some individuals with autism and for aided approaches to become an option for this population (Mirenda, 2003). Another reason aided approaches may be more effective for individuals with ASD is due to their strong visuospatial skills and need for visual input (ASHA, 2006b).

Peterson, Bondy, Vincent, and Finnegan (1995), Tetzchner et al. (2004), Millar, Light, &Schlosser (2006) and others have demonstrated that given the appropriate opportunities and instruction, individuals with autism can learn aided techniques for functional communication. Goossens' (1984) has demonstrated that graphic symbols may be easier to learn because it makes fewer demands on memory than manual sign. For aided approaches to be successful, appropriate intervention strategies are needed (Mirenda, 2003).

Speech generating devices (SGD) and autism. A speech generating device is a electronic device that has a screen that displays symbols. Upon touching a symbol, the device will provide a voice output message that has been stored under that symbol (Downing, 2005). There are two main types of displays with SGDs, static displays and dynamic displays. Static displays are fixed displays in which the number of symbols is limited depending on a person's visual, tactile, cognitive, and motor capabilities. A person who relies on static forms of AAC often has several displays to accommodate their vocabulary needs. There are several static options including picture boards and some SGDs. Dynamic display is a computer screen display that, when activated, automatically changes the selection set to a new set of programmed symbols. This allows an individual to have access to a large set of vocabulary (Beukelman & Mirenda, 2005).

A case study by Brady (2000) provided evidence of increased speech comprehension for object names. This case study involved two children under 6 years of age with severe cognitive disabilities, one of whom also had a diagnosis of autism.

These children were taught to request using an SGD. The comprehension of the targeted vocabulary was measured before and after the intervention. The children learned to request six objects using their SGD as well as showing increased comprehension skills for the name of objects requested.

SGDs have been shown to facilitate the integration of alternative methods into everyday environments with unfamiliar people. By having voice output, there is no need for the communication partner to be skilled in sign language or symbol sets to communicate with the AAC user nor do they have to be in close proximity to understand the message. As a result, SGDs have the ability to facilitate natural interpersonal interactions and socializations. Parsons and Sorte (1993) researched Computer- Assisted Instruction (CAI) with children with autism who were verbal. During this investigation, the children were exposed to two different conditions; one with synthetic speech output and one without. During both teaching sessions the children's spontaneous verbal utterances were counted. Results of this study indicated that synthetic speech resulted in a marked increase in spontaneous utterances.

Research has shown advantages of SGDs over nonelectronic, picture communication boards including a visual cue followed by an auditory stimulus. Schlosser Ravinigam, Blishcak, & Hetzroni (1995) compared SGD and non-SGD use with children with autism. The results indicated that the number of training sessions needed to meet criteria was consistently decreased in the SGD condition across all 4 sets of lexigrams for each participant. This study indicated that auditory stimuli are effective in promoting and reinforcing the learning of graphic symbols.

Another advantage of an SGD is that it permits programming of messages of varying length and content that are easily understood by individuals who are both familiar and unfamiliar with the user. This means that the communication partner can be anyone, not just someone who knows manual sign or another form of communication. The device also provides a potentially efficient way to gain attention of the communication partner over other forms of communication (Schepis, Reid, Behrmann, & Sutton, 1998).

Graphic symbols . There are several available options with aided symbols including tangible symbols and graphic symbols. A variety of tangible symbols exist including real objects, miniature objects, and partial objects. Varieties of graphic symbol systems are also available including photographs, line drawings, and picture symbols. Different forms of line drawings include Picture Communication Symbols (PCS) (Johnson, 1994), Blissymbolics (Silverman, 1995) and rebus symbols (Woodcook, Clark, & Davies, 1968) while different forms of picture symbols includes DynaSyms (Glennen & DeCoste, 1997), Minspeak (Baker 1982, 1986), and Pictorgram (Maharaj, 1980) symbols.

Symbols vary in their level of iconicity (Beukelman & Mirenda, 2005). Koul and Schlosser (2004) compared the acquisition of symbols with varying iconicity. This study coded a set of symbols considered highly translucent and compared them to symbols that were considered low translucent. The symbols were coded as high translucency if they had a visual resemblance of the referent and they were coded low translucency if their association with the referent could not be determined by their

visual resemblance. Participants in this study learned more high translucent symbols than low translucent in both the SGD and non-SGD conditions. Symbols are learned more readily when the symbols closely resemble their referents and when auditory feedback may assist in this.

Intervention Strategies to Teach AAC

When teaching AAC, there are many intervention approaches to use and places where intervention can occur. Two intervention approaches to teach AAC include direct instruction (Beukelman & Mirenda, 2005) and aided input (Drager et al., 2006) Intervention contexts include natural contexts such as play, classrooms, community settings, or arranged environments such as rooms specifically for teaching that have few distractions .

Intervention approaches. Direct instruction is characterized by an adult or computer generated discrete trials with each trial typically consisting of a stimulus, a response, and a reinforcer. The trials are repeated to a set level of mastery before the prompt is gradually faded to produce an independent correct response (Beukelman & Mirenda, 2005).

A direct approach to teach AAC is Functional Communication Training (FCT), which is designed to reduce problem behavior by teaching functionally equivalent communication skills. A thorough assessment is performed to determine the function of the behavior in question and systematic instruction is used to teach an equivalent skill. AAC is often used as a the equivalent substitute (Mirenda, 2001; Tager-Flusberg, 2004).

Picture Exchange Communication System (PECS) is another direct approach used to teach requesting with aided symbols. Using this method, individuals are taught to exchange a symbol for the desired item. There are several stages to this approach including the first phase in which the person learns to pick up a single symbol and hands it to the facilitator who exchanges the symbol for the item. During the first phase, an assistant provides physical and gestural prompts which are gradually faded until the exchange is made independently. In the second phase the person learns to find the picture and take it to the facilitator independently while during the third phase the number of symbols available are increased (Beukelman & Mirenda, 2005).

Aided input or aided modeling is another method of AAC instruction. This approach is used to augment the input the child is receiving while also providing a model for vocabulary expansion. This method provides the individual with opportunities to use and observe a model combining the symbols into a meaningful utterance. The model highlights the symbols on the AAC user's device as well as interacting verbally with the user in a natural environment. The System for Augmenting Language (SAL) is a method of aided language stimulation taught in a natural situation in which the child is encouraged, but not required, to use symbols (Sevcik, Romski, & Adamson, 2004). A speech generating device (SGD) along with communication interventions such as System for Augmenting Language (SAL) may help support the engagement of a child with developmental delay in the environment. Sevcik, Romski, & Adamson (2004) used SAL as a multi-modal instructional

method. SAL consists of an SGD used in a natural environment with an individualized symbol system. During intervention expressive use of device by the child is encouraged but is not required while the facilitator augments input to the child. Ongoing resource and feedback to support communication is utilized throughout. These authors found that a preschool child with a developmental delay increased his quantity of utterance attempts along with frequency when an SGD was introduced along with SAL. This study used the Mayer-Johnson symbol set (Johnson, 1994) as well as a synthetic voice output device called WOLF. Schepis, Reid, Behrmann, & Sutton (1998) studied the use of SGDs by four young children with autism in a classroom setting. Teachers were trained to incorporate the device into daily activities. Results indicated that all of the children in the study benefited from the intervention and were able to make requests, answer yes and no questions, make statements, and social comments using their device. Natural Aided Language is a strategy that was described by Cafiero (1998) to be used specifically with children with autism. This method is taught with several communication boards placed around a classroom or another natural environment where the child use the board to request preferred items, which have been placed out of reach.

Drager et al. (2006) described an approach similar to these approaches called Aided Language Modeling (ALM). The three primary components of ALM include the communication partner using an index finger to point to a referent, sequentially pointing to a symbol for the referent while simultaneously vocalizing the verbal symbol for the referent. Using ALM, interventionists engaged two preschool children

with autism in interactive play while providing models of use of the AAC symbols. Drager et al.(2006) determined that ALM was an effective treatment to increase symbol comprehension and increasing symbol production in preschoolers with autism. These authors used daily and maintenance probes to determine symbol comprehension and symbol production. Research has shown that in children with spoken language, verbal input may contribute to learning to comprehend and produce graphic symbols. This is also what is hoped will be accomplished through aided input methods with AAC. The children either receive spoken language in the form of output from the device or from the communication partner in order to build their own knowledge of the language.

There is also growing evidence that disputes the assumption that comprehension precedes production (Harris & Reichle, 2004; Sevcik, Romski, & Adamson, 2004). Harris and Reichle (2004) conducted a study in which 3 preschool children participated in aided language stimulation with 12 vocabulary words. They evaluated symbol comprehension throughout the study. Their results suggest that young children with moderate cognitive disabilities can acquire, concurrently, comprehension and production skills as a result of aided language stimulation in the context of a scripted routine.

Intervention context. Naturalistic teaching for children involves taking advantage of naturally occurring play opportunities to develop communication skills. By using the environment and what is of interest to the child, they will be rewarded by having their communication needs understood by their communication partner

(Schepis, Reid, Behrmann, & Sutton, 1998). The ASHA Guidelines for Treatment of Autism Spectrum Disorders Across the Life Span (ASHA, 2006b), states that "natural learning environments invite higher rates of initiation and generalization, progress in these contexts is more likely to result in school success and translate into a better quality of life and increased social acceptance" (p. 16).

Schepsis, Reid, Behrmann and Sutton (1998) define naturalistic teaching as the use of naturally occurring opportunities to teach communication skills during the course of an individual's daily routine. The focus is on communication behaviors of immediate functional use. These researchers also studied the effects of a speech generating device and naturalistic teaching on the communication interactions of young children with autism. Four children participated in this study with intervention during snack routines while two of the children also participated in play routines. The authors of this study instructed classroom staff on naturalistic teaching approaches. The classroom staff was instructed to use the least amount of physical guidance to instruct the use of the SGD by the child. If other methods were not successful physical prompting could be used to obtain a correct response but this approach was infrequently necessary. During the study, the rates of communicative interactions increased for all of the children during the snack condition. Communicative interactions that were SGD responses averaged 93% of all interactions. The adults did not physically guide the majority of the SGD use and each child used the SGD consistently without a specific verbal prompt to communicate. The study presented efficacy of using an SGD along with naturalistic

teaching procedures to increase the frequency of communication behaviors in four young children with autism including using the SGD to request items, to respond to questions, and make social comments.

There is some evidence that aided language input used in natural contexts can increase the communication of youngsters with autism (Cafiero, 1998). Although there are a variety of options for AAC with individuals with autism there currently is not much evidence comparing SGDs and static picture board or the effects of these on the communicative functions used.

Purpose

The purpose of this study was to compare the effects of a speech generating device with a dynamic display and a picture board on the communicative functions of children with autism.

Chapter II

Method

The purpose of this research was to compare the effects of a dynamic display speech generating device and a static picture board on the communicative functions of children with autism.

Participants

The participants in this study were two boys who had been diagnosed with autism spectrum disorder. Participants were recruited through area preschools. Information packets were delivered to area preschools which included fliers (Appendix A), invitation letter to parents (Appendix B), and introduction letter to administrators (Appendix C). Announcements (Appendix D) were also posted in the newspaper and on listerservs. These announcements explained the subject criteria, timeline of the study, purpose of the study, and contact information of the investigators. For a list of preschool sites and listservs see Appendix E and Appendix F. Once families expressed interest in the study by contacting the investigators, information packets were sent to them including consent forms(Appendix G), preference inventory (Appendix H), and the MacArthur-Bates Communicative Development Inventory. Potential participants were screened through phone interviews with the parents. Initially four families expressed interest in the study, one child did not meet our participant requirements and another child met

the requirements but was unable to arrange to participate in this study. Two of these four children participated in the study.

Participant A was a 4 year old Caucasian boy who received a diagnosis of autism spectrum disorder at the age of three. He lived at home with his parents and older brother. He attended preschool four days a week for two hours each day. He received two thirty minute speech therapy sessions and one thirty minute occupational therapy session a week. He also received individual private speech therapy services once a week for forty-five minutes. Table 1 displays the results of the MacArthur-Bates Communicative Development Inventory: Words and Gestures (Fensen, L. et al, 1992). Participant A was reported to use the following words or word approximations: baa baa, grr, moo, ouch, uhoh, vroom, ball, daddy, bye, no, peekaboo, shhh, hug, love, open, and mine. Participant A communicated mainly through vocalizations, body movement, action on object and facial expression. He predominantly communicated to request and protest. See Table 2. Participant A had some experience communicating with the Picture Exchange Communication System (PECS) which he had begun using ten months prior to the initiation of the study and was using 75 icons at home and 150 icons at school for requesting.

Table 1

Participant A: MacArthur-Bates Communicative Development Inventory Profile

Communication Forms	Total
Words produced	12
Words comprehended	209
Early gestures	11
Later gestures	32
Total gestures	43

Table 2

Participant A: Baseline Frequency and Percentage of Communicative Functions

Communicative Functions	Frequency
Protest/Reject	12 (28.5%)
Request	17 (40.5)
Confirm/ Deny	7 (16.6%)
Social	2 (4.8%)
Comment/ Label	0
Gain attention	1 (2.4%)
Direct attention	2 (4.8%)
Ask a question	1 (2.4%)

Participant B was a 5 year, 2 month old boy. His family was from India and spoke only English in the home. Participant B was born in the United States. See Table 3 for results of the MacArthur Bates Communicative Development Inventory: Words and Gestures (Fensen, L. et al, 1992). The two words Participant B used were "hi" and "bye". Participant B primarily communicated with others by leading or directing them, other body and a few vocalizations. His primary communicative function was requesting. He attended half-day special education pre-kindergarten. He received occupational and speech therapy each for one hour per week. He was using a low-tech communication device, the Blue Bear, infrequently to ask questions at school. He only used the device at school during speech therapy and had been using it for approximately a month when the study began. Because his use of an SGD was limited and in one context, he was included in the study.

Table 3

Participant B: MacArthur-Bates Communicative Development Inventory Profile

Communication Form	Total
Words spoken	2
Words understood	84
Early gestures	14
Late gestures	33
Total gestures	47

Table 4

Participant B: Baseline Communicative Functions

Communicative Functions	Frequency
Protest/ reject	1 (3%)
Request	19 (57.6%)
Confirm/ deny	8 (18.2%)
Comment/ Label	4 (12.1%)
Direct attention	3 (9.1%)

Setting and Context

Setting. The study was conducted at the University of Kansas Schiefelbusch Speech-Language- Hearing Clinic in an individual treatment room. During the sessions two investigators were present as well as a parent as needed by the child.

Context. Each child participated in five sessions that were theme based with 14 targeted vocabulary per theme on the SGD or picture board. The themes were: transportation, around the house, actions, construction, and opposites. To determine what themes to use, a preference assessment was given to each family. The top five themes that were preferred by both children were chosen.

During the sessions, various activities were presented including book reading, motor activities, and art activities. Activities were adapted from *Building a Language Focused Curriculum for the Preschool Classroom: A Planning Guide* (Bunce, 2005). Each theme was centered around a children's story book with

vocabulary words chosen from the book to be placed on the SGD or picture board. Materials used in the sessions included books and various toys depending on the theme for that session (e.g. toy boat, toy car, magnetic space board). All sessions were digitally recorded to be viewed at a later date.

AAC supports. Two supports were used in this study, the Springboard speech-generating device and a picture communication board. The Springboard is a full color, touch screen computer with a text display panel for users to see what is being spoken. It has voice output that speaks the pre-programmed word or phrase when a button is pressed. The Springboard screen can be arranged in 4, 8, 15, or 32 buttons to accommodate different levels of knowledge. The Springboard can be accessed through direct touch, switch, joystick, or an infrared pointer. It can also be connected to a computer via the USB port to be used with a mouse and printer (Prentke Romich, no date). The Springboard contains dynamic display technology in which a selection on a display results in a new array of graphic symbols. Dynamic display offers the advantage of having fewer symbols on a page at one time while still allowing access to a large number of vocabulary (Drager et al., 2004). For this study the Springboard displayed fifteen buttons, fourteen icons representing the targeted vocabulary and an icon to clear the display. See Figure 1.

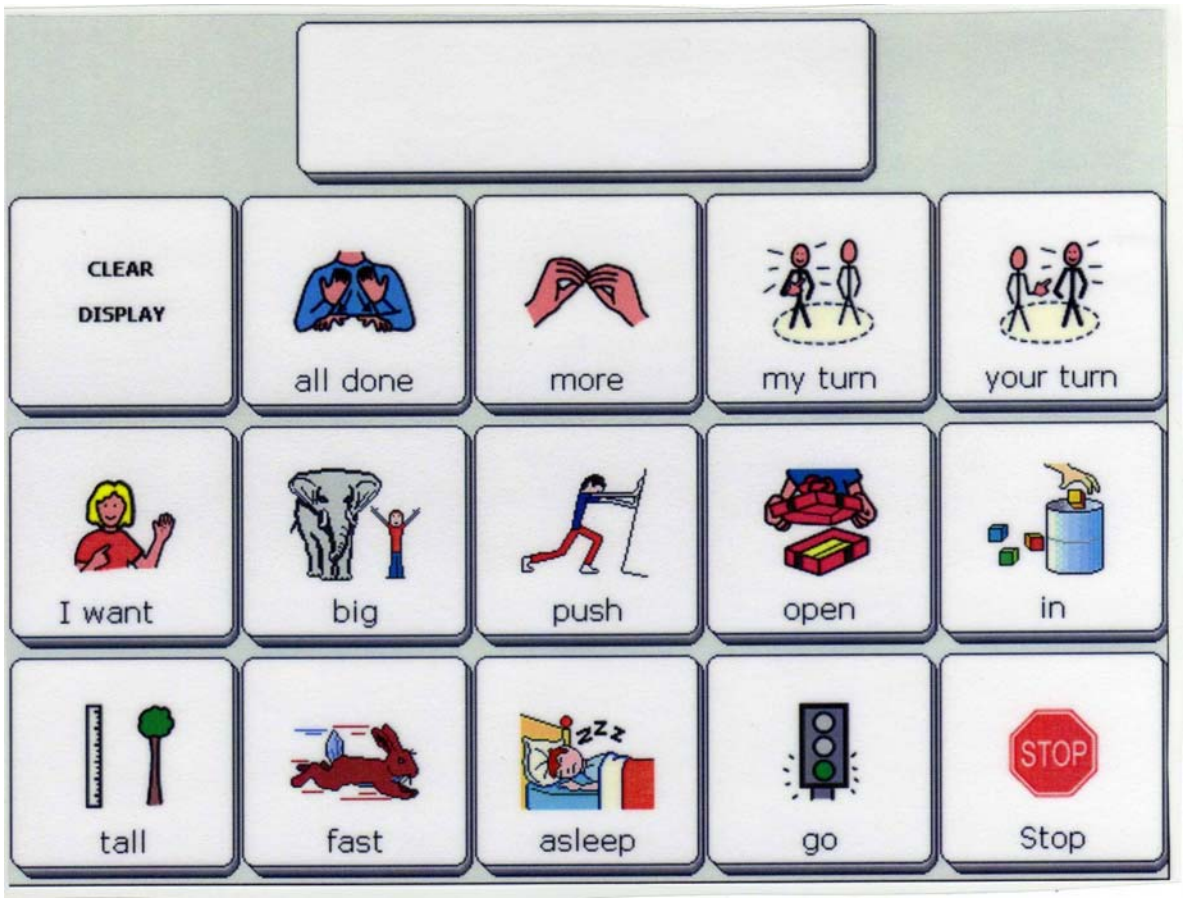
Figure 1.

Springboard Speech Generating device (SGD)

The Prentke Romich Company Application and Support Software (Prentke Romich, n.d.) was used to make each of the picture communication boards so that the Springboard and communication boards were identical. See Figure 2. Each communication board was 6 x 8 inches and displayed fourteen icons representing the targeted vocabulary words and an icon to clear display.

Figure 2.

Picture Communication Board



Vocabulary. Vocabulary words were chosen based on preferred themes by the children. Once themes were established, vocabulary words and the activities were chosen that would be appropriate for the age level of the children as determined by the experience of the investigators in a preschool classroom. Table 5 displays the themes and vocabulary used for each theme. Of the fourteen vocabulary words, seven of them were constant and remained the same throughout the study while the

remaining seven words changed every session with the theme. The vocabulary words selected could be used for a variety of communicative functions.

Table 5

Session Themes and Vocabulary

Session 1: Transportation	Session 2: Actions	Session 3: Home	Session 4: Opposites	Session 5: Building
More	More	More	More	More
Turn the page	Turn the page	Turn the page	Turn the page	Turn the page
My turn	My turn	My turn	My turn	My turn
Your turn	Your turn	Your turn	Your turn	Your turn
All done	All done	All done	All done	All done
Stop	Stop	Stop	Stop	Stop
Go	Go	Go	Go	Go
I want	I want	I want	I want	I want
Rocket	jumping	cook	Big	toolbox
Boat	spinning	music	push	wrench
Airplane	pinwheel	bath	open	hammer
Motorcycle	swinging	bed	in	saw
Hot air balloon	swimming	car	tall	Clock
car	flying	ball	fast	screwdriver
Sticker please	marching	house	asleep	present

Procedures

Baseline. Prior to intervention, one session was conducted to introduce the children to the setting and to observe their current communication status including communicative forms and functions. This session consisted of a similar lesson plan as the intervention sessions including a play theme and targeted vocabulary terms but no communication aid was used in the session. Each vocabulary term was modeled verbally 10 times without the use of any AAC.

Intervention. An alternating treatment design was used with the treatments, SGD and picture board, alternating sessions. Each participant had two 30-45 minute sessions with the SGD and two with a communication board. Participant A began with the communication device and Participant B began with the communication board. Each participant participated in four treatment sessions, two with each communication method. Each session began with the assent procedures and then moved toward introduction of the play theme for the day. The participant was encouraged to explore any activity including the device during the session. Throughout the session the investigator modeled each of the fourteen vocabulary words ten times with the device or picture board as well as verbally. A child-centered, aided input approach was the basis of the session with the investigator commenting, labeling, and modeling throughout. The investigator primarily followed the child's lead in choosing activities. Once the child showed a preference for an activity the investigator modeled how the child could request more or comment using the device or picture board. A sample lesson plan can be seen in Appendix I. To control for equal amount of input, each vocabulary word was modeled only ten times. While the investigator interacted with the participant, the assisting investigator kept track of the number of times each vocabulary word was modeled, alerting the interacting investigator when she had met the limit of ten. A grid was used to track each time a vocabulary word was modeled (Appendix J).

Date Collection and Coding

All sessions were recorded with a wall mounted Mace camera and a Pioneer 640H DVD Recorder. Data were collected for 30-45 minutes each session depending on the length of time it took to meet the limit for all of the vocabulary words to be modeled by the investigator. The average session length for participant A was 45 minutes and the average session length for participant B was 35 minutes. A modification of the Social Interaction Coding System (Rice, Sell, & Hadley, 1990) and Rowland, Schweigert, and Stremel's (1992) communication observation form was used to record data (Appendix K). The recording of each session was reviewed and the interactions documented. If communicative attempts were separated by more than 5 seconds or there was a change in partner, this was coded as a separate interaction. Within each interaction, the investigator recorded time, play activity, interactive status, communicative form, communicative function, and content/message. Each turn was coded as an initiation or a response. The communicative forms were noted as gross vocalizations, simple body movements, simple action on people, simple action on objects, point, facial expression extend hands/ reaching, speech or device use. See table 6 for a list of definitions of the communicative functions used in the coding. (Downing, 2005; Rowland, Schweigert, & Stremel, 1992).

Table 6

Communicative Function Definitions and Examples

Communicative Functions	Description	Example
Protest/ reject	The child indicating a desire for another person to stop an activity or to remove an undesired object	Screaming or pushing away
Make a request	The child indicating a desire to obtain an object, to engage in an activity, or to acquire assistance from another person	Reaching for a desired object
Gain attention	The child seeks to attract attention from another person	Child moves towards a person and looks into their face
Direct attention	The child attempts to draw another person's attention to an external object, event, or person	Switches activities through body movement
Social interaction	The child's expressions serve a strictly social purpose	Saying "hello" or "goodbye"
Confirm/ deny	The child responds appropriately to a "yes" or "no" question	"Yes" or "no"
Label/ Comment	The child identifies something or makes a remark about it for the purpose of sharing information rather than as a request, protest, or other intent	Holds up a toy car and says "car"
Ask a question	Ask about something	Looks at a toy question what it is

Reliability

Reliability for interaction coding was determined for four of the sessions including baseline sessions for each participant. A second observer, a graduate student in speech-language pathology, viewed the recordings of these sessions and recorded data. (See Appendices L and M). Reliability was first determined on the occurrence of interactions. Reliability for interactions across the four sessions was 59.5%. Due to the low inter-observer agreement, each recording was reviewed by the investigator and second observer together to obtain consensus about whether an interaction occurred. Once consensus was reached, the reliability of the coding was determined. Coding reliability was 100%.

Data Analyses

Descriptive statistics and visual analysis were used to compare the communicative functions of the participants in the alternating treatments.

Chapter III

Results

The purpose of this study was to compare the effects of a speech generating device with a dynamic display and a picture board on the communicative functions of children with autism. Specifically, did communicative function frequency differ between treatment conditions?

Participant A

Overall, participant A communicated more often when the picture board was available as opposed to when the SGD was available. He used the SGD more to request while he used the picture board more to confirm/deny. Table 7 illustrates participant A's communicative functions across all sessions including all forms. Table 8 illustrates participant A's total communicative functions for each treatment condition including all forms. Participant A did not use either aid to communicate very frequently. He used the picture communication board a total of four times and the SGD a total of three times across all sessions. Figure 3 illustrates the communicative functions used with the devices.

Table 7

Participant A: Communicative Functions Across Sessions

Communicative functions	Session					
	Baseline	Session 2 SGD	Session 4 SGD	Session 3 Board	Session 5 Board	**Total**
Protest/reject	12 (28.5%)	8 (24.2%)	13 (42%)	17(50%)	17 (31%)	67 (34.3%)
Request	17 (40.5%)	14 (42.4%)	14 (45.2%)	4 (11.8%)	7 (12.7%)	56 (28.7%)
Confirm/deny	7 (16.6%)	5 (15.2%)	1 (3.2%)	2 (5.8%)	22 (40%)	37 (19%)
Social	2 (4.8%)	1 (3%)	0	1 (3%)	3 (5.4%)	7 (3.6%)
Comment/label	0	1 (3%)	3 (9.6%)	6 (17.6%)	2 (3.6%)	12 (6.2%)
Gain attention	1 (2.4%)	0	0	0	0	1 (.5%)
Direct attention	2 (4.8%)	4 (12.2%)	0	4 (11.8%)	4 (7.3%)	14 (7.2%)
Ask a question	1 (2.4%)	0	0	0	0	1 (.5%)

Note: Values represent all forms of communication used

Table 8

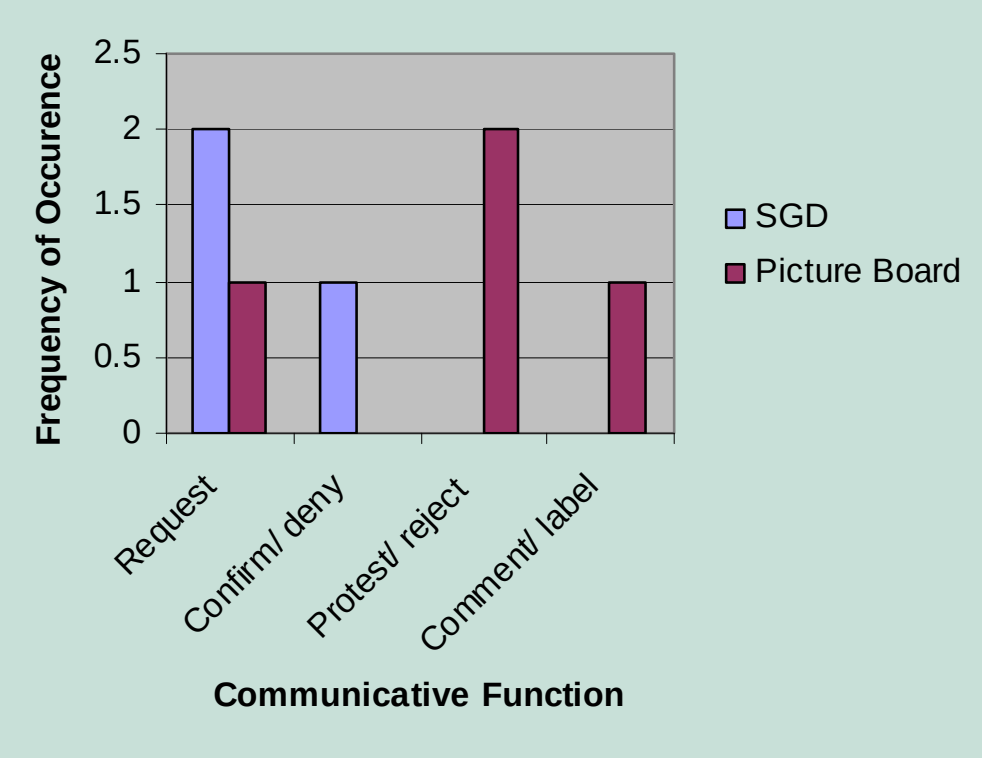
Participant A: Communicative Functions Across Conditions

Communicative functions	Condition		
	Baseline	SGD	Board
Protest/reject	12	21	34
Request	17	28	11
Confirm/deny	7	6	24
Social	2	1	4
Comment/label	0	4	8
Gain attention	1	0	0
Direct attention	2	4	8
Ask a question	1	0	0

Note: Values represent all forms of communication used

Figure 3

Participant A: Communicative Functions with Devices



Participant B

Overall participant B, communicated more often when the picture board was present as opposed to the SGD. He used the SGD primarily to protest/reject. Table 9 illustrates participant B's communicative functions across all sessions including all forms. Table 10 illustrates participant B's total communicative functions for each treatment condition including all forms. He used the picture board twelve times and the SGD forty-three times. Figure 4 illustrates participant B's communicative functions with the devices.

Table 9

Participant B: Communicative Functions Across Sessions

Communicative Function	Session					
	Baseline	Session 2 SGD	Session 4 SGD	Session 3 Board	Session 5 Board	**Total**
Protest/reject	1 (3%)	0	0	1 (4.5%)	4 (8.9%)	6 (4.2%)
Request	19 (57.6%)	7 (33.3%)	19 (82.67%)	21 (95.5%)	19 (42.2%)	85 (59%)
Confirm/deny	6 (18.2%)	10 (47.6%)	1 (4.3%)	0	19 (42.2%)	36 (25%)
Social	0	0	0	0	0	0
Comment/label	4 (12.1%)	1 (4.8%)	1 (4.3%)	0	3 (6.7%)	9 (6.3%)
Gain attention	0	0	0	0	0	0
Direct attention	3 (9.1%)	3 (14.3%)	2 (8.7%)	0	0	8 (5.5%)
Ask a question	0	0	0	0	0	0

Note: Values represent all forms of communication used

Table 10

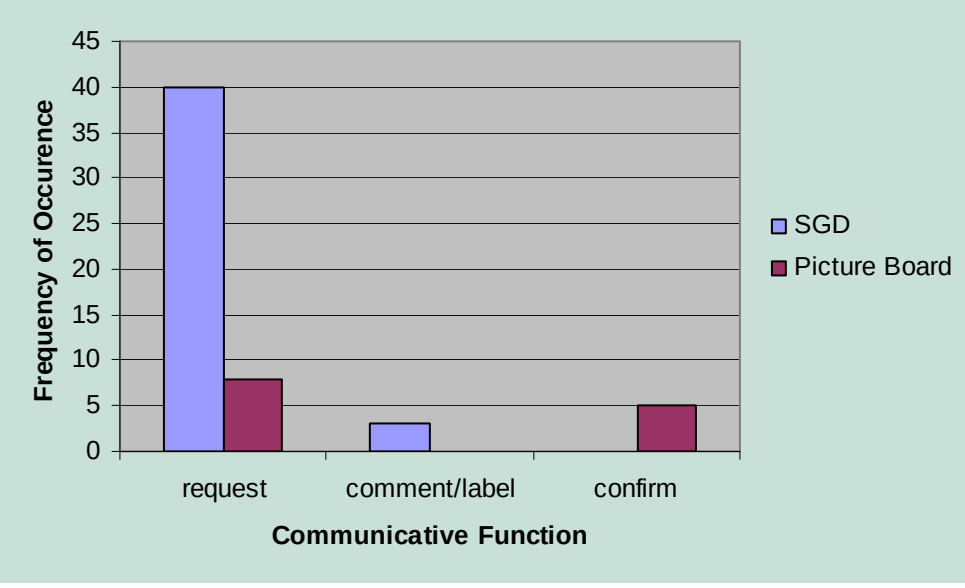
Participant B: Communicative Functions Across Conditions

Communicative Functions	Condition		
	Baseline	SGD	Board
Protest/reject	1	0	5
Request	19	26	40
Confirm/deny	6	11	19
Social	0	0	0
Comment/label	4	2	3
Gain attention	0	0	0
Direct attention	3	5	0
Ask a question	0	0	0

Note: Values represent all forms of communication used

Figure 4

Participant B: Communicative Functions with Devices



Chapter IV

Discussion

The purpose of this study was to compare the effects of a speech generating device with a dynamic display and a picture board on the communicative functions of children with autism. Two preschoolers with ASD who had minimal verbal language participated in this study which included a baseline and four treatment sessions. This study used an alternating treatment design in which the communication device was alternated between sessions. The primary finding of this study showed mixed results in that one participant used the SGD more frequently and one the picture board more frequently. Participant A used requesting more frequently when the SGD was present and used protest/ reject more frequently when the picture board was present. Participant B used request and confirm/deny more frequently when the picture board was present.

The participants used the communicative functions to protest/reject, request, and confirm/deny most frequently. This supports the reports in the literature that children with ASD use communicative functions more for behavior regulation than social interaction. The two participants had acquired other methods of communicating including body movement and vocalizations functioning to request, protest/reject, and confirm/deny. This is also what is reported in the literature.

Individual variability was seen in the communicative functions used by the two participants in the baseline and in both conditions. There was limited use of the

devices for participant A. This could be due to the limited amount of time for this study and the need for participant A to have more time to become comfortable in a new environment. Another possibility could have that he was ill and sessions had to be rescheduled. There was more time between sessions, which may have led to a more difficult to transition. He also may have not been feeling well when he returned. Participant A also appeared to have more difficulty adjusting to new people and settings than Participant B and he was younger.

Participant B used both devices but used the SGD more. This may have been because of the limited previous experience with a low tech SGD. Another possible explanation is that he was older and had more school experience than Participant A.

During this study, fourteen vocabulary terms were chosen for each session. Seven of these remained constant and seven were variable depending on the theme. A limitation of this study was the number of times each vocabulary word was modeled for the participant. Once the maximum number of times had been met there were often subsequent chances to model the vocabulary word that could not be taken advantage of due to the input limit placed. This may have impacted the ability for participants to learn the vocabulary terms. Had there been more input there may have been a difference in the participants use of the terms. Anecdotally, it was noted that the vocabulary used by the participants was the consistent vocabulary. Perhaps because they had more exposures to that vocabulary, they used it more frequently. Another possibility is that the constant vocabulary served communicative functions

the participants used frequently, regulating the behavior of others. The targeted vocabulary chosen also may not have been at an appropriate instructional level for the participants, either too hard or easy. This could have impacted their ability to learn or their interest in the targeted vocabulary.

Limitations

Several limitations were inherent in this study including a limited amount of time for the intervention sessions and the number of participants. The limited number of sessions did not allow enough time for the participants to become comfortable in the new environment and with the communication devices as well. Due to the low incidence of autism spectrum disorder, the limited interest in participating in research and the vocabulary requirement for this study, a limited the number of participants responded to the solicitation for participants.

Suggestions for Future Research

Future research should seek to improve upon this preliminary study including more participants for participating in more sessions. Future studies could also assess the generalization and the maintenance of the use of the devices to impact communicative functions. Future studies should also examine a child's characteristics and what impact this may have on the acquisition of AAC and the effect on the communicative functions used and their frequencies.

Conclusions

The purpose of this study was to compare the effects of speech generating device with a dynamic display and a picture board on the communicative functions of

children with autism. The results of this study were inconclusive. Neither condition affected communicative functions used by the participants. However, both participants did learn, with a limited amount of teaching, to use both devices. One participant communicated more frequently with the picture board and one with the SGD.

References

American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders, 4th edition, text revision. Washington, DC: American Psychiatric Association.

American Speech-Language-Hearing Association. (2002). augmentative and alternative communication: knowledge and skills for service delivery. *ASHA Supplement*, 22, 97-106.

American Speech-Language -Hearing Association. (2006a). Guidelines for speech-language pathologists in diagnosis, assessment, and treatment of autism spectrum disorders across the life span.

American Speech-Language -Hearing Association. (2006b). Principles for speech-language pathologists in the diagnosis, assessment, and treatment of autism spectrum disorders across the life span: Technical Report.

Baker, B. (1982). Minspeak: A semantic compaction system that makes self-expression easier for communicatively disabled individuals. *Byte, 7*, 196-202.

Beukelman, D. R., & Mirenda, P. (2005). *Augmentative and alternative communication: supporting children and adults with complex communication needs* (3rd ed.). Baltimore: Paul H. Brooks Publishing Co.

Boucher, J. (2003). Language development in autism. *International Journal of Pediatric Otorhinolaryngology, 67 Supp 1*, 159-163.

Brady, N. C. (2000). Improved comprehension of object names following voice output communication aid use: two case studies. *Augmentative and Alternative Communication, 16*(3), 197.

Bunce, B. H. (2005). *Building a language focused curriculum for the preschool classroom: A planning guide* (Vol. II). Baltimore: Paul H. Brooks Publishing Company.

Cafiero, J. (1998). Communication power for individuals with autism. *Focus on Autism and Other Developmental Disabilities, 13,* 113-121.

Calloway, C. J., Myles, B. S., & Earles, T. L. (1999). The development of communicative functions and means in students with autism. *Focus on Autism and Other Developmental Disabilities, 14*(3), 140-149.

Castermans, D., Vermeesch, J. R., Fryns, J.-P., Steyaert, J. G., Van de Ven, W. J., Creemers, J. W. M., & Devriendt, K., (2007). Identification and characterization of the TRIP8 and REEP3 genes on chromosome 10q21.3 as novel candidate genes for autism. *European Journal of Human Genetics*, 1-10.

Center for Disease Control and Prevention (CDC). (2007). *Prevalence of autism spectrum Disorders (ASDs) in Multiple Areas of the United States, 2000 and 2002.*

Downing, J. E. (2005). *Teaching communication skills to students with severe disabilities*. Baltimore: Paul H. Brookes.

Drager, K. D. R., Light, J. C., Carlson, R., D'Silva, K., Larsson, B., Pitkin, L., & Stopper, G. (2004). Learning of dynamic display AAC technologies by typically developing 3-year-olds: effect of different layouts and menu approaches. *Journal of Speech, Language, and Hearing Research, 47*(5), 1133-1148.

Drager, K. D. R., Postal, V. J., Carrolus, L., Castellano, M., Gagliano, C., & Glynn, J. (2006). The effect of aided language modeling on symbol comprehension and production in 2 preschoolers with autism. *American Journal of Speech-Language Pathology, 15*, 112-125.

Glennon, S. L. & DeCoste, D. (1997). *The handbook of augmentative and alternative communication.* San Diego: Singular Publishing Group.

Goossens', C., Crain, S., & Elder, P. (1992). *Engineering the preschool environment for interactive, symbolic communication.* Paper presented at the Southeast Augmentative Communication Conference, Birmingham, AL.

Harris, M. D., & Reichle, J. (2004). The Impact of Aided Language Stimulation on Symbol Comprehension and Production in Children with Moderate Cognitive Impairment. *American Journal of Speech-Language Pathology, 13*(2), 155-167.

Houghton, J., Bronicki, G. J., & Guess, D. (1987). Opportunities to express preferences and make choices among studetns with severe disabilities in classroom settings. *Journal of the Association for Persons with Severe Handicaps, 12*, 18-27.

Johnson, R. (1994). *The Picture Communication Symbols Combination Book.* Solano Beach, CA: Mayer-Johnson Company.

Koul, R. K., & Schlosser, R. W. (2004). Effects of synthetic speech output in the learning of graphic symbols of varied iconicity. *Disability and Rehabilitation, 26*(21-22), 1278-1285.

Fensen, L., Marchman, V. A., Thal, D.J., Dale, P. S., Reznick, S., & Bates, E. (1992). *MacArthur Bates Communicative Development Inventories*: Baltimore: Paul H. Brooks Publishing Company.

Light, J., Roberts, B., Dimarco, R., & Greiner, N. (1998). Augmentative and alternative communication to support receptive and expressive communication for people with Autism. *Journal of Communication Disorders, 31*(2), 153-178.

Maharaj, S. (1980). *Pictogram ideogram communication.* Regina, Saskatchewan, Canada: The George Reed Foundation for the Handicapped.

McDuffie, A., Yoder, P., & Stone, W. (2005). Prelinguistic Predictors of Vocabulary in Young Children with Autism Spectrum Disorders. *Journal of Speech, Language, and Hearing Research, 48*(5), 1080-1097.

Mirenda, P. (2001). Autism, Augmentative Communication, and Assistive Technology: What do we really know? *Focus on Autism and Other Developmental Disabilities, 16*(3), 141- 151.

Mirenda, P. (2003). Toward Functional Augmentative and Alternative Communication for Students with Autism: Manual Signs, Graphic Symbols,

and Voice Output Communication Aids. *Language, Speech, and Hearing Services in Schools, 34*(3), 203-216.

NG, D. K.-K., Chan, C.-H., Soo, M.-T., & Lee, R. S.-Y. (2007). Low-level chronic mercury exposure in children and adolescents: Meta-analysis. *Pediatrics International, 49*, 80-87.

Parsons, C., & Sorte, D. L. (1993). The effects of computers with synthetic and no speech on the spontaneous communication of children with autism. *Australian Journal of Human Communication Disorders, 21*¸12-31.

Peterson, S. L., Bondy, A. S., Vincent, Y., & Fennegan, C. S. (1995). Effects of Altering Communicative Input for Students with Autism and No Speech: Two Case Studies. *AAC Augmentative and Alternative Communication, 11*¸ 93-100.

Prentke Romich Company. (n.d) Springboard description. Retrieved January 1, 2007, from http://store.prentrom.com/cgi-bin/store/SB-AEN-IBM-MORE.html.

Prentke Romich Company. (n.d.) Application and Support Software. Retrieved November 18, 2006, from http://www.prentrom.com/ component/ option,com_docman/Itemid,108/task,cat_view/gid,53/.

Prizant, B. M., Wetherby, A. M., & Roberts. (1993). The Checklist of communicative functions and means.

Quill, K. A. (2000). *Do-Watch-Listen-Say: social and communication intervention for children with autism*. Baltimore: Paul H. Brooks Publishing Co.

Rice, M.L., Sell, M.A., and Hadley P.A. (1990). *The Social Interactive Coding System (SICS).* Language, Speech, and Hearing Services in Schools. *21*, 2-14.

Ricks, D., & Wing, L. (1975). Language, communication, and the use of symbols in normal and autistic children. *Journal Autism Childhood Schizophrenia, 5*¸ 191-221.

Rowland, C., Schweigert, P., & Stremel, K. (1992). *Observing and Enhancing Communication Skills for Individuals with Multisensory Impairments*. Tucson: Communication Skill Builders, Inc.

Schepis, M. M., Reid, D. H., Behrmann, M. M., & Sutton, K. A. (1998). Increasing Communicative Interactions of Young Children with Autism Using a Voice Output Communication Aid and Naturalistic Teaching. *Journal of Applied Behavior Analysis, 31*(4), 561-578.

Schlosser, R. W., & Lee, D. L. (2000). Promoting generalizatin and maintenance in augmentative and alternative communication: A meta-analysis of 20 years of effectiveness. *Augmentative and Alternative Communication, 16* (4), 19.

Schlosser, R. W., Ravinigam, P. J. B. a., Blischak, D., & Hetzroni, O. (1995). The Effects of Speech Output Technology in the Learning of Graphic Symbols. *Journal of Applied Behavior Analysis, 28*, 537- 549.

Sevcik, R. A., Romski, M. A., & Adamson, L. B. (2004). Research Directions in Augmentative and Alternative Communication for Preschool Children. *Disability and Rehabilitation, 26*(21-22), 1323-1329.

Sigafoos, J., Woodyatt, G., Keen, D., Tait, K., Tucker, M., Roberts-Pennell, D., & Pittendreigh, N. (2000). Identifying potential communicative acts in chilren with developmental and physical disabilities. *Communication Disorders Quarterly, 21*, 77-86.

Silverman, F. (1995). *Communication for the speechless* (3rd ed.). Needham Heights, MA: Allyn & Bacon.

Spencer, J., O'Brien, H., Riggs, K., Braddick, O., Atkinson, J., & Wattam-Bell, J. (2000). Motion-Processing in Autism: evidence for a dorsal stream deficiency. *NeuroReport, 11*¸ 2765-2767.

Tager-Flusberg, H. (2000). Differences between neurodevelopmental disorders and acquired lesions. *Developmental Sciences, 3*, 33-34.

Tager-Flusberg, H. (2004). Strategies for Conducting Research on Language in Autism. *Journal of Autism and Developmental Disorders, 34*(1), 75-80.

Tetzchner, S. V., Ovreeide, K. D., Jorgensens, K. K., Ormhaugs, B. M., Oxhoms, B., & Warmes, R. (2004). Acquisition of graphic communication by a young girl without comprehension of spoken language. *Disability and Rehabilitation, 26*(21-22), 1335-1346.

Wetherby, A., & Prizant, B. (2000). *Autism spectrum disorders: a transactional developmental perspective* (4th ed. Vol. 9). Baltimore: Paul H Brooks Publishing Co.

Woodcock, R., Clark, C., & Davies, C. (1968). *Peabody Rebus Reading Program.* Circle Pines, MN: AGS Publishing.

Yoder, P., & Stone, W. L. (2006). Randomized Comparison of Two Communication Interventions for Preschoolers With Autism Spectrum Disorders. *Journal of Consulting and Clinical Psychology, 74*(3), 426-435.

Appendix A: Flier

Looking for:
Preschoolers with autism to participate in a study at the University of Kansas Schiefelbusch Speech and Hearing Clinic

Is your child:

1. **3-5 years old?**
2. **Diagnosed as being on the autism spectrum?**
3. **Nonverbal or have limited communicative abilities (doesn't speak as main way to communicate; fewer than 20 words used regularly)?**

If yes to all of the above, then we would like to invite your child to participate in a study that will train them in using two forms of augmentative alternative communication.

For more information please contact:

Katylin Brown (785-766-7414)
or
Melissa Shaver (816-803-4165)
Or
Dr. Jane Wegner (864-4690 or Jwegner@ku.edu)

Appendix B: Invitation Letter to Participate

Dear parents,

We are graduate students in the Speech- Language- Hearing Department at the University of Kansas in Lawrence. We are conducting thesis research with young children with autism spectrum disorders (ASD). Specifically, we are interested in whether children with ASD communicate more when they are taught to use a speech generating communication device or when they are taught to use a picture symbol board.

We are looking for children who:

1. Are between the ages of 3 and 5
2. Have been diagnosed with autism spectrum disorder
3. Do not speak many words or phrases (less than 20 words)

During the study, we will provide intervention at the Schiefelbusch Speech and Hearing clinic on the University of Kansas campus using both pictures and a communication device. Intervention will take about 4 weeks for each child and sessions will take place twice a week for 30-45 minutes. If you would be interested please feel free to contact us at 785-864-4690 or email Jwegner@ku.edu. We will then provide you with more detailed information about our study.

We appreciate your kind consideration.

Sincerely,

Melissa Shaver
Student Researcher

Katylin Brown
Student Researcher

Jane R. Wegner, Ph.D., CCC-SLP
Faculty Advisor

Appendix C: Introduction Letter for school administrators

Dear administrator:

We are conducting research to determine if young children with autism initiate more and use more communicative functions when using picture communication systems or a speech generating communication device. We are looking for children who:

1. Are between the ages of 3 and 5
2. Have been diagnosed with autism spectrum disorder
3. Do not speak many words or phrases (less than 20 words)

Would you please hand out these flyers to any families that have a child who meets these requirements and would you please hang one up in as prominent place in your school. If you have any questions, please contact us at 864-4690 or Jwegner@ku.edu. Thank you for your time.

Sincerely,

Melissa Shaver
Student Researcher

Katylin Brown
Student Researcher

Jane R. Wegner, Ph.D., CCC-SLP
Faculty Advisor

Appendix D: Announcement

ANNOUNCEMENT:

University of Kansas graduate students are seeking preschoolers (ages 3-5) diagnosed on the autism spectrum who use no more than 20 spoken words (nonverbal) to participate in a study that will investigate their communication using a communication device that speaks and picture boards.

For more information please contact:
Melissa Shaver, Katylin Brown or Dr. Jane Wegner
Schiefelbusch Speech-Language-Hearing Clinic
University of Kansas
785 864 4690

Appendix E: Flier Sites

Language Acquisition Preschool
Sunshine Acres Preschool
Community Children's Center- Head Start
Raintree Montessori School
Hilltop Child Development Center
Brookcreek Learning Center
Ballard Child Care Center
Stepping Stones
East Heights Early Childhood Developmental Center

Resource Centers
Lawrence Autism Society

Appendix F: Listservs to post announcement on:

kansasautismadvoc · Kansas Autism Advocacy
faithinourchildren · Faith In Our Children Support Group
autismandaspergerssyndromeinkansas · Autism and Aspergers syndrome in Kansas
Kcmetrosupport_autism · Kc Metro Autism Spectrum Support
heartlandfeat · Heartland Feat

Appendix G: Consent Form

Approved by the Human Subjects Committee University of Kansas, Lawrence Campus (HSCL). Approval expires one year from 11/3/06.

COMPARISON OF AAC INTERVENTIONS FOR PRESCHOOLERS WITH AUTISM

INTRODUCTION

The Department of Speech Language Hearing at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish your child to participate in the present study. You may refuse to sign this form and not allow your child to participate in this study. You should be aware that even if you agree to allow your child to participate, you are free to withdraw at any time. If you do withdraw your child from this study, it will not affect your relationship with this unit, the services it may provide to you, or the University of Kansas.

PURPOSE OF THE STUDY

The purpose of this research is to compare communication of preschool children with Autism Spectrum Disorders when they are using a picture communication board as opposed to a speech generating communication device while playing with a researcher. We want to know if they use one system more than the other, if they initiate communication (try to tell researcher things that are not in response to a question), and if they communicate for different purposes (requesting, commenting, protesting) with one system more than another.

PROCEDURES

Once you have expressed interest in your child participating in this study, you will receive a MacArthur-Bates Communicative Development Inventory (to help us understand how much language your child has) that will be used to determine if your child meets the requirements to participate in this study. To participate in this study your child will be asked to attend 9 sessions 30-45 minutes in length. The first session will be a play session with the researcher in which neither the picture communication board nor the speech generating device will be used. In each of the following 8 sessions your child will play with the researcher but will have either the communication device or a picture board to use. Each session will take place in the Schiefelbusch Speech Language and Hearing Clinic. The sessions will each have a play theme and play activities such as book reading, art (making something that we

read about) and motor activities (making objects do what they do in the story). During the session the researcher will model the vocabulary that is on the device being used that day. It will be recorded how many times mode of communication your child uses. The tapes will only be accessible to the principal investigators and the faculty advisor. At the end of the two years, these tapes will be destroyed.

RISKS

There are no anticipated risks in participating in this study.

BENEFITS

During this study, the researchers hope to learn more about the communication patterns of children with autism, and more specifically the participant's communication, so that we can share this information with you, the caregivers. The researchers also hope to gain insight into a device that may help your child better communicate their wants and needs by expanding their language knowledge.

PAYMENT TO PARTICIPANTS

No payment will be involved in this study.

PARTICIPANT CONFIDENTIALITY

Your child's name will not be associated in any way with the information collected about them or with the research findings from this study. The researchers will use a study number or a pseudonym instead of your child's name. The researchers will not share information about you unless required by law or unless you give written permission about your child. Permission granted on this date to use and disclose your child's information remains in effect for the next five years. By signing this form you give permission for the use and disclosure of your child's information for purposes of this study at any time in the future.

REFUSAL TO SIGN CONSENT AND AUTHORIZATION

You are not required to sign this Consent and Authorization form and you may refuse to do so without affecting your right to any services you are receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas. However, if you refuse to sign, your child cannot participate in this study.

CANCELLING THIS CONSENT AND AUTHORIZATION

You may withdraw your consent for your child to participate in this study at any time. You also have the right to cancel your permission to use and disclose information collected about your child, in writing, at any time, by sending your written request to: Melissa Shaver and Katylin Brown at 2101 Haworth Hall, 1200 Sunnyside Ave, Lawrence, KS 66045-7534. If you cancel permission to use your child's information, the researchers will stop collecting additional information about them. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

QUESTIONS ABOUT PARTICIPATION

Questions about procedures should be directed to the researchers listed at the end of this consent form.

PARTICIPANT CERTIFICATION:

I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my child's rights as a research participant, I may call (785) 864-7429 or (785) 864-7385 or write the Human Subjects Committee Lawrence Campus (HSCL), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email dhann@ku.edu or mdenning@ku.edu.

I agree to allow my child to take part in this study as a research participant. By my signature I affirm that I have received a copy of this Consent and Authorization form.

_____ _____

Type/Print Participant's Name Date

_____

Parent/Guardian Signature

Researcher Contact Information

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Appendix H: Preference Inventory

Parents,

Please rank these themes according to your child's interest (1= most interesting and 10 = least interesting) and mark any themes that your child would hate or would really really like. This will help us to get a better idea of the activities that will most interest your child. Thank you!

___ Transportation
___ Building
___Bugs
___Around the house
___At school
___At the park
___Going Shopping
___Dinosaurs
___Actions (jumping, playing, reading etc)
___Frogs and animals

Appendix I: Sample Session Plan

Goals: Compare how a child is communicating initiations and communicative functions, and the frequency of use when using a picture communication board versus a speech generating communication device.

Consistent vocabulary always present on the device: More, Turn the Page, My turn, Your turn, The end, Stop, Go, I want

Theme Based Vocabulary: Rocket, Boat, Airplane, Motorcycle, Hot air balloon, Car, Sticker please
***Each of the 14 vocabulary items will be modeled 5 times (once during story reading, once during story review, and then 3 additional times during play activities; EXCEPT for "Turn the Page" which will be modeled on 5 of the pages before giving the child the opportunity to communicate that vocabulary item). When a total of five is reached, the data collector will signal to the researcher that she can no longer model that vocabulary item.

1. Read the participant the verbal assent procedure.

2. Give the participant the system that they will be using that day (the picture communication board or the Speech Generating Device).

3. Read the pop-up story Ready, Set, Go. After a page is read, introduce the vocabulary by modeling the word in speech, pointing to the picture in the book and then point to the picture/ perform the action represented on the child's communication device.

Page 1: Rocket, turn the page
Page 2: Boat, turn the page
Page 3: Plane, turn the page
Page 4: Motorcycle, turn the page
Page 5: Hot air balloon, turn the page
Page 6: Car, turn the page

4. Point to "More" on the communication device and then review the vocabulary items by again modeling the word in speech, pointing to the picture in the book and then pointing to the picture/ performing the action represented on the child's communication device.

5. Allow the child to choose an activity from the following:

- Driving cars and motorcycles around on a car mat (using vocabulary from the story as well as “my turn”, and “your turn” on the communication device).
- Making a rocket ship by decorating a toilet paper roll with stickers (use “sticker please”, “More” etc. from the communication device) and placing a piece of paper shaped like a cone over the top.
- Floating a boat in a small bucket of water that has a cover for when it is time to move to a new activity. .
- Make paper airplanes fly through the air and model vocabulary usage from the device.
- Fly a pre assembled hot air balloon (made out of a small balloon with a basket attached to the bottom).
- Use Magnetic Board with space scene to place various space magnets (Rocket, stars, moon, aliens etc) on the board.

Appendix J: House Vocabulary Grid

Participant_____ Date _____ Session #_____

Vocabulary Word	**Number of Times Presented**									
More										
My Turn										
Your Turn										
All Done										
Stop										
Go										
I want										
Kitchen										
Living Room										
Bathroom										
Bedroom										
Garage										
House										
Room										

Assent Procedures Read _____

Appendix K

Data Collection Form (SICS)

Child's Name: ________________________ Date: _________ Time: ___________

Observer: _________________________Theme:______________________________

Play Activity	Verbal Interactive Status	Form	Function	Content/ Message

Appendix L: Reliability Coding Form

Child's Name: ______________________ Date: _________ Time: ____________

Observer: ________________________Theme:____________________________

Katylin	Melissa	Interaction	Interaction coding	Function Coding

Katylin	Melissa	Interaction	Interaction coding	Function Coding

Appendix M: Completed Reliability Form

Coding Form (SICS)

Child's Name: A Date: 12/4/06 Time: 3:15

~~Observer:~~ Session #2 Theme: opposites

Katylin	Melissa	Interaction	Interaction coding	Function Coding
R	R			
X	X	A		
R	R			
X	X	A		
I	I			
X	X	A		
R	R			
X	X	A		
R	R			
X	X	A		
I	I			
X	X	A		
I	I			
X	X	A		
R	R			
X	X	A		
R	R			
X	X	A		
I	I			
X	X	A		
R	R			
X	X	A		
I	I			
X	X	A		
I	I			
R	R			
X	X	A		