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Comparing Two Modes of AAC Intervention For Children with Autism

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Comparing Two Modes of AAC Intervention For Children with Autism

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Dedication

Thanks to my parents, Pyung Up Son and Jung Sook Kim,

for your continued love and unconditional support

Thanks to my loving husband, Sung Kwan Yang,

and lovely sons, Sunoo, & Jinoo Yang

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Comparing Two Modes of AAC Intervention For Children with Autism

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The purpose of this study was to compare the relative effectiveness of two modes of Augmentative and Alternative Communication (AAC) for children with autism and related developmental disabilities. In order to achieve the stated purpose of this study, the following research questions were addressed: (1) are there differences in acquisition rates for requests taught using Picture Exchange Communication System (PECS) v. Speech Generating Device (SGD)? ; (2) do children show a preference for one mode over the other?; and (3) are there differences in perceived social validity of PECS v. SGD? This study employed an alternating treatment design within each subject to compare the effectiveness of PECS and SGD for teaching communicative requesting.

Results indicate that both modes of AAC intervention were effective across participants. For acquisition, SGD training required fewer sessions, trials, and resulted in higher correct responses for two of three participants. However, all three participants showed comparable acquisition with PECS and SGD training. It would appear that the prompt and the time delay instructional procedures were equally effective in teaching PECS and SGD. The children preferred one mode over the other when given choices. Two children showed a preference for PECS, and one child showed a preference for SGD. Social validity data suggests that raters preferred SGD training.

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CHAPTER ONE

INTRODUCTION

AUTISM

Autism is a developmental disability syndrome that affects social interaction, communication, learning, and adaptive behavior functioning (American Psychiatric Association, 2000; Freeman, 1997; Lord & Risi, 2000; National Research Council, 2001). The severity of autism can vary, but a significant percentage of individuals with autism function in the severe range of intellectual disability (APA, 2000; Freeman, 1997; Simpson & Myles, 1998). When autism was first explicitly described by Kanner in 1943, it was considered a rare disorder with an estimated prevalence of approximately 2 to 5 per 10,000 children. Today the prevalence of autism is thought to be much greater at 10 to 20 per 10,000 (Autism Society of America, 1999; Costello, 1996; National Research Council, 2001). The higher estimated rates could reflect a real increase in the incidence and prevalence of autism or greater public awareness and perhaps the inclusion of the broader range of conditions within the spectrum of autistic disorders due to increased screening for the disorder (Bryson, 1997; Cohen & Volkmar, 1997; Scott, Clark, & Brady, 2000). In any event, it is clear that there is an increased demand for services for individuals with autism in the United States and in many other countries and this would be likely to include an increase demand for communication intervention.

Autism is currently classified as one of five related neurological disorders under the umbrella label of Pervasive Developmental Disorder (PDD) in the Fourth Edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 2000). In the DSM-IV, PDD covers (a) autistic disorder, (b) Asperger disorder, (c) pervasive developmental disorder-not otherwise specified (PDD-NOS), (d) Rett syndrome, and (e) childhood disintegrative disorder (CDD). More recently, the term autism spectrum disorders (ASD) has been adapted to convey the fact that autism covers a range in terms of levels of severity (Volkmar, Klin, & Cohen, 1997; Volkmar & Rutter, 1995).

The cause of autism is unknown, but current research suggests it is a neurological disorder with a biological and possibly genetic basis (Bristol et al., 1996). In the absence of biological markers, the diagnosis of autism is based on developmental and behavioral characteristics. The defining characteristics of autism include: (a) atypical language development, (b) inability to relate to other persons, (c) insistence on a stat of sameness within environments, (d) stereotyped play, (e) splinter cognitive ability levels, (f) absence of imagination and (g) onset of occurrence during infancy (Lord & Paul, 1997; Mauk, Reber, & Batshaw, 1997; National Research Council, 2001; O'Connor & Hermelin, 1991; Volkmar, Klin, & Cohen, 1997). In addition, autism is associated with a high prevalence of severe behavior problems, such as, self-injury, aggression, extreme tantrums, and stereotyped movements (i.e., rocking, hand waving, arm flapping, spinning (Dunlap, Vaughn, & O'Neill, 1998; Mauk, Reber, & Batshaw, 1997).

The defining characteristics of autism have been classified into three major areas in the Diagnostic and Statistical Manual (4th ed.) of the American Psychiatric Association (APA, 2000):

Impairment in social interaction. Autism is characterized by impairment of social interaction, which is manifested by limited eye contact, facial expressions, and body gestures (Frith, 1989). Social reciprocity is impaired in that individuals with autism typically show infrequent attempts to engage in social interaction with others and have difficulty developing peer relationships or seeking interactions with others (Kasari & Sigman, 1997; Scott, Clark, & Brady, 2000). In addition, individuals with autism are described as showing a lack of attachment to human beings, and extreme social aloofness (Mundy & Sigman, & Kasari, 1990).

Impairment in language and communication. The communication and language impairments of people with autism can range from complete lack of any functional speech to the development of functional but idiosyncratic language (Mesibov, Adams, & Klinger, 1997). Expressive language and communication deficits are evidenced by absence of speech, delayed language, echolalia, stereotyped and repetitive use of language, lack of functional use of language, and limited nonverbal language and communication usage (APA, 2000; Wetherby, Schuler, & Prizant, 1997). Also, there is strong evidence that children with autism show impairment in sharing attention and emotion with others, understanding of the feelings and thoughts of others, and initiation of social behaviors and responsiveness to others' feelings at all ages (Bristol et al., 1996; Quill, 1998).

Restricted repertoire of activities and interests. Children with autism may have a preoccupation with an item or restricted patterns of interest (Scott, Clark, & Brady, 2000). Inflexible adherence to nonfunctional routines and preoccupation with restricted patterns of interest may be exhibited. Another pattern of repetitive activity is stereotyped movements that have been described previously (Koegel & Koegel, 1996; Simpson & Myles, 1998).

COMMUNICATION CHARACTERISTICS

Deficits in speech/language/and communication are defining characteristics of autism and other developmental disabilities (A/DD) (APA, 2000; Quill, 1995). Many children with A/DD do not communicate using spoken language and they demonstrate significant language and communication delay (APA, 2000; Cohen & Volkmar, 1997; Mesibov, Adams, & Klinger, 1997; Ogletree & Harn, 2001; Volkmar & Rutter, 1995). Expressive language and communication deficits are evidenced by absence of speech, delayed language, echolalia, stereotyped and repetitive use of language, lack of functional use of language, and limited nonverbal language and communication usage (APA, 2000; Wetherby, Schuler, & Prizant, 1997).

Absence of Speech and Limited Communicative Forms

A significant number of children with A/DD do not speak or have extremely limited spoken language. In the absence of speech, many children with autism rely on prelinguistic communicative behaviors. Examples would include reaching, pointing, and other hand gestures to communicate (Downing, 1999; Keen, Sigafoos, & Woodyatt, 2001). Children with autism often fail to develop more symbolic forms of communication in the absence of explicit intervention and instead often develop challenging behaviors, which may be shaped into intentional forms of communication (Durand, 1999). While prelinguistic behaviors may serve communicative functions, these behaviors are often highly idiosyncratic and subtle (Drasgow, Halle, Ostrosky, & Harbers, 1996), and may be difficult for the communicative partner to interpret (Keen, Sigafoos, & Woodyatt, 2001). Some prelinguistic communication forms can also be socially stigmatizing (i.e., screaming, challenging behavior) (Sigafoos, Drasgow, Halle, O'Reilly, Seely-York, Edrisinha, & Andrews, 2004). It would therefore seem important to develop alternative forms of communication to replace the child's existing prelinguistic behaviors (Carr & Durand, 1985; Mirenda, 1997; Sigafoos & Meikle, 1996).

Echolalia

Echolalia, which is the repetition of speech of others, is a common language problem in individual with autism who has spoken language skills. The echolalia

may be immediate (i.e., repeating the last part of a question) or delayed (i.e., repeating songs, or long commercial jingles heard at some time in the past) (Koegel, 1996; Mauk, Reber, & Batshaw, 1997). The immediate and delayed echolalic productions of children with A/DD have been studied to determine whether or not they might indicate communicative intent (Rydell & Mirenda, 1994) and there is some evidence that echolalia serves a communicative functions, such as representing the child's way of maintaining a social interaction, access to preferred toys, and escape from unfamiliar tasks (Prizant & Rydell, 1984; Prizant & Whetherby, 1987).

Lack of Functional Use of Language

In addition to deficits in appropriate forms of communications, children with A/DD characteristically display deficits in communicative functions (Mundy, Sigman, & Kasari, 1990; Stone et al., 1997; Wetherby & Prutting, 1984). Children with autism typically communicate only to fulfill wants and needs (Stone et al., 1997; Wetherby, Prizant, & Hutchinson, 1998). In studying young children with autism numerous researchers have reported relative strength in behavior regulation (e.g., protesting, requesting items) and relative weaknesses in joint attention (e.g., commenting) (Loveland & Laundry, 1986; Mundy, Sigman, & Kasari, 1990; Wetherby, Prizant, & Hutchinson, 1998). Wetherby and Prutting (1984) found that while students with autism frequently make requests and protests, they infrequently

display functions of exclamation and reaction, and almost never acknowledge others, show-off, comment, and label.

Given the severe impairment of communication and language associated with A/DD, there is a considerable need for intervention to develop functional communication skills for children with autism. Researches have provided a number of empirically validated strategies for teaching communication skills to children with autism (Goldstein, 2002). For children who are nonverbal and at the beginning stages of communication, intervention focused on teaching functional augmentative and alternative communication (AAC) skills is indicated (Harwood, Warren, & Yoder, 2002; Prizant, 1996; Schwartz, Garfinkle, & Bauer, 1998).

AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC)

Augmentative and alternative communication (AAC) is an area of clinical practice that attempts to "compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders" (ASHA, 1991, p.10). AAC also is defined as an area of inquiry and practice emphasizing the supplementation or replacement of natural speech and/or writing using aided and/or unaided symbols (Lloyd, Fuller, & Arvidson, 1997). AAC is any system or device, other than talking or writing, which represents vocabulary, ideas, and meaningful messages. An AAC system refers to an individual's complete functional communication system that includes a

communicative technique, a symbol set or system, and communication/ interaction behavior (Bryant & Bryant, 2003).

Research has demonstrated effective procedures for teaching the use of augmentative and alternative communication systems to replace or supplement insufficient communication skills in children with A/DD (Downing, 1999; Mirenda & Ericson, 2000). Sigafoos and Mirenda (2002) argued that AAC intervention can begin by replacing existing prelinguistic behaviors with more symbolic forms of AAC. For example, if a beginning communicator relies on screaming and crying to gain access to preferred items, then intervention could begin by teaching the individual to use a picture-based communication board to gain access to preferred items, thereby replacing screaming and crying with a more socially acceptable form of requesting.

AAC intervention for individuals with A/DD has often focused on teaching manual signs. However, the use of manual signs may be limiting given that communication partners in the community may not understand manual signs. As a result of this potential limitation, attention has shifted to explore the use of aided modes of communication for individuals with A/DD (Beukelman & Mirenda, 1998) as these systems may be more functional in community settings (Rotholz et al., 1989). Among aided AAC systems, two modes, Picture Exchange Communication System (PECS) and Speech Generating Devices (SGD) have been advocated for use with non-speaking children who have A/DD. Both have evidence

to support their use but little research is available to suggest which is preferable for students with A/DD (Schlosser, 1999). There still remains controversy regarding which AAC system is more effective (Mirenda, 2003). The following sections summarize the researches related to the use of PECS and SGDs with individuals with A/DD.

Picture Exchange Communication System (PECS)

PECS is a communication training program that teaches the learner to initiate requests, respond to questions, and make social comments utilizing graphic symbols (Bondy & Frost, 1994; Charlop-Christy et al., 2002; Schwartz, Garfinkle, & Bauer, 1998). PECS uses line drawings to represent a wide variety of topics such as common activities, body parts, food, requests for assistance, emotions, and so on. PECS system involves first teaching the child to select a picture from an array of several choices and hand the picture to an adult as a way of requesting access to the item represented by the line drawing (Cafiero, 1998). PECS was originally designed for preschoolers with autism.

Several studies have been done using PECS to teach specific communicative functions (i.e., choice making, requesting, functional communication training, and expressive language) to individuals with autism with varying degrees of success (Bondy & Frost, 1994; Charlop-Christy et al., 2002;

Frea, Arnold, & Vittimberga, 2001; Kravits et al., 2001; Peterson, Bondy, Vincent, & Finnegan, 1995; Schwartz, Garfinkle, & Bauer, 1998).

Bondy and Frost (1994) provided outcome data of small- and large-group concerning the acquisition of picture use via PECS and the acquisition of speech after a five-year period of using PECS. They reviewed the progress of seven preschool children with autism who developed speech through PECS training. The children acquired the use of 10 pictures to make requests in three months of training on average**.** The children developed their first spoken word in 5.4 months, while they developed 10 spoken words in 7.1 months of training on average. In addition, the authors reported the use of PECS intervention with 85 preschool children with autism over a five-year period. Bondy and Frost (1994) stated that over 95% of the children learned to use at least one picture within 1 month of training and use two or more pictures symbols to make requests and label items after six months of training. For the 66 preschool children with autism who used PECS for more than 1 year, 39 (59%) of the children developed functional speech and no longer required any AAC supports. Also they reported that 76% of all the children of the total group (i.e., children using PECS for more than 1 month) used a combination of speech and graphic symbols to make requests and label items. These results provide some evidence that children with A/DD can be taught to use PECS for functional communication. However, the data on speech development is difficult to interpret because the study did not use a controlled experimental design;

therefore, no causal relationship can be inferred between using PECS training and development of speech.

Peterson, Bondy, Vincent, and Finnegan (1995) presented two case studies on the effects of altering the communicative input for two students with autism (7 and 9-year-old). The students had no speech and severe problem behaviors (i.e., self-injury, disruptive behavior). The students were systematically exposed to three variations in communicative input: spoken input alone, nonspeaking alternative (pictorial and/or gestural communication), and augmented spoken input (spoken input plus the same nonspeaking alternative). In the spoken-alone condition, both students made few correct responses and engaged in high frequencies of self-injury. Both of these students appeared to be more successful at making correct responses and performed better when given pictorial cues either alone or as an augmentation to the spoken request. The authors suggested that spoken input alone is a challenge for some students with autism, thus augmentative systems, alternative modalities, and avoiding spoken input alone may facilitate interactions with such individuals.

Schwartz, Garfinkle, and Bauer (1998) investigated the use of PECS in two experiments. They first examined the rate of acquisition of PECS for 31 preschool children between the ages of 3-6 years who used PECS for four years. The children displayed a variety of developmental disabilities, including autism, Down syndrome, and mental retardation. The authors collected the history data from each

child's IEP data book and identified dates of acquisition for each stage of training. PECS training involved the use picture cards with preferred items and activities for making requests, as well as more advanced levels to teach commenting and responding. The training program steps in this study were: basic exchange, distance and persistence, discrimination, sentence building, and PECS with peers. The results of mean number of months for mastery of PECS training phases were provided. On average, the participants mastered the basic exchange within two months of the start of training. On average, the participants mastered the distance and persistence phase two months after mastery of the basic exchange. After an average of three months, the children were able to complete the discrimination phase. To master the sentence building phase, an additional four months of average training was required. Lastly, after an average of 3 months of training, the children mastered PECS with peers. This study indicates children with autism can be taught to use PECS to communicate within a few months. There was no control group to compare the results in this study.

The second experiment by Schwartz et al. (1998) involved 18 participants (a subset of the original 31) during snack and free choice time. The major dependent measures for this study were the forms of communication (e.g., gestures, vocalizations, manual signs, and PECS) and the functions of communication (e.g., requests, comments, protests, responses, and no communicative intent) used by the participants across two school years. Each child was observed three times over a

12-month period during snack and free-choice activities in integrated preschool classrooms. The authors reported results on the acquisition of spontaneous speech and communication profiles by function. The results on the acquisition of spontaneous speech were reported by the children who are talkers and nontalkers. Of 18 participants, 8 children were categorized as talkers and 10 children as nontalkers. The definition of talkers was children who used 5 or more words in the first observation; nontalkers used fewer than five words. For the talkers, the average number of words increased from 12 to 24 at the second observation and continued to increase to 40 at the end of the third observation during free choice time. For the nontalkers, the average number of spoken words increased from 1 during the first observation to 2 and 4 during the second and final observation. The talkers group demonstrated similar pattern of increase in spontaneous words used during Snack time but the nontalkers showed little or no growth in spoken vocabulary. Results showed that the children also increased the use of different communication functions after 12 months of using PECS. However, due to limitations of the study, there may be alternative explanations for the gains in communication functions, such as maturation, or practice effects.

Cafiero (2001) used a natural aided language approach and picture communication boards to provide a 13-year-old boy with autism with intense visual-paired-with-verbal-language input in each activity and environment of his school day. Natural aided language approach has emphasis on the implementation

of augmentative communication strategy (with PECS and text above each icon) in natural, real, and reinforcing environments. In this case study, the classroom staff were trained in natural aided language modeled by the classroom teacher and speech and language pathologist. The results indicated that the participant's functional lexicon increased from 4 to 27 words in multiple environments. In addition, behavioral data and anecdotal reports indicated that he showed increased on-task and in-seat behaviors and decreased tantrums. The author suggested the need for more systematic study with more clearly defined behavioral descriptions and language interventions on the effect of the intervention on aberrant behavior.

Frea, Arnold, and Bittimberga (2001) examined the use of PECS (Picture Communication Symbol) as a means of reducing the classroom aggression of a fully included preschool child with autism. This study was conducted in a general education preschool classroom during typical daily play routines. The results of this study indicated that the participant's aggressive behavior decreased when PECS training was introduced to his play activities and challenging behavior ceased within 6 days of training. The authors concluded that the reduction in aggressive behavior was possibly because PECS served as communication for access to preferred items and also increased the child's ability to make choices and exert some degree of control in the activity.

Kravits et al. (2002) evaluated the effectiveness of teaching Picture Exchange Communication Systems (PECS) on the spontaneous communication

(i.e., requesting, commenting) of a 6-year old child with autism across home and school environments by the mother, classroom teachers, and peers. The treatment included Phase I, II, & III from PECS training manual (Frost & Bondy, 1994) and social intervention with PECS. Phases I-III as outlined in the training manual (Frost & Bondy, 1994) included reinforcer assessment, Phase I, Physically-Assisted Exchange, Phase II, Expanding Spontaneity, and Phase III, Discrimination of Pictures. During the social intervention with PECS condition, PECS was used in combination with social skills training to increase the duration of the participant's interaction with peers. Social skills training included training on sharing materials, taking turns, asking and answering questions, and extending Play interaction. This study resulted in increase in spontaneous language, which included initiations with icons (picture cards), as well as verbal language without the icons across the settings. The duration of social interaction was also increased in school journal time during the intervention. However, it was unclear if the effects were from PECS alone or PECS plus the social intervention.

Charlop-Christy et al. (2002) assessed the use of PECS with three (12-, 3-, and 5-year old) children with autism. The efficacy of PECS program was assessed by the number of trials to criterion (80% trials with correct unprompted response) for each of the six PECS phases. The collateral effects of PECS training on several behaviors, such as, cooperative play, joint attention, and eye contact, were assessed to document the types of ancillary gains that have been anecdotally reported

following PECS training. All 3 children met criterion (80% correct for each phase) for each PECS phase during an average of 246 trials. The participants also showed an increased spontaneous speech in two nontraining settings, and with stimuli not directly included in the training set. The authors concluded that PECS procedure may promote generalization by incorporating child-selected reinforcers, multiple settings, and interactions with multiple trainers that occur throughout the day in their natural environment. Also, the results indicated that increased social communicative behaviors (e.g., joint attention, eye contact, or toy play) occurred in conjunction with decreased problem behaviors (e.g., tantrums, or out of seat behaviors).

To summarize, these studies support the use of PECS for children with A/DD, demonstrating the benefit of using PECS to make requests and comments. The results appear to generalize in natural environments (i.e., classroom and home setting) across various tasks (i.e., snack, play) with various trainers (i.e., teachers, parents, peers) (Kravits et al., 2002) and may lead to improvements in other areas such as speech and problem behavior (Bondy & Frost, 1994; Cafiero, 2001; Charlop-Christy et al., 2002; Frea, Arnold, & Vittimberga, 2001).

Speech Generating Device

The second promising aided communication system for children with autism is the use of speech-generating devices (SGD). SGD can be programmed or

recorded to provide synthetic or digitized speech, which may offer a more natural, understandable system. As a result of the voice-output, SGD have several advantages over other aided systems, such as PECS (Schepis et al., 1998; Schlosser & Blischak, 2001). SGD include detailed messages, which may enable the child to communicate very precise requests and eliminate communicative breakdowns (Sigafoos, Drasgow, Halle, O'Reilly, Seely-York, Edrisinha, & Andrews, 2004). SGD combines communication with attention getting, which may increase probability of a listener response. Also, voice output may facilitate acquisition and maintenance of communication skills. Several studies have focused on teaching individuals with A/DD to use SGD (Brady, 2000; Schlosser et al., 1995; Schepis, Reid, & Behrman, 1996; Soto et al., 1993). There are also a few studies by Sigafoos et al. (Sigafoos, Didden, & O'Reilly, 2003; Sigafoos & Meikle, 1996; Sigafoos, Laurie, & Pennel, 1996).

Schepis, Reid, Behrmann, and Sutton (1998) taught four young children with autism to use SGD combined with naturalistic teaching procedures for increasing the communicative interactions during classroom routines with their classroom teacher and staff. Results indicated that the number of communicative interactions increased and all participants used SGD to request items, respond to questions, and make social comments during the natural routines of snack or play. However, there was no evidence of SGD use being associated with a decrease in the frequency of other child communicative behaviors (e.g., gestures, words, or

vocalization). Also, the results did not show an increase in communicative exchanges among children in the classroom. Classroom staffs showed increased communicative interactions with the children, which might be due to the recent training and understanding the children's SGD communication. There were no data available on staff behaviors following the procedures.

In the Schlosser et al. (1998) study, a ten-year-old boy with autism was taught to use synthetic speech output and orthographic feedback on spelling under three conditions. In the speech condition, the participant received auditory feedback from the speech synthesizer after he typed each letter and word. In the print condition, the participant obtained only visual feedback from SGD display without the speech output. In the third condition, the participant received both auditory feedback from speech output and visual feedback from the liquid crystal display (LCD) screen. Results indicated that the participant learned to spell the words up to criterion in each condition. However, he spelled target words more efficiently in the speech condition, followed by speech + print, and then print alone.

Dyches (1998) studied the use of a simple SGD switch to teach four children with autism and severe intellectual disabilities to make requests for a drink using a withdrawal design. In a switch training phase, a system of least-to-most prompts was used, including five levels of prompting. The results indicated that each of the four students increased the number of communicative interactions

spontaneously and independently in the switch training phase. Also, the authors reported that the switch training increased number of verbalizations and did not hinder the use of speech for one participant. However, Schlosser and Blischak (2001) cautioned the interpretation of the results because of methodological flaws, such as, the use of different dependent measures in baseline and intervention, and lack of procedural integrity data.

In another study, Dyches, Davis, Lucido, and Young (2002) focused on skill generalization following instruction of an adolescent with multiple disabilities using two AAC devices: a simple pictographic display and a SGD with an identical display used as an overlay. In the training phase, the participant was able to use both AAC devices in the community, following classroom instruction without prompts across 14 training sessions. In the community generalization phase, community member's response latency, focus of attention, and comprehension of requests were measured. Most community members responded to the participant's request in a timely fashion and focused on the participant rather than the accompanying adult. However, further analysis of the data showed a relationship between the focus of community member's attention. It was notable that when community members focused on the participant following a request made with the pictographic display, 90% of her requests were understood. However, when community members focused on the participant's the accompanying adult, only 17% of the requests made with pictographic display were understood. Whereas,

community members understood 100% of the request when their attention was directed to the participant but understood no requests when attention was focused on the accompanying adult. Most of the community members understood the participant's request, or after a single repetition. The authors emphasized the importance of the use of multiple modes of AAC systems to increases the quality and number of interactions with community members. They advocated incorporating individual preferences to enhance the communicative competence of individuals.

Brady (2000) reported successful use of a SGD to teach two 5-year-old children with autism and cognitive disabilities to request items to complete the activity routines. The participants' responses were both requests and labeling responses. A comprehension probe was administered to determine whether participants would learn to recognize the spoken labels for the target objects. Both participants learned to request six different objects using their SGD in the context of preferred activities. One participant met criterion (90% correct, unprompted responses over three consecutive sessions) after 11 sessions in the picture/glitter routine and after 13 sessions in Snack routine. The other participant met criterion after 30 sessions in the tape player routine and after 5 sessions in the picture/glitter routine. In addition, both participants showed evidence of increased comprehension of spoken labels of the object names requested with 100% accuracy in an art and

snack routine. The authors suggested further research on a causal relationship between SGD use and gains in comprehension of object names.

Dicarlo and Benajee (2000) evaluated the effects of using an SGD on the communicative initiation behaviors of two young children who were developmentally delayed and nonverbal. The participants, ages 28 months and 24 months, were diagnosed with Angelman syndrome. The participants were chosen for this study because they had low levels of communicative initiation behaviors during a snack time routine. During Snack routine, a succession of items was placed within view of the children, allowing them to request materials introducing the augmentative devices and modeling device use within natural environments and routine activities across 7 intervention sessions. Results of this study indicated that the augmentative voice output devices were effective in increasing communicative initiations and decreasing unclear initiated behaviors of two young nonverbal children during Snack time routine. Also, the authors reported that this study resulted in gains in initiated gestures and sign language use, suggesting that the use of the augmentative communication device did not decrease the other forms of communicative behaviors.

Sigafoos and Drasgow (2001) reviewed two types of AAC systems and presented a case study related to the conditional use of aided and unaided AAC. The participant was a 14-year-old boy with developmental disability and communication impairment. He had a diagnosis of moderate to severe intellectual

disability with autistic-like behaviors. Two modes of communication: manual sign and aided device were taught in acquisition training and conditional phase to teach a generalized request. The participant produced trained manual signs after four minutes of training and was prompted to produce 11 times manual signs before he reached the acquisition criteria of 3 independent manual signed requests. Whereas, he pressed SGD within a minute of training and had to be prompted only once to press the switch before he reached criteria. The collateral effect on speech occurred only in the manual sign condition. The authors provided several possible explanations suggesting further study to consider the variables that might contribute to this result. Another interesting result shown in this case study was that the participant always used manual sign when SGD was absent and used SGD when it was present.

In summary, SGD intervention may benefit children with autism in terms of increasing spontaneous communication (Dicarlo & Benajee, 2000; Dyches, 1998; Schepis et al., 1998; Sigafoos & Drasgow, 2001), comprehension of language (Brady, 2000), and speech (Dyches, 1998). Participants were able to acquire skills within a short period of training time and generalize to a community setting (Dyches et al., 2002; Sigafoos & Drasgow, 2001).

This review of the interventions, however, revealed that the participants of the studies were heterogeneous with different diagnoses (intellectual disabilities, multiple disabilities) and speaking abilities. Although approximately 75% of

individuals with autism demonstrate some level of cognitive (intellectual) disabilities, autism itself is a separate diagnostic category (APA, 2000). Given that the nature of communication is social, and that learning different communication systems involve different levels of attention, it is probable that individuals with autism would have different performance profiles than individuals with intellectual disabilities (i.e., mental retardation, Down syndrome). Also, very few studies on PECS/SGDs involved children who were younger than five years old. It is difficult to apply the results of studies conducted with older children, who have more developed motor and cognitive skills (Schlosser & Lee, 2000). Still, based on this review, there would seem to be sufficient evidence to suggest that both PECS and SGD may represent promising modes of AAC for teaching communication skills to young children with autism.

Researchers and practitioners state the advantages of using one device over the other, however, relatively little research is available to validate these potential advantages for the user. Also, research is needed to compare the use of different AAC options and identify individual differences in performance, and attempts to associate these differences with specific child characteristics.

STATEMENT OF THE PROBLEM

Communication and language play a major role in the learning process. Consequently, the absence of functional communication skills in children with

autism may directly affect the level of participation an individual may have in home, school, work, and community activities and perhaps more importantly, social interactions with others (Goldstein, 2002; Prizant & Wetherby, 1987). Therefore, one of the greatest needs and critical goals for intervention for young children with autism is assistance in communication skills (APA, 2000; Ogletree & Harn, 2001; Wetherby & Prutting, 1984). AAC systems represent a useful means of assisting children with autism to communicate using less disruptive forms of communication (Schepis et al., 1998).

However, there is relatively little rigorous, systematic research to elucidate the components of AAC that may best address specific characteristics of children with autism and interact to produce effective intervention (National Research Council, 2001). Research is needed on PECS and SGD that investigates the performance of carefully diagnosed, young children with autism and compares the effects of PECS and SGD. Also, very few studies on PECS and SGD have involved children who were younger than five years old. It is difficult to apply the results of studies conducted with older children who may have more developed motor and cognitive skills. In addition, very little research is available to validate the potential advantages for the use of two AAC modes and user's preferences for young children with autism.

PURPOSE OF THE STUDY

The purpose of this study was to compare the relative effectiveness of two modes of augmentative and alternative communication (AAC) for children with autism and related developmental disabilities.

RESEARCH QUESTIONS

In order to achieve the stated purpose of this study, the following research questions were addressed:

1. Are there differences in acquisition rates for requests taught using PECS v. SGD?

2. Do children show a preference for one mode over the other?

3. Are there differences in perceived social validity of PECS v. SGD?

SIGNIFICANCE OF THE STUDY

This study is significant because it focused on teaching early communication functions and involved a comparison of PECS and SGD intervention for young children with autism within the natural environment (i.e., home setting for children with disabilities). Early communication functions serve as the foundation of later cognitive, social, and language development (Koegel, 1996; Prizant & Wetherby, 1987; Yoder & Warren, 2001). Therefore, intervention is necessary to provide opportunity to develop appropriate communication skills

and social development. Such research has the potential to provide support for the provision of PECS and SGD intervention to young children with autism who are in the early stages of language development. Also, due to the paucity of research in the literature on the systematic comparison of PECS and SGD modes of AAC intervention with children with autism, research is required that specifically compares PECS and SGD in very young, nonverbal children with autism. The outcomes of this comparative study provide empirically validated instructional procedures related to PECS and SGD intervention for young children with autism and evaluate the relative effectiveness of PECS and SGD to improve communicative functions of young children with autism. This comparative study may yield useful information for parents, special educators, and other professionals deciding to use one system versus the other for AAC training.

CHAPTER TWO

METHODS

The purpose of this study was to compare the effectiveness of PECS and SGD for teaching communicative requesting. This chapter describes the research questions, participants, setting/context, materials, variables, procedures, inter-observer agreement, treatment integrity, and data analysis used in this research study.

RESEARCH QUESTIONS

The following questions guided this research:

1. Are there differences in acquisition rates for requests taught using PECS v. SGD?

2. Do children show a preference for one mode over the other?

3. Are there differences in the perceived social validity of PECS v. SGD?

PARTICIPANTS

Selection Criteria and Procedure

In this study, three children with autism and developmental disabilities (A/DD) participated. Two were girls and one was a boy. Participants were selected based on the following criteria:

1. Children under the age of 5 years to cover children in preschool age who are less likely to have received AAC intervention.

2. Children with diagnosis of autism or a related developmental disability.

3. Children who have an expressive language vocabulary of 10 or less spoken words.

4. Children who do not have significant physical and/or sensory disabilities that would preclude the use of PECS or SGDs.

Each child displayed the central characteristics of autism delineated in the DSM-IV by the report from the school district or local agency. These children were selected for the study because they did not speak and were therefore candidates for AAC intervention that focused on providing functional basic communication intervention. The participants did not communicate through speech but they did use behavioral indications, such as, reaching, leading, screaming, or disruptive behaviors to communicate with others. The participants' skills in communication

and language comprehension were considered to be severely impaired as determined by the school records, teacher reports, and parent reports.

Participants were recruited through the voluntary participation. Parents of potential participants received a letter from the researcher inviting their children to take part in the study voluntarily (Appendix B). The letter explained the subject criteria, purpose of the study, the timeline of the study, and contact information of the investigator. The investigator met with parents who wished to participate and obtained the parental consent for the child to participate and to be videotaped for educational and research purpose. Parental consent form can be seen in Appendix A. Following parental consent, potential participants were observed in their home setting by the investigator.

Participant Description

Participant 1 was a five-year five-month-old Asian-American girl with diagnosis of autism. She was nonverbal and spoke no words at the start of the study. She had attended educational classes at a preschool program for children with disabilities (PPCD) for two years prior to the onset of the study. Participant 1 had moderate levels of stereotypic and disruptive behavior, such as hand flapping, screaming, crying and tantrum throwing. Stereotypic behaviors observed on a daily basis at school included: staring at hands or other items for over 5 seconds; flicking or flapping hands, whirling or turning in circles; rocking back and forth; making lunging or darting movements, high pitched sounds or vocalizations and slapping,

hitting or biting herself. Atypical social interaction observed daily at school and home included: avoiding eye contact; becoming upset when routines change; laughing or crying inappropriately; being unaffectionate and non-imitative of others playing; responding negatively or with tantrums when given directions or requests; using toys or objects inappropriately; looking through people; withdrawing in group settings and behaving in an unreasonably frightened or fearful manner. She did not imitate sounds, point to body parts or use names to identify familiar people or objects based on the information on the Vineland Adaptive Behavior Scale reported by the mother. Based on the information contained in the Full and Individual Evaluation, she appeared to meet eligibility criteria to be identified as a student with autism and speech impairment. Participant 1's Individual Education Program (IEP) goals in the communication domain included requesting desired items without screaming and crying 3 times a day.

Participant 2 was a three-year eight-month-old African-American girl with diagnosis of autism and speech impairment at the start of the study. Participant 2 was placed in a preschool program for children with disabilities (PPCD) for the previous eight months. Participant 2's ability to follow directions was significantly delayed, as she provided an incorrect or no response to novel directions. It was reported that Participant 2 did not respond to social cues in a way that would be expected at her age. Her facial expression was almost always neutral not making eye contact or responding in ways that suggest she was listening or reacting to others. Results of the Vineland Adaptive Behavior Scale indicated Participant 2's

communication was delayed as she obtained a standard score of 50, placing her below the first percentile for her chronological age. Her development has been delayed in all areas except her physical growth, and her communication skills were seriously delayed. She communicated requests by hand leading, reaching, pointing, or throwing tantrums. Participant 2 was experiencing difficulty conforming to classroom routines and expectations, and teachers reported that her tendency was to run around the room. It was apparent from the evaluation that Participant 2 exhibited many of the features of autism.

Participant 3 was a three-year-old Asian-American boy at the start of the study. He had attended a regular private preschool for previous two months. Before he entered into the current private school, he was served by the local early childhood intervention agency for six months. He was diagnosed with language delay and pervasive developmental disabilities (PDD) by the local early childhood intervention agency. It was reported by his mother that Participant 3 initiated requests by pointing, leading or pulling to obtain desired toys and foods. His primary modes of communication were signing “more”, pointing, leading, and some vocalization (i.e., “uh-oh”, “yeah”, “ba”). His parents were seeking any help in his language and communication development and wanted to try PECS or SGD. Standardized assessment information was not available for Participant 3.

SETTING/CONTEXT

The study was conducted in the participants' home in the living room or separate room with a small table. Teaching occurred in the context of 2 activities. One activity involved snack time, where children learned to use PECS and SGD to request preferred snack items. The other activity involved play, where children learned to use PECS and SGD to request preferred toy items. The study involved 30- to 50-minutes of intervention per day, depending on the number of sessions the students received. Within each session, the trainer provided eight opportunities for the participant to access the item. The sessions were conducted in a one-to-one situation with the trainer. The participant and the trainer sat at a table in the room. For participants 1 and 3, the sessions were conducted in a separate room where the parents were not present. For participant 2, the sessions were conducted in the living room where the bed was placed and mom was present. The investigator administered instruction and collected data during all phases of the study.

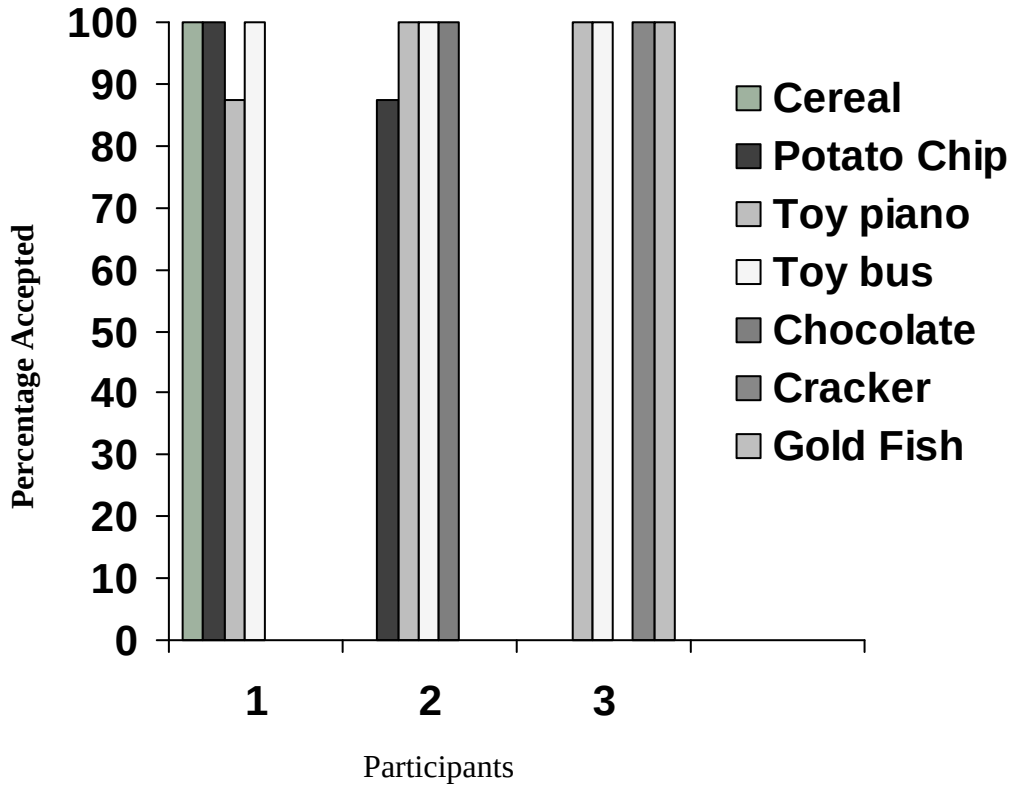
MATERIALS

A preference assessment (see *Procedure*) was conducted for each student to identify items to be used in training. Items that accepted 80% or more of presentations were considered as preferred and used as stimuli items. Results (Figure 1) showed that the students rarely failed to access and consume each item when offered. Each participant had four items and the same items were used for

both PECS and SGD training. Snack items: for Participant 1, cereal, potato chip; for Participant 2, potato chip, chocolate; for Participant 3, cracker, Gold Fish™ were used. The same play items (toy piano and toy school bus) were used for all the participants based on the parent reports and the preference assessment.

The materials included snacks (e.g., potato chips, cereal, chocolate, and cracker) and toy items (e.g., toy school bus, toy piano) that were used for each of the routines and picture cards corresponding to each item. Black-and-white line drawing picture cards were obtained for each preferred stimulus item. A set of pictures representing preferred items were either printed from the Boardmaker computer program (Mayer-Johnson Company, 1994) or constructed from pictures of preferred snack items. The picture cards were placed on a SGD called a Tech/Talk™. The Tech/Talk™ was programmed to provide the voice output, "I want the [preferred item], please", when the template with the picture cards of the stimulus were pressed.

Figure 1. Preference assessment results



DEPENDENT VARIABLES

Three dependent measures were collected during Play and Snack sessions: percentage correct responses, number of trials to criterion, and percentage of times devices selected. First, to calculate the percentage correct response for each participant, four types of responses were recorded: independent, verbal prompt and/or gesture model, physical prompt and no response. An independent response

was recorded when the child requested an item (handed in the correct picture to the trainer or pressed the correct picture on a panel of the Tech/Talk™) within 10 seconds after the presentation of the items without any prompt. A verbally prompted and/or gesture modeled response was recorded when the child requested an item within 10 seconds after the delivery of verbal prompt, such as "Point to the picture" and/or after the delivery of gesture model by the trainer, such as pointing to the picture cards or picture on a panel of the Tech/Talk™. A physically prompted response was recorded when the child requested an item after the delivery of physical prompt by the trainer, such as touching some part of the participant's elbow, wrist, or hand to guide the response of pointing to a picture or pressing the panel on a Tech/Talk™. A no response was recorded when the child did not respond within 10 seconds after the delivery of the prompts. Second, for each participant, data was collected on the number of sessions (trials) to reach criterion to compare the acquisition rates using each device. Third, for each participant, data was collected on the percentage of times devices were selected for use at the beginning of opportunities during choice assessment probe sessions.

The columns vocalization and behavior was recorded anecdotally by the trainer during the sessions throughout the study and discussed as anecdotal results to support the results.

OBSERVATION AND MEASUREMENT

When an opportunity for requesting was initiated by the trainer during the session, the trainers recorded the child's type of response to the opportunity (i.e., independent, prompted, or no response). Data sheets for all the sessions included columns in which the data collector recorded whether the response was independent, what level of prompting was needed to request, what verbalizations the student made, and what behaviors the children enacted. The trainer collected data during the sessions for all phases of the study. The responses were recorded on data sheets as independent, verbally prompted and/or gesture modeled, physically prompted, or no response so as to collect data on the percent correct of target behaviors (see Appendix C: Data Collection Sheet). Percentage correct response was calculated for each block of 8 trials. Percentage correct of requesting behaviors was calculated for each session by summing the total independent responses, dividing by the total number of trials in that session, and multiplying the calculated number by 100. This data was plotted graphically for each participant. The number of trials required for the child to reach criterion (e.g., 75% of trials performed correctly for two consecutive 8-trial sessions) was counted to compare the speed of acquisition of each mode. Only independent responses were counted for calculating the percent correct response toward criterion.

EXPERIMENTAL DESIGN

The design of this study involved a single-subject alternating treatment design. The alternating treatment design was used to evaluate the comparative effects of PECS and SGD training on communicative requesting behaviors within each subject, as the two different conditions were represented in rapid alternation (Barlow, & Hayes, 1979; Gast & Wolery, 1988). In this study, the investigator was interested in determining the relative effectiveness of two AAC modes of intervention in a short period of time. More specifically, the study aimed to determine if children with autism would show different acquisition of requesting behavior using two AAC modes; and if they would show a preference for one type of AAC mode over another. The order of treatment schedule within sessions was alternated in an ABAB design so that the treatment sequences are equally comparable in number (Alberto & Troutman, 1999). Intervention was introduced after the baseline and choice was introduced after the mastery criterion was met. The criterion required that accurate requesting response was at 75% (over 6 correct responses out of 8 trials) or higher for two consecutive training sessions. It is recommended to end with implementing the most effective treatment in the final phase in an alternating treatment design (Richards, Taylor, Ramasamy, & Richards, 1999). In this study, choice assessment probe continued with learner's device choice. The order of introduction of each item was varied for each child to control for the order effects.

PROCEDURAL OVERVIEW

Preference Assessment

The first step in teaching was to identify the preferred items for use during PECS and SGD sessions. The parent identified a list of snack items which were highly reinforcing for each participant. The investigator presented one item at a time (Pace et al., 1985) to the participant in a random order for at least 8 trials per session. If the participant reached for an item, he or she was given a small amount of the item. In order to be included in this study, the items must have been chosen by the participant 75% or more of the opportunities in which they were offered. As a result of the preference assessment, four items for each participant were determined to be highly preferred as described previously in this chapter (See Figure 1 for Preference Assessment Results).

Baseline

During baseline sessions, the child was seated in front of a desk across from the trainer. The trainer instructed the child that it was time to have a snack or play and initiated the requesting opportunity by presenting the preferred item. Each session typically contained 8 trials and lasted approximately 10 minutes, although the length of sessions and the number of trials varied depending on the participant's behavior. Four sessions (PECS play and snack, SGD play and snack) were conducted per day. During Snack time, food items were placed within the

view of the participants but out of reach. During Play time, toy items were placed within the view of the participants but out of reach. Either the picture cards or the speech generating device were placed within the reach of the participants in each condition.

The trainer waited for at least 10 seconds for the child to request the item. The children were given items on request by reaching or other behavioral indication (Drasgow, Halle, Ostroky, & Harbers, 1996) during the baseline. Regardless of the displayed behavior, no physical or verbal prompts or models were given during the baseline phase. Six baseline probes were administered to the participants for both Play and Snack sessions.

PECS Training

The participants were taught PECS during 10-minute training sessions two to four times per week for eight trials per session, until the participants' acquisition of requesting behavior reached mastery criterion (75% or higher independent correct responses) using PECS. The children learned to present a picture to a trainer, who subsequently provided the object and reinforced the behavior. An appropriate requesting behavior (i.e., present picture card) resulted in access to the object. If no attempt to request an object was made, the trainer would prompt the child to use PECS to request an item.

The participant was provided with a snack item (e.g., cracker, cereal, potato chip) but out of reach during Snack time. The picture cards representing the objects

were placed within view of the participants. PECS was taught using time delay and the least-to-most prompt systems. Time delay is a treatment approach that focuses directly on increasing spontaneous speech (Charlop, Schreibman, & Thibodeau, 1985). The trainer waited 10 seconds for the participant to request. If the child did not respond, the teacher asked the question "What do you want?" while holding up the preferred item and waiting for 10 seconds. If the child did not touch the symbol within 10 seconds, the trainer provided a verbal prompt (e.g., "Give me the picture") and/or gesture modeling a correct response (e.g., pointing to the picture). If the participant made a correct response within 10 seconds after the prompt, verbal praise was given and allowed access to the item. If the participant did not respond, then the next level of prompting was used, this consisted of physical prompting, by guiding the learner's hand or arm to place the correct picture cards in the trainer's hand.

Each session had blocks of 8 trials with two items. The participants had trials to request each of the target items four times per teaching session. The same procedure was continued until the participant was successful on 75% of the trials without prompt for two consecutive sessions.

SGD Training

In SGD condition, the procedures were basically the same as PECS training. The participants were provided with SGD during the targeted routine. At the beginning of the first experimental session, the participant was allowed to

freely explore SGD, pressing switches and listening to messages for approximately 1-2 minutes. The trainer modeled the use of SGD by pressing and commenting on what each symbol/message set represented.

Device Choice Assessment Probe

Following the training session, post-acquisition session was conducted to assess students' preference of communication modality. No teaching procedure was conducted during the post-acquisition session. The participant was presented with repeated opportunities to select an item when given a choice of two AAC modes, PECS/SGD to request snack or play item. The number of times devices were selected was recorded at each session. The device selected more frequently was presumed to be more preferred over the less frequently selected device.

INTER-OBSERVER AGREEMENT

Two graduate students served as independent observers and coded reliability data of 35.7% from videotapes of all the sessions. Prior to data collection, the observers were provided with the operational definitions of the dependent variables to be scored and descriptions of observation procedures. The observers then practiced the observation and recording procedures by watching videotapes with the investigator. During the reliability sessions, the observer recorded, on a trial-by-trial basis, whether the participant's request was an independent correct response or prompted or whether the trial ended with the child

making no response (see Appendix C: Data Collection Sheet). This data was compared to those collected by the investigator. An agreement was counted when the two observers recorded the same response for all response categories for each item presentation. For example, to achieve agreement during the training sessions, observers had to agree on independent responses, level of prompted responses, and devices selected. A disagreement was defined as the second observer not matching on any of the above response categories. A percentage of agreement was calculated at the end of each observation session using the formula: Agreements/ (Agreements + Disagreements) X 100%.

Inter-observer agreement (IOA) across each condition of the study for participants 1 to 3 is summarized in Table 1. Table 1 presents data on the number of training trials across PECS and SGD conditions for each participant. The number of trials in each condition was eight and consistent from session to session. However, if the participant failed to access the item or rejected the item, training trials did not proceed. The row labeled “Number of Trials with IOA” displays the number and percentage of inter-observer agreement sessions conducted in each condition of the study for each participant. Inter-observer agreement data was collected at 33.5% during snack and 50% during play sessions for participant 1, 39.2% during snack for participant 2, and 32.3% during snack and 28.5% during play sessions for participant 3. Inter-observer agreement data was collected 35.7% for all participants across the conditions.

The row labeled “Agreement” displays the inter-observer agreement for participants 1 to 3 averaged across each condition of the study. Mean inter-observer agreement for participant 1 was 98.6% during snack, and 97.4% during play. Mean inter-observer agreement for participant 2 was 94% during snack. Mean inter-observer agreement for participant 3 was 92.5% during snack, and 93% during play. Overall inter-observer agreement for all participants (averaged across conditions) was 95% with a range of 82% to 100%. Inter-observer agreement was high throughout all of the sessions.

Table 1 Total number of sessions, total number of trials, number of trials with inter-observer agreement (IOA), and Agreement.

	Participant 1		Participant 2	Participant 3		Total
Condition	Snack	Play	Snack	Play	Snack	
Number of Sessions	28	22	37	31	30	
Number of Trials	215	158	327	248	246	
Number of Trials with IOA data collected (%)	72 (33.5)	79 (50)	119 (36.4)	80 (32.3)	70 (28.5)	418 (35.7)
Agreement (Average %) (range)	98.6 (88-100)	97.4 (88-100)	94 (88-100)	92.5 (82-100)	93 (82-100)	95 (82-100)

TREATMENT INTEGRITY

Two trained observers collected treatment integrity data for 13 sessions, distributed across all sessions, to ensure that the same procedures for both conditions were implemented correctly. After receiving instruction on procedural steps for both conditions, two trained observers scored the trainer behaviors including: 1) initiation of requesting opportunities by placing the items and devices, 2) amount of time wait for the response, 3) whether the teacher accurately provided the designated assistance (prompt) depending on the participant's response, and 4) whether the reinforcement was contingently delivered (See Appendix D: Treatment Integrity Checklist adapted from Tincani, 2002). The

responses to those questions were “Yes”, “No”, or “N/A (“not applicablë). A percentage was calculated with a “Yes” response meaning agreement and a “No” response meaning disagreement.

Table 2 presents the data percentage of “Yes” responses by an independent observer across each condition of the study. Treatment integrity data were collected for 4 baseline sessions; 6 sessions from the treatment, and 3 device choice assessment probes from all participants. The columns labeled for each participant display the percentage of “Yes” responses for participant 1 to 3 averaged across each condition of the study. The average percentage correct of the trainer’s use of instructional procedure for all participants was 99% (range, 97% to 100%).

Table 2. Treatment Integrity: Percentage of trials in which correct training procedure was obtained during baseline, treatment, and choice assessment probe.

Condition	Participant 1	Participant 2	Participant 3	Average
Baseline	100	100	100	100
PECS Training	97	100	97	98
SGD Training	100	97	100	99
Choice	N/O	100	100	100
Average	99	99	99	99

SOCIAL VALIDITY

Social validity of treatment outcome was measured using the rating forms. The independent raters were asked to complete a questionnaire addressing the communication skills of the participants. The questionnaire covered the following areas of interest: (a) the rater's impression of the effectiveness after the intervention; (b) the rater's impression of the ease of implementation; (c) the rater's impression of the age-appropriateness, (d) the rater's impression of acceptability, (e) the rater's impression of generalizability in other setting, and (f) the rater's personal preference (See Appendix E: Social Validation Questionnaire).

Four videotaped sessions were presented to a group of seven undergraduate students and one graduate student enrolled in a course in Practicum in autism and developmental disabilities. Two sessions for each condition (PECS/SGD) were randomly selected from the training sessions for each participant. The social validity measures were obtained during a meeting of the Practicum course. The raters were not informed of the purpose of the study prior to viewing the videotaped sessions. The investigator did not provide any information about whether the child's response was correct during these sessions.

DATA ANALYSIS

Data analysis for the study used visual analysis to compare the general performance of participants during baseline, alternating treatment, and choice

assessment phase using two modes (PECS and SGD) for each participant. Visual analysis of graph figures that contained the percentage of independent correct response for baseline, training, and choice assessment sessions were used to compare the effects of the both PECS and SGD treatment.

Average percentage correct was calculated for each device and total number of training trials to reach mastery criterion was counted for each participant to answer Research Question 1, comparing the effectiveness of each treatment. The percentage of devices chosen during the choice assessment probe was calculated during choice assessment probe sessions to answer Research Question 2, regarding a child's preference for one mode over the other. Lastly, social validity measures on effectiveness, appropriateness, and generalizability were evaluated by comparing the frequencies of ratings for each mode of PECS and SGD, to answer Research Question 3.

CHAPTER THREE

RESULTS

The purpose of this study was to compare the effects of PECS and SGD for teaching communicative requesting skills. In the following sections, the results of the study are described in terms of the effects of the intervention by the individual results and research questions.

Data was collected for three participants on the acquisition of the requesting skills (acquisition criteria was that the participants used the given augmentative device independently over 75% of the time for two consecutive sessions during the treatment) and the preference for one mode over the other (preference was determined for each participant comparing the two modes, PECS and SGD in terms of percentage of time device selected). After the study, the social validity measures were collected from a group of seven undergraduate students and one graduate student. Supplemental analysis on the level of prompts, behaviors, and vocalization/speech development are presented at the end of this chapter.

INDIVIDUAL RESULTS

Individual results for each participant during Play and Snack are graphically presented in Figures 2 through 4. In each figure, the circle represents the data

obtained in PECS training and the triangle represents the data obtained in SGD training.

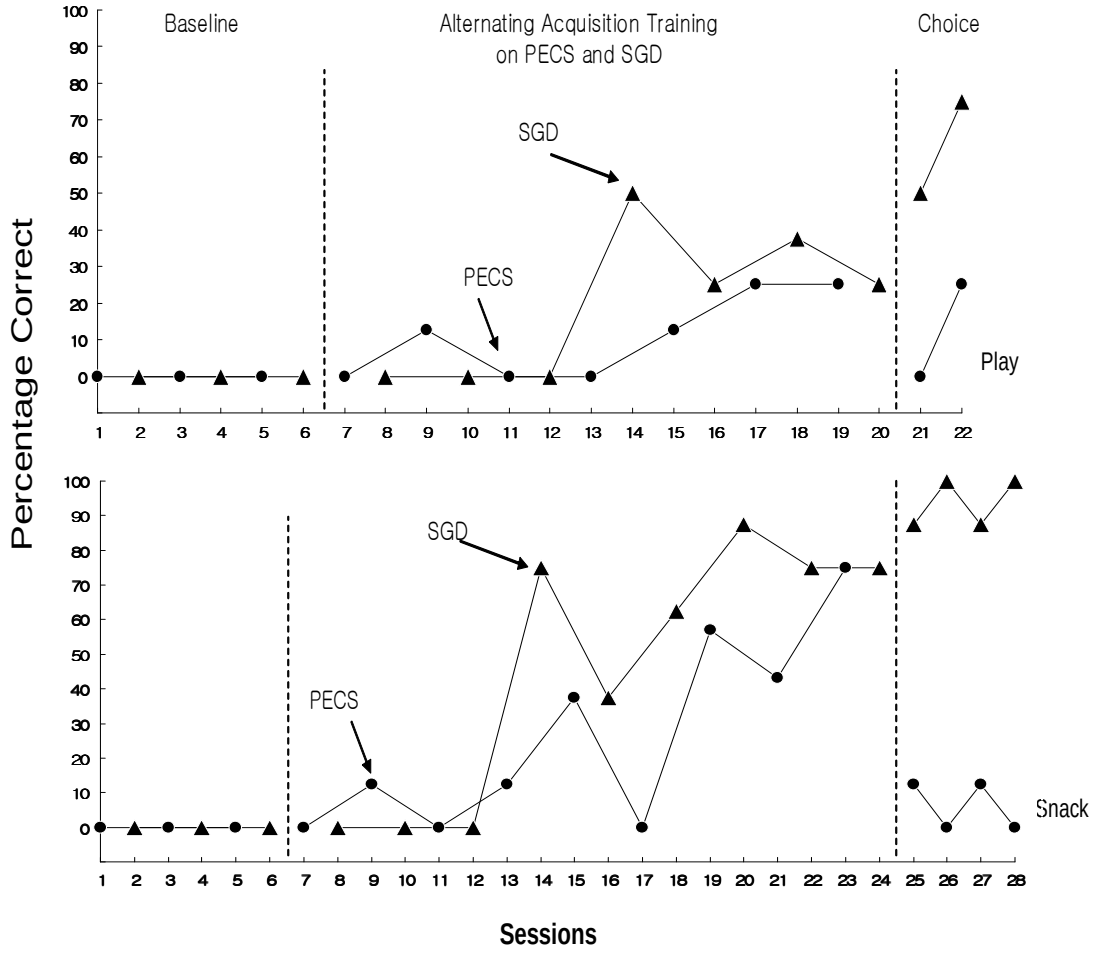
Participant 1

Figure 2 illustrates Participant 1's acquisition rates across all three phases: baseline, intervention, and device choice assessment probe during Play and Snack. Participant 1 participated in a total of 50 sessions (22 play sessions and 28 snack sessions) and 463 trials (158 trials in play sessions and 215 trials in snack sessions) (See Table 1).

Play. The upper panel of Figure 2 shows a graphical representation of independent requesting responses emitted by Participant 1 during Play. In baseline she emitted no correct responses, even though she reached for preferred items or led the trainer's hands to obtain the preferred items. In alternating acquisition training sessions 7 through 20, Participant 1's independent requesting responses increased from 0% to 37.5% in PECS training, and 0% to 50% in SGD training. Visual inspection of the data from sessions 14 to 22 revealed differences of PECS and SGD training data paths, with SGD training producing a higher percentage of independent requesting responses. During the choice assessment sessions 21 to 22, her independent requesting responses increased from 50% to 75% using SGD, and 0% to 25% using PECS. Participant 1's acquisition training and choice sessions were cut short because she had to move to another state.

Snack: The lower panel of Figure 2 shows a graphical representation of independent requesting responses emitted by Participant 1 during Snack sessions. In baseline she emitted no correct responses. In alternating acquisition training Sessions 7 through 24, Participant 1's independent requesting responses increased from 0% to 75% in PECS training, and 0% to 87.5% in SGD training. Visual inspection of the data path from Sessions 14 to 24 indicates an increasing trend in independent responses. Visual inspection of the data in Sessions 14 to 24 revealed slight differences of PECS and SGD training data paths, with SGD training producing a higher percentage of independent requesting responses. During the choice assessment Sessions 25 to 28, her independent requesting responses maintained the mastery from 87.5% to 100% using SGD.

Figure 2. Percentage of independent responses across baseline, alternating treatment, and choice assessment probe during Play and snack for Participant 1

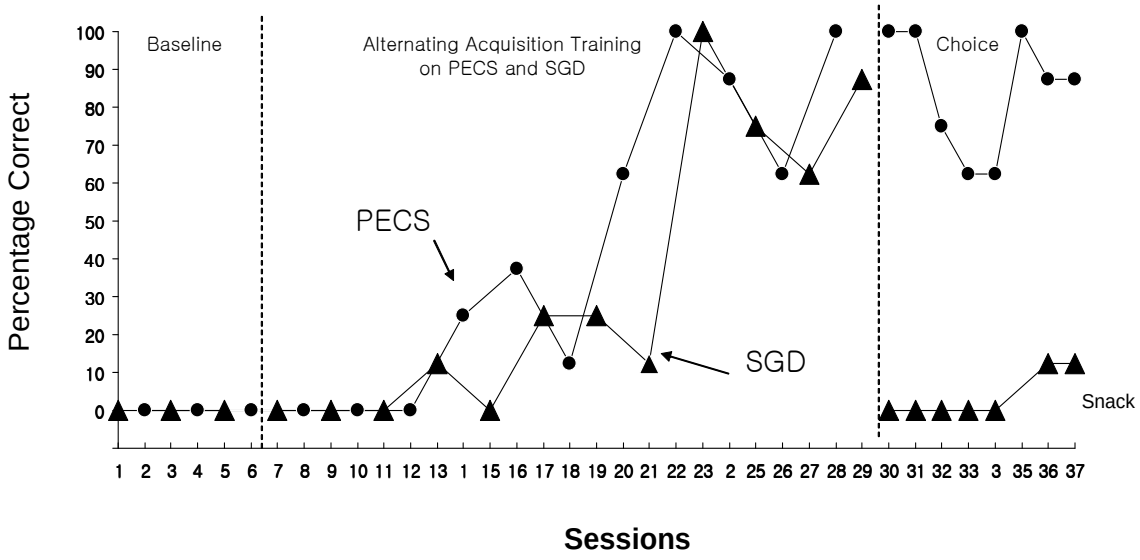


Participant 2

Figure 3 illustrates Participant 2's acquisition rates across all three phases: baseline, intervention, and device choice probe during play and snack context. She participated in a total of 48 sessions (14 play sessions and 37 snack sessions) and 399 trials (96 trials in play sessions and 327 trials in snack sessions) (See Table 1). Play was withdrawn because her tantrum was extremely interfering with the sessions.

S***nack*** Figure 3 shows a graphical representation of independent requesting responses emitted by Participant 2 during Snack. In baseline she emitted no correct responses. In alternating acquisition training Sessions 7 through 29, Participant 2's independent requesting responses increased from 0% to 100% in both PECS training and SGD training. Participant 2's independent responses were observed after the withdrawal of Play sessions, which happened at session 14. Anecdotal data indicated that Participant 2 showed problem behaviors, such as tantrums, crying and whining when the toy piano was withdrawn for the next opportunity during Play. Therefore, the investigator decided to withdraw Play for Participant 2. Visual inspection of the data in Sessions 14 to 29 revealed a slight difference of PECS and SGD training data paths, with PECS training producing a higher percentage of independent requesting responses. During the choice assessment sessions 30 to 37, her independent requesting responses ranged from 62.5% to 100% using PECS, and 0% to 12.5% using SGD.

Figure 3. Percentage of independent responses across baseline, alternating treatment, and choice assessment probe during Snack for Participant 2



Participant 3

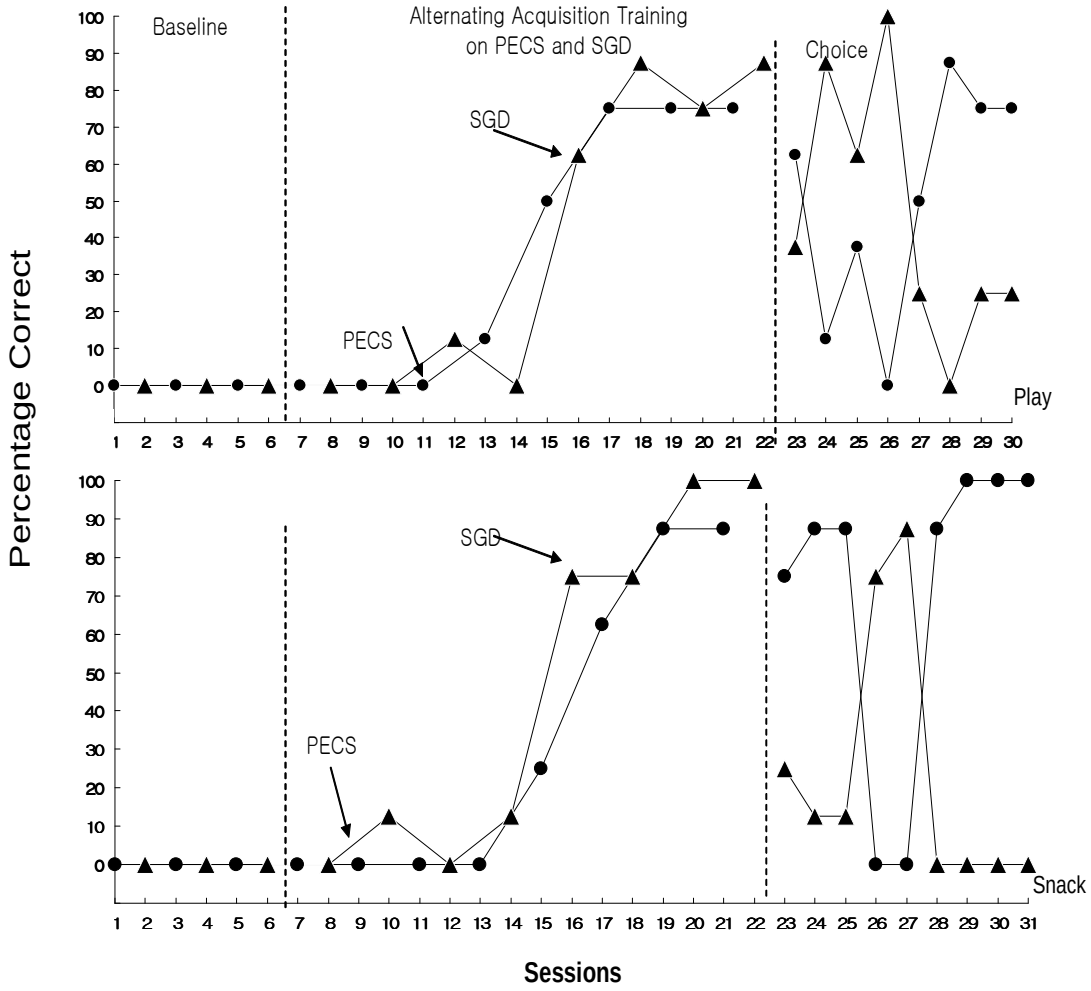
Figure 4 illustrates Participant 3's acquisition rates across all three phases: baseline, intervention, and device choice probe during play and snack sessions. He participated in a total of 61 sessions (30 play sessions and 31 snack sessions) and 596 trials (246 trials in play sessions and 248 trials in snack sessions) (See Table 1).

Play. The upper panel of Figure 4 shows a graphical representation of independent requesting responses emitted by Participant 3 during Play. In baseline he emitted no correct responses, even though he reached for preferred items, pointed to the preferred items, or produced "more" signs during most presentations. In the alternating acquisition training Sessions 7 through 22, Participant 3's independent requesting responses increased from 0% to 75% in PECS training, and 0% to 87.5% in SGD training. Visual inspection of the data path from Sessions 12 to 22 indicates an increasing trend in independent responses. Also, visual inspection of the data in Sessions 15 to 22 revealed slight differences between PECS and SGD training data paths, with SGD training producing a higher percentage of independent requesting responses. During the choice assessment sessions 23 to 30, he did not clearly show consistent preference for one over the other but selected each device for a comparable number of times.

Snack: The lower panel of Figure 4 shows a graphical representation of independent requesting responses emitted by Participant 3 during Snack sessions. In the baseline session, he emitted no correct responses, even though he reached for preferred items and produced "more" signs during most presentations. In the alternating acquisition training Sessions 7 through 22, Participant 3's independent requesting responses increased from 0% to 87.5% in PECS training, and 0% to 100% in SGD training. Visual inspection of the data path from Sessions 14 to 22 indicates an increasing trend in independent responses. Also, visual inspection of the data in Sessions 16 to 22 revealed a slight difference of PECS and SGD

training data paths, with SGD training producing a higher percentage of independent requesting responses. During the choice assessment sessions 23 to 31, he showed preferences for PECS over SGD.

Figure 4. Percentage of independent responses across baseline, alternating treatment, and choice assessment probe during Play and Snack for Participant 3



RESEARCH QUESTION #1

Are there differential effects of PECS and SGD training on the acquisition of requesting skills?

The first research question examined whether or not a difference in the acquisition of communicative requesting skills existed between PECS and SGD training. The measure of acquisition of the requesting responses was obtained from the average percentage correct and the number of trials to meet a mastery criterion. In order to achieve a mastery criterion, two consecutive sessions of requesting responses must have at least 75% accuracy during the training trials. The average percentage correct and the number of trials required to obtain mastery were compared between two conditions: 1) PECS and SGD during play and 2) PECS and SGD during snack across each participant. Each mode showed differences in rates of acquisition between children and each child showed differences in rates of acquisition between two modes.

Tables 3 and 4 display the number of training sessions, trials to mastery, and average percentage correct during Play and Snack. The range of number of trials to reach to mastery within PECS condition was between 56 to 72 training trials for each participant. The range of number of trials to reach mastery within SGD condition was between 48 to 80 training trials for each participant. Participants 1 and 3 had fewer numbers of trials to reach mastery under SGD training than PECS training, whereas Participant 2 had fewer number of trials under PECS training than SGD training.

Figures 5 and 6 compared the average percentage correct across each participant during Snack and Play under PECS and SGD training . The range of average percentage correct within PECS condition was between 10.8% to 44.3% for each participant. The range of average percentage correct within SGD condition was between 19.6% to 46.9% for each participant. Participants 1 and 3 produced more independent requesting responses during SGD training, whereas Participant 2 produced more independent requesting responses during PECS training.

Table 3. Total number of sessions, total trials, trials to criterion for each participant during Play

	Participant 1		Participant 2		Participant 3	
Condition	PECS	SGD	PECS	SGD	PECS	SGD
Number of Training Sessions	7	7	4	4	8	8
Total Trials	56	53	27	24	64	64
Trials to Criterion	N/O	N/O	N/O	N/O	56	56
Average Percent Correct	10.8	19.6	0	0	36	40.6

Note: N/O means Not Obtained

Figure 5. Average percentage correct across participants during Play

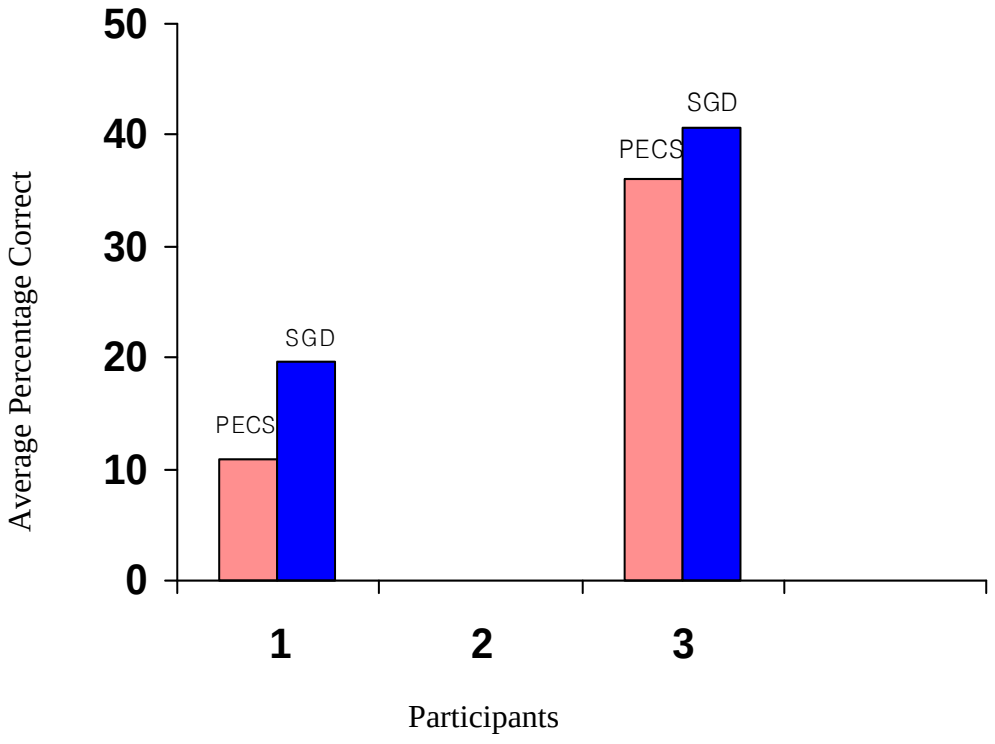
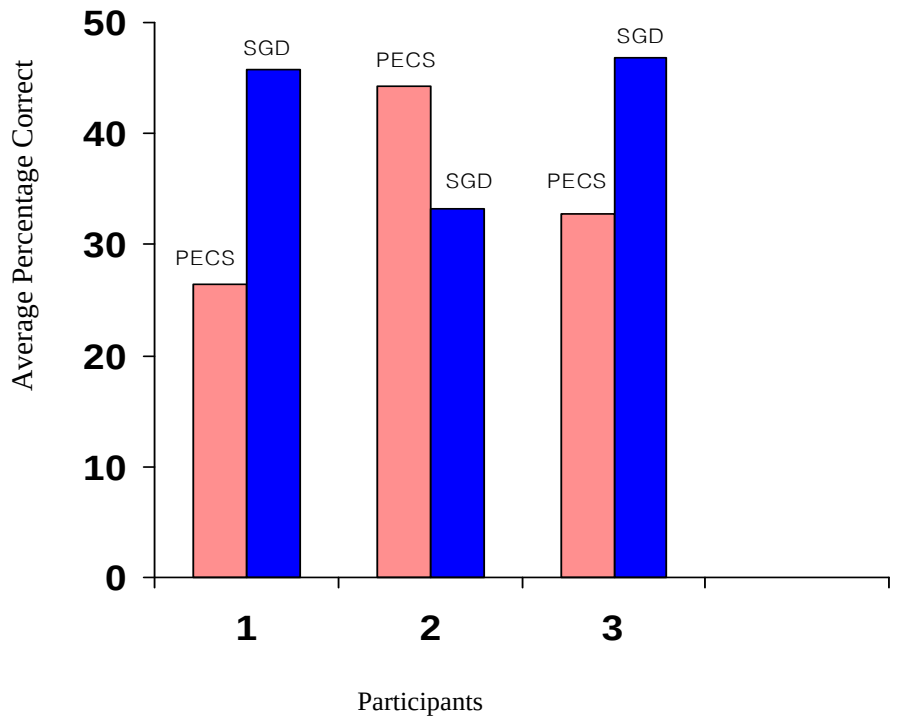


Table 4. Total number of training sessions, total training trials, trials to criterion, and average percent correct for each participant during Snack

Participants	Participant 1		Participant 2		Participant 3	
Condition	PECS	SGD	PECS	SGD	PECS	SGD
Number of Training Sessions	9	9	11	12	8	8
Total Training Trials	64	71	88	94	64	64
Trials to Criterion	N/O	64	72	80	64	48
Average Percent Correct	26.4	45.8	44.3	33.3	32.8	46.9

Note: N/O means Not Obtained

Figure 6. Average percentage correct across participants during Snack



RESEARCH QUESTION #2

Do children show a preference for one mode over the other?

Device choice assessment probes were taken at post-treatment. Tables 5 and 6 illustrate the percentage of devices chosen and the percentage correct for each device during the choice assessment probe. Participant 1 chose SGD 94% of the time during snack and 85% during play, with 94% and 62.5% average percentage correct respectively. Participant 2 chose PECS 98% of the time during snack, with 84% average percentage correct. Participant 3 chose PECS 72% of the time during snack and 54% during play. Participant 3 had extended number of sessions because he did not show clear preference during the choice assessment probe.

Participants 1 and 2 showed a pattern between the acquisition (average percentage correct) during the training and the device choice (percentage of times device chosen) during the choice assessment probe. The mode that they used with higher acquisition accuracy during the training was the mode they chose during the choice assessment probe. However, Participant 3 showed mixed results and did not show the same pattern as the other participants. That is, Participant 3 chose more percentage of the time PECS than SGD, even though his average percentage correct during the training was higher with SGD during Snack. The average percentage correct did not remarkably differ between PECS and SGD during Play for Participant 3.

Table 5. Total number of choice assessment trials, number (percentage) of times devices chosen, and average percentage correct, one chosen for each participant during Play.

Participants	Participant 1		Participant 2		Participant 3	
Condition	PECS	SGD	PECS	SGD	PECS	SGD
Total Number of Opportunities to Make a Choice	13		N/O		70	
Number of times device chosen (Percentage)	2 (15%)	11 (85%)	N/O		38 (54%)	32 (46%)
Average Percentage Correct, one chosen	12.5%	62.5%	N/O		50%	45%
Average Percentage Correct	75%		N/O		95%	

Note: N/O means Not Obtained

Table 6. Total number of choice assessment trials, number (percentage) of times devices chosen, and average percentage correct, one chosen for each participant during Snack.

Participants	Participant 1		Participant 2		Participant 3	
Condition	PECS	SGD	PECS	SGD	PECS	SGD
Total Number of Opportunities to Make a Choice	32		88		72	
Number of times device chosen (Percentage)	2 (6%)	30 (94%)	86 (98%)	2 (2%)	52 (72%)	20 (28%)
Average Percentage Correct, one chosen	6%	94%	84%	2%	71%	24%
Average Percentage Correct	100%		86%		95%	

RESEARCH QUESTION #3

Are there differences in perceived social validity of PECS versus SGD?

Seven undergraduate and one graduate students completed a social validity questionnaire regarding: (a) the rater's impression of the effectiveness after the intervention, (b) the rater's impression of the ease of implementation, (c) the rater's impression of the age-appropriateness, (d) the rater's impression of acceptability, (e) the rater's impression of generalizability in other settings, and (f) the rater's personal preference (See Appendix E: Social Validation Questionnaire). The rater responses to social validity questionnaires are summarized in Table 7.

Ratings demonstrated favored responses for SGD in terms of effectiveness, appropriateness, sophistication, and developmental appropriateness. Seven out of eight raters rated that SGD was more effective and appropriate than PECS. Only one rater rated both modes as equally effective and appropriate. Five raters rated that SGD was more sophisticated and developmentally appropriate than PECS. As to personal preferences, two raters indicated personal preference for PECS but the others preferred SGD.

All of the raters characterized both modes as being fairly to very acceptable, well generalizable, and fairly to very easy to understand, with the exception of two raters which rated PECS as being "difficult" to understand. Possible explanations for these results will be discussed in the Discussion section regarding Research Question #3.

Table 7. Frequencies from the ratings of social validity measures.

Questions	PECS	SGD	EQUAL
More effective		7	1
More age-appropriate		7	1
More sophisticated		5	3
More developmentally appropriate		5	2
More comfortable		4	4
More advanced		4	4
Personal preference	2	6	

PECS

Acceptable	Not at all	Fairly	Acceptable	Very
		2	4	2
Generalize in other settings	Not at all	Not so well	Well	Very Well
		3	4	1
Understandability	Difficult	Fairly Easy	Easy	Very Easy
	2	4	2	

SGD

Acceptable	Not at all	Fairly	Acceptable	Very
			3	5
Generalize in other settings	Not at all	Not so well	Well	Very Well
		1	5	2
Understandability	Difficult	Fairly Easy	Easy	Very Easy
		1	3	4

CHAPTER FOUR

DISCUSSION

This chapter discusses the findings of the study, which examined the effects of PECS training versus SGD training on three children with autism and developmental disabilities acquisition of requesting skills. The investigator addressed the following research questions to compare the effects of PECS and SGD training: 1) are there differences in acquisition rates for request taught using PECS and SGD; 2) do children show a preference for one mode over the other, and 3) are there be differences in perceived social validity of PECS versus SGD? Results on individual differences and research questions are evaluated. Discussions on limitations of the study, suggestions for future research, and implication are included.

DISCUSSION OF RESULTS

The results of the present study indicate relatively equal rates of acquisition with PECS and SGD. Baseline data suggest that although the three participants did not speak, they had acquired prelinguistic acts (e.g. reaching, leading, tantrums, and whining). These acts appeared to function as the children's way of gaining access to preferred items. With acquisition training, all three participants began to use both PECS and SGD after a few training sessions. As they acquired use of

PECS and SGD, prelinguistic acts decreased to the point where they rarely occurred. This suggests that the newly acquired communicative forms (PECS and SGD) were functionally equivalent to the children's prelinguistic acts and that the new forms had become the more probable members of the [requesting] response class hierarchy.

Because all three participants showed comparable acquisition with PECS and SGD during training, it would appear that the prompt and the time delay instructional procedures were equally effective in teaching PECS and SGD. There did not appear to be any major differences in how well or quickly the children learned to use PECS and SGD for requesting in either Snack or Play. This study is the first direct comparison for PECS versus SGD. Given that PECS is an exchange-based system, whereas the use of SGD involves selection-based responding, differences in acquisition might have been expected. Previous research has indicated that each of these two modes of communication can be successfully taught to people with developmental disabilities (Charlop-Christy, 2002; Schepis, Reid, Berhmann, & Sutoon, 1998; Schwartz, Garfinkle, & Bauer, 1998; Sigafoos, Didden, & O'Reilly, 2003). The present study extends this literature by directly comparing PECS to SGD. One important extension was the final device choice assessment phase. In this phase, the children were given a choice between using PECS or SGD prior to each session. Choice-making is considered as one of the pivotal responses that children with autism should engage in to learn more efficiently (Koegel et al., 1999). Enabling children to choose their communication

device may help to promote self-determination in communication intervention (Baer, 1998; Brown, Gothelf, Guess, & Lehr, 1998). In this study, the children preferred one mode over the other when given the choice. SGD was perceived to be more socially valid according to the raters of the study.

Individual Results

Although all of the participants acquired requesting skills using both PECS and SGD in a short period of time, the individual variability was observed and should be interpreted considering several circumstances that emerged during the course of the study. Participant 1's data was limited because she had to move to another state and had a limited number of acquisition training and choice sessions. So Participant 1 could not reach mastery using PECS and SGD during play training sessions due to lack of time permitted.

Another possible explanation of the failure to reach master during Play, even though she was able to reach mastery during Snack in the limited amount of time, relates to the idea that the participant was repeatedly given the opportunity to play with the toy but since the toy was repeatedly taken away she might not have been able to maintain interest. It is suggested that learners often fail to make progress during training simply because the preferred items used in training may have lost their attractiveness to the kids (Duker, Didden & Sigafoos, 2004). It is also recognized that young children with disabilities, especially autism, often

engage in less toy play than their typically developing peers (DiCarlo & Reid, 2004).

Participant 2 did not show any significant improvement during play activity. Anecdotal data suggest that inappropriate behaviors, such as, tantrums, screaming, and whining interfered with training. Participant 2 seemed to be frustrated with the withdrawal of her preferred play item so that the trainer could make multiple opportunities to request. Participant 2's overall increase in independent responses during snack sessions was observed after the removal of play session. In other instances, Participant 2 was distracted by the presence of mom at home during the training. There were several other variables to consider that emerged during the course of the study for Participant 2. The sessions started during the summer break and the school started in the midst of the study. Participant 2 responded differently depending on the time of the day. The trainer tried meeting her at different times of the day to try to maintain her interest. It was important for the trainer to remain flexible in order to maintain the child's interest and consider the motivational variables, such as, sleeping condition, hunger, illness, to continue the sessions without interruption in her natural environment, at home (Duker, Didden, & Sigafoos, 2004).

Participant 3 was the youngest in the group, but demonstrated the highest acquisition rate (highest average percentage corrects requiring the fewest number of trials). One possible explanation pertains to the individual characteristics (e.g., level of language development, level of intellectual functioning, degree of

developmental delay) and how they affect the responsiveness of the child to the intervention (Ganz & Simpson, 2004; Peterson et al., 1995; Romski, Sevcik, & Adamson, 1997). He seemed to demonstrate more competence in language comprehension skills and his disability may not have been as severe as other participants. Another possible explanation to the more rapid acquisition of Participant 3 is that he had less behavioral issues than the other two participants.

Despite the individual differences, the results of this study suggest that all children could learn to request appropriately instead of showing inappropriate behaviors (i.e., tantrum, crying) or other behavioral indication (i.e., reaching, leading).

Research Question #1

The first research question was whether or not a difference in the acquisition of requesting responses existed between the two modes of AAC systems, PECS and SGD. An analysis of descriptive data (number of trials to mastery and average percentage correct) displayed mixed results with respect to this question across all of the participants. More specifically, Participants 1 and 3 learned more quickly with SGD training, resulting in a higher average percentage correct, whereas Participant 2 learned more quickly during PECS training resulting in a higher average percentage correct. However, the comparable acquisition rates between PECS and SGD training may have been due to the relatively rapid acquisition displayed by each student in both modes (Newman et al., 2002). It was

hard to draw a conclusion that one mode produced better results with these three children because one child did better using one mode and the other two children performed better with the other mode. So these results need to be replicated with more children with similar characteristics in order to draw a more accurate conclusion.

Research Question #2

The second research question addressed in this study was whether or not the participants showed preference one mode over the other. When the choice assessment probe data are examined, mixed results are evident. Participants 1 and 2 exhibited clear preferences during the choice assessment probes. Even though Participant 3 had more sessions to determine his preference for one mode over the other with the repeated exposure to the both devices, he did not show clear preferences during play sessions, choosing both devices a relatively equal number of times (54% v. 46%).

Preference data for Participants 1 and 2 reflected their performance during training. That is, both participants chose the device with better acquisition during training, which was similar to the results of Tincani (2002) who compared PECS and sign language. Participant 3 exhibited preference, choosing PECS more often during snack. However, his acquisition was better using SGD during training than PECS.

It is hard to draw a thorough conclusion on the relationship between the individual preference and acquisition due to the lack of the participant assessment information and prolonged observation on the generalized use of preferred modes in other settings.

Research Question #3

The third research question in this study regarded whether or not a difference existed between the rater's impressions on the effectiveness and appropriateness of both PECS and SGD training on social validity measures obtained from the seven undergraduate students and one graduate student. The social validity measures taken in the study suggest that use of SGD appeared to be favored and rated as more effective, appropriate, and personally preferred by the raters. The raters characterized both modes as being acceptable, work in other settings, and easy to understand, except two raters responded as being "difficult" to understand PECS. This was because the raters rated from the video tape, which made it hard to see the picture from the video. On the other hand, SGD had voice output so they could listen clearly to what the participants wanted to have.

Because the raters were not asked the reasons for their responses, it was difficult to ascertain why they thought one mode was better than the other in the questionnaires. To better assess the social validity in this study, there needed to be more questions asking why they answered that way. Also, the social validity measure could have been obtained from the parents or teachers to have their

perceptions and preferences on the use of each mode of AAC for these children using in-depth questionnaire or interviews.

Anecdotal Results

The level of prompts, the behaviors, and the vocalizations were recorded during the study by the investigator. I found the results to be interesting and relevant; therefore, I included them in the paper even though they were not the focus of my research questions.

With the application of a least-to-most prompt system, the participants were able to learn how to request using AAC devices. The level of prompts was faded gradually in teaching PECS and SGD in order to request preferred items (Dyches, 1998; Reichle & Johnston, 2001; Sigafoos, Didden, & O'Reilly, 2003). Individual differences in the analysis of the level of prompts were noted. Participant 1 and Participant 2 needed more physical prompt than verbal prompt, whereas Participant 3 needed more verbal prompt. The results of this study also indicated that teaching children with autism how to communicate using PECS and SGD with the combination of least-to-most prompt systems and time delay is an effective approach for promoting the independent use of PECS and SGD at the children's home setting.

Anecdotal recordings on problem behavior and verbalization (or vocalization) were reported. Participant 1 and Participant 2 exhibited behavioral indication of reaching, and leading the hand; problem behaviors, such as tantrums,

banging the table, crying, and screaming; and stereotypical behaviors, such as flapping hands, gazing at the fingers, and closing eyes during the baseline portion of the study. Participant 3 did not exhibit particular problem behaviors of concern but instead just had mild self-injurious behavior (e.g., thumb biting) and stereotypic behavior (e.g., lining up the toys and objects).

Problem behaviors (i.e., tantrum, screaming, whining, and thumb biting) was reduced for all participants, especially for Participant 1 and Participant 2 in both conditions of the alternating treatments as compared to levels displayed during the baseline (Keen, Sigafoos, Woodyatt, 2001). Anecdotal data on the collateral effects are consistent with the functional communication training (Durand, 1999), which has shown that existing prelinguistic and problematic or inappropriate forms of communication behavior (reaching, leading, tantrum, etc.) were decreased (Sigafoos et al., 2004). Children with a high frequency of self-stimulation, disruptive and problematic behavior, and/or self-injury may require in-depth functional assessment and advanced intervention and systematic evaluation of treatment efficacy for such behaviors (Jensen, & Sinclair, 2002).

From the anecdotal data on vocalization, no child showed a notable increase in the use of vocalization (or speech) as a result of this intervention. Participant 3 was the only one who used sign language (“more”) and had some vocalization (“yeah”, “uh-oh”, “ba” for “bye-bye”). Anecdotal data indicated that the use of sign decreased after he was prompted to use PECS/SGD during the acquisition training and when he began to independently use PECS/SGD to request preferred items.

This result was contrasted to the report by Dicarlo & Benajee (2000). In the Dicarlo & Benajee (2000) study, results indicated that use of the VOCA did not decrease the amount of gestures or sign language. This was because sign response was not reinforced, but only PECS or SGD use was reinforced. However, the use of vocalization (verbalization) did not decrease, which was supported by the previous study (Charlop-Christy et al., 2002). There are mixed results of increased speech development (Brady, 2002; Iacono, Mirenda, & Beukelman, 1993; Sigafoos, Didden, & O'Reilly, 2003).

LIMITATIONS

Several limitations were inherent in the research methods and outcomes of this study. One limitation was the short duration of the study therefore creating the lack of maintenance and generalization phases. Without these phases, it is difficult to assess whether or not the children still would use their newly learned skills with different people or different setting. Even though choice assessment probe proved the acquisition of requesting skills using AAC devices immediately after the training, it was not possible to collect follow-up data due to the short period of time. Longer periods with generalization, maintenance, and follow-up phases need to be conducted to determine the long-term effectiveness of the treatment.

Another limitation occurred because autism is a very low incidence disorder and locating subjects that met the criteria was difficult. Therefore, this study is limited in its adaptability to a larger population because the number of children

with autism participating in this study was relatively small and may not have been representative of all children with autism. Also, because each child with autism is unique and functions very differently in different settings, future studies might assess the child's characteristics using pre-treatment measures from various sources to compare and investigate the relationship between the child characteristics and their acquisition and preferences. This information will be useful to ascertain which sub-populations of children with autism will most benefit from this intervention.

There were two limitations in data collection of the collateral behaviors. First, problem behaviors should have been measured with more accurate measures (well defined and measurable) and using systematic recording procedures (recording systems such as, event recording, interval recording or time sampling dependent upon the behaviors interested in, c.f., Alberto & Troutman, 1999). In this study, the investigator recorded the event of problem behaviors that interrupted the training. The investigator did not have a list of operationally-defined behaviors to be observed before-hand. Pre-assessment information including this behavior list might have been helpful when collecting these data. Collateral gains in speech development and the decrease in problem behavior could have been collected from the videotape of all sessions. Data collection from the videotape would have enabled more than one observer independently to record the occurrence of the behaviors. Functional outcomes for participants in this study within a limited context need to be considered.

SUGGESTIONS FOR FUTURE RESEARCH

Future research should seek to improve upon this preliminary study and explore numerous intriguing issues that have arisen in the discussion of the results. The viability of training parents to implement the intervention with their children might be the next step with regards to the present study. Parent training has frequently been a focus of the literature regarding children with autism (Koegel, & Koegel, 1995; Laski, Charlop, & Schreibman, 1988). Future studies might assess the generalization of treatment investigating the effectiveness of teaching parents of children with autism to utilize the instructional procedures (time delay and prompt fading techniques) to teach to the use of AAC devices at the home setting. Previous study (Sigafoos, O'Reilly, Seely, Weru, Son, Green, & Lancioni, 2004) has demonstrated successful acquisition of AAC skills and transferring AAC use from clinic to the home setting with the parent via email consultation. Effective techniques are needed to teach parents and classroom teachers or community based providers to successfully embed instructional procedures within the context of naturally occurring interactions, including very distractive situations. Future studies might assess the generalization of treatment effects across school and community settings for longer periods of time. Further support from the school would be vital when AAC consideration is indicated in each child's Individual Education Program (IEP).

Future studies should also investigate functional outcomes other than requesting to expand our knowledge of the efficacy of different settings on the

other communicative function (e.g., rejecting, or commenting) of children with autism. The children were taught to request preferred snack or toys in this study. However, the children were showing problem behaviors and interrupted the session when they did not want to continue. For example, Participant 1 put her hands on her ears and ran around when the toy piano was repeatedly given. Even though the toy piano was selected as "preferred toy item" for Participant 1, repeated exposure to this item led to satiation (Sigafoos, Drasgow, O'Reilly, Green, & Tait, 2004). There, these behaviors could be considered as "communicative reject" with two possible purposes: escape and avoidance (Sigafoos, Drasgow, O'Reilly, Green, & Tait, 2004). In that case, the trainer had to manage those problem behavior with different strategies, such as verbal prompt (e.g., "come back") or gesture (e.g., "pointing to the table"). Future research can incorporate the strategy to teach communicative reject (c.f., Sigafoos, Drasgow, O'Reilly, Green, & Tait, 2004) as well as communicative request for children with autism and developmental disabilities.

Future studies should examine child's characteristics that may be related to performance in each modality to find out potential benefits of using a child's preferred mode of communication and specific characteristics that may be associated with the performance (Romski, Sevcik, & Adamson, 1997). Future research could develop pre-assessment procedures that provide information about differences in individual child's characteristics and how they are attributed to their respective performance. Caregiver preferences in each setting and caregiver

characteristics should be examined (Sevcik, Romski, & Anderson, 2004). Social validity questionnaires with in-depth questions from potential user of devices, especially from the parents and teachers, might be helpful to consider the caregiver information.

IMPLICATIONS FOR RESEARCH AND PRACTICE

For this study, the communicative requesting acts of the children with autism and developmental disabilities were trained in their natural, home setting. The results may therefore have implications for practice with other children with autism with their parents at their home setting.

An important implication for practice arising from this study is that not all children with autism benefit from one system of augmentative alternative communication. Rather, each child with autism needs to be individually considered for the appropriate type of device (Schepis, Reid, Behrmann, & Sutoon, 1998). The use of multiple modes of communication will increase the opportunities for children with autism to interact with a variety of individuals across a wide range of environments. Several studies suggested the benefits of using multiple modes of communication. Blischak & Lloyd (1996) advised the use of multiple modes of communication to promote success in a variety of situations and settings. Iacono & Duncum (1995) stated advantages for the combined use of unaided and aided AAC. Sigafoos & Drasgow (2001) also demonstrated rapid acquisition and conditional use of aided and unaided AAC. The collateral effect on speech may be

an important variable to consider when evaluating outcomes in multimodal AAC interventions. Therefore, the findings of this study have implications for the use of multimode AAC devices and incorporating individual preferences to enhance "self-determination" of individuals with autism (Soto et al., 1993).

Empirically validated instructional procedures related to communication intervention to increase communicative requesting ability of three children with autism and/or developmental disabilities. With the systematic application of time delay, prompting and reinforcement, children with autism and developmental disabilities were able to use two modes of AAC systems to communicate (Dyches, 1998).

CONCLUSIONS

The purpose of this study was to compare the effects of two different modes of AAC training on children's requesting abilities. The primary findings of this study were that: (a) differences in the performance were found between the participants within each mode and between the modes for each participant; (b) participants appeared to prefer one mode over the other, based on correct usage during the intervention and the number of times (shown as a percentage) a device was chosen during the choice assessment probe; and (c) social validity measure results indicated favorable ratings on using SGD

Results of the study suggest that use of PECS and SGD within the home setting was effective in increasing communicative requests of three nonverbal

young children with autism and developmental disabilities. The study provided the empirical evidence to support previous studies in that all children learned PECS/SGD in a relatively short period of time (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2001; Frost & Bondy, 1994; Schwartz et al., 1998; Sigafoos, Didden, & O'Reilly; Sigafoos & Drasgow, 2001). Also, this study added experimental data on the children's preference of one mode over the other and the decreases in maladaptive behaviors as noted in Charlop-Christy et al. (2001) study. This study expands the research conducted on the communication intervention using two modes of AAC devices in children with autism by comparing two modes of AAC and assessing children's preferences for one mode over the other. The results of this study confirm the results of previous studies which indicated that time delay and least-to-most prompt system (Wolery, Ault, & Doyle, 1992) are effective in teaching children with autism and developmental disabilities.

In conclusion, this study found that the use of the picture exchange communication system and the speech generating device was an effective support for nonverbal children with autism to request preferred items and also increased the number of independent communicative requesting responses for all three participants.

APPENDICES

Appendix A: Consent Form

The University of Texas at Austin
Institutional Review Board
Approved: 6-23-04
Expires: 6-23-05

IRB#
2004-03-0123

Informed Consent to Participate in Research

The University of Texas at Austin

You are being asked to consider allowing your child to participate in a research study. This form provides you with information about the study. Seung-Hyun Son, the Principal Investigator (the person in charge of this research) or his/her representative will also describe this study to you and answer all of your questions. Please read the information below and ask questions about anything you do not understand before deciding whether or not to take part. Participation of your child is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled. If you decide to allow your child to participate, you can also decide to withdraw your consent and discontinue your child's participation at any time without penalty or loss of benefits to which you are otherwise entitled.

Title of Research Study:

Comparing Two Modes of Augmentative and Alternative Communication (AAC) Intervention for Children with Autism.

You are invited to consider allowing your child to participate in a research study on teaching children with autism to use AAC. My name is Ms. Seung-Hyun Son.

Principal Investigator(s) (include faculty sponsor), UT affiliation, and Telephone Number(s):

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The University of Texas at Austin
Institutional Review Board
Approved: 6-23-04
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Funding source:

I am doing this research for my doctoral dissertation. This research is not receiving any outside funding.

What is the purpose of this study?

The purpose of this research is to compare how easily children learned to use two types of communication systems. One system is the picture exchange communication system (PECS) and the other system involved the use of electronic communication, known as speech generating devices (SGDs).

What will be done if you take part in this research study?

Your child will participate in approximately 20 communication training sessions. Each session will last about 10 minutes. Ten sessions will be devoted to teaching your child to use PECS and 10 sessions will be devoted to teaching your child to use a SGD. During the PECS training, the children will learn to use the PECS system to make requests for preferred objects. This involves giving a picture of the item to a trainer. In the SGD condition, the procedures are basically the same except that the child will be taught to use the SGD to make requests. To teach the requesting responses, the trainer will use standard special education procedures. Specifically, the trainer will offer a preferred item, such as a toy. The trainer will then say, "Let me know if you want this." And wait 10 seconds to allow the child to make the request. When the child makes a request, the trainer will give the child the toy. IF the child does not make a request within 10 seconds, then the trainer will assist the child to make the request by gently guiding the child to use the correct symbol. All of the sessions will be videotaped and the percentage of correct requests will be assessed from those videotapes. The videotapes will only be observed by the investigator and/or appropriately trained research associates from the University of Texas who will be involved in the research.

What are the possible discomforts and risks?

There are no known risks to your child if they participate in this research.

What are the possible benefits to you or to others?

The results of this research may provide information to help your child's teachers develop communication goals. The outcomes of this comparative study will provide information about which system your child seems to use better for making requests. It is anticipated that your child will learn to use both the PECS and the SGD as a result of participating in this study.

What are the cost associated with this study?

Participation in this study will not cost you anything.

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Will you receive compensation for your participation in this study?

Neither you nor your child will not receive any compensation for participating in this research.

What if you are injured because of the study?

This study does not involve any physical risk on the part of your child.

If you do not want to take part in this study, what other options are available to you?

Participation in this study is entirely voluntary. You are free to refuse to be in the study, and your refusal will not influence current or future relationships with The University of Texas at Austin or your school.

How can you withdraw from this research study and who should I call if I have questions?

If you wish to stop your participation in this research study for any reason, you should contact Seung-Hyun Son at (512) 478-7919. You are free to withdraw your consent and stop participation in this research study at any time without penalty or loss of benefits for which you may be entitled. Throughout the study, the researchers will notify you of new information that may become available and that might affect your decision to remain in the study.

In addition, if you have questions about your rights as a research participant, please contact Clarke A. Burnham, Ph.D., Chair, The University of Texas at Austin Institutional Review Board for the Protection of Human Subjects, 512/232-4383.

How will your privacy and the confidentiality of your research records be protected?

Authorized persons from The University of Texas at Austin and the Institutional Review Board have the legal right to review your research records and will protect the confidentiality of those records to the extent permitted by law. If the research project is sponsored then the sponsor also has the legal right to review your research records. Otherwise, your research records will not be released without your consent unless required by law or a court order.

To the extent that the result of this study will be used for my dissertation, your identity will not be disclosed. If the results of this research are published or presented at scientific meetings, your identity will not be disclosed. In both instances, pseudonyms will be used to protect your anonymity.

All of the sessions will be videotaped. The cassettes from these observations will be coded so that no personally identifying information is visible on them. The cassettes will be kept in the principal investigator's home. The videotapes will only be viewed for research purposes by the investigators and appropriately trained research associates from the University of Texas who are involved in the research.

Will the researchers benefit from your participation in this *study*?

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Yes. The information collected in this study will contribute to the completion of my doctoral dissertation.

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Signatures:

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

_____

Signature and printed name of person obtaining consent **Date**

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this Form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

_____

Printed Name of Your Child **Date**

_____

Please Print Your Name(s) **Date**

_____

Signature of Parent(s) or Legal Guardians **Date**

_____

Signature of Principal Investigator **Date**

Appendix B: Invitation Letter to Participate

Dear parents,

I am a doctoral student in the Special Education Department of The University of Texas at Austin.
I am conducting my dissertation research in communication training, using augmentative and alternative communication for children with autism/developmental disabilities.
I am looking for children who:

1. Are preschoolers or early elementary (ages 3 to 8)
2. Are diagnosed with autism/developmental disabilities
3. Are nonverbal or have limited communication ability (don't speak to communicate)

I will provide intervention at the child's home, and it will take about 6 weeks or more for each child. If you would be interested please feel free to contact me.
I will then provide you with more detailed information about my study.

I appreciate all your kind consideration and help.

Sincerely,

Seung Hyun Son

Appendix C: Data Collection Sheet

Student:	Date/Session:
	Phase: Baseline or Treatment
Observer:	Condition: PECS or SGD

Trial	Object	Vocalization /Speech	Response				
			I	V+M	P	No	Behavior
1							
2							
3							
4							
1							
2							
3							
4							
1							
2							
3							
4							
1							
2							
3							
4							

Note: I: Independent; V: Verbally prompted; M: Gesture modeled; P: Physically prompted; No: No response

Comments:

Appendix D: Treatment Integrity Checklist

Observer:	Condition: PECS or SGD

Student:	Session:
	Phase: Baseline or Treatment

1. The teacher places item in front of student	Y/ N
2. If the student reaches for toys, or snack item, he or she is given access to that item to play for 30 seconds, or if it is a snack item, access the item until it is finished.	Y/ N/ NA
3. The teacher places picture card (speech generating device) in front of student	Y/ N/ NA
4. (PECS) If the student does not place picture symbol in teacher's hand within 10 seconds, the teacher prompts (verbal, gesture model, physical) student to place picture symbol in teacher's hand	Y/ N/ NA
5. (SGD) If the student does not press the switch of SGD within 10 seconds, the teacher prompts (verbal, gesture model, physical) student to press the switch to request.	Y/ N/ NA
6. When student performs correct response within 10 seconds, the teacher provides positive feedback and gives the student access to the item.	Y/ N/ NA

Appendix E: Social Validation Questionnaire

This survey is designed to measure social validity as it relates to graduate students' perceptions in the college of education on *two* types of communication modes (*Picture Exchange Communication System and Speech Generating Devices).* This is not a test. No grade will be given as a result of this questionnaire.

Please complete the demographics section, read each statement/question carefully. You will find a list of questions related to the social validity on a variety of communication modes for students with Autism. From the available choices, circle the one that best fits your reaction to each question. Thank you for your cooperation!

I. Demographics of Graduate Student

Student's Name: _____ Program of Study_____

Circle one Male Female

Race/Ethnicity:

Asian Hispanic African American European Bi-racial

Educational Level:

Masters 1st 2nd 3rd or **PhD** 1st 2nd 3rd year

II. Demographics of student in Video

Name of Student in video: _____
Date of Videotape: _____

III. Social Validity and Perceptions

The Communication Modes used by this student include (1) PECS, which involves the use of flash cards with symbols of various objects, and (2) SGD, which involves the use of voice-output communication aid with symbols of various objects.

1. In your opinion, which mode of communication was more effective?

PECS SGD EQUAL

2. In your opinion, which mode of communication was more age-appropriate?

PECS SGD EQUAL

3. In your opinion, which mode of communication was more sophisticated?

PECS SGD EQUAL

4. In your opinion, which mode of communication was more developmentally appropriate?

PECS SGD EQUAL

5. Which mode of communication would you be more comfortable with when interacting with the person?

PECS SGD EQUAL

6. Which one do you think is more advanced?

PECS SGD EQUAL

7. If you had to communicate with one of these methods, which one would you want to use?

PECS SGD EQUAL

8. How acceptable was PECS mode of communication?

NOT acceptable Fairly acceptable Acceptable Very acceptable

9. How acceptable was SGD mode of communication?

NOT acceptable Fairly acceptable Acceptable Very acceptable

10. How well do you think these PECSwould work in other settings, such as ordering in a restaurant?

Not at all Not so well WELL Very WELL

11. How well do you think SGD would work in other settings, such as ordering in a restaurant?

Not at all Not so well WELL Very WELL

12. How easy was it to figure out what the person wanted when they were using PECS?

Difficult Fairly EASY EASY Very EASY

13. How easy was it to figure out what the person wanted when they were using SGD?

Difficult Fairly EASY EASY Very EASY

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