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GRADUATE COLLEGE

**THE EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON
COMMUNICATIVE INTERACTIONS AND DISRUPTIVE BEHAVIOR
FOR INDIVIDUALS WITH AUTISM**

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

In partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

**SUE E. HOPPE
Norman, Oklahoma
2003**

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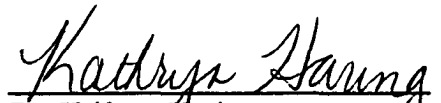
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THE EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON
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A Dissertation APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

BY



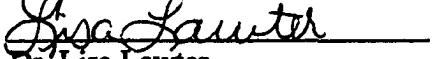
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Abstract

The present study was designed to examine the effects of computer-assisted instruction using a naturalistic language paradigm intervention (independent variable) for five adult individuals with autism. Four of the individuals reside in a private residential care facility and one individual is currently in high school. The computer-assisted instruction procedure employed in this study produced an increase in the participants' communicative interactions and a decrease in the participants' disruptive behaviors. However, each participant's data indicated a great deal of variance from session to session. The results of the present study suggest computers may be a valuable tool in teaching communication and interaction skills for individuals with autism.

Chapter 1

Introduction

Augmentative and alternative communication (AAC) and assistive technology (including computers) have been defined as a means to support communication and learning in individuals with autism and other communication disabilities. The potential of using AAC and computer technology has been noted in several studies to enhance the learning of communication and language (Cafiero, 2001; Schepis, Reid, Behrmann, & Sutton, 1998; Mechline, Gast, & Langone, 2002; Miranda, Wilk, & Carson, 2000; Hitchcock & Noonan, 2000; Bernard-Opitz, Sriram, & Nakhoda-Sapman, 2001; Ronski & Sevcik, 2001; Hagiwara & Myles, 1999; Kuttler & Myles, 1998). However, little research has been completed examining the effect of computer-assisted instruction based on a naturalistic teaching paradigm (Koegel, O'Dell, & Koegel, 1987) intervention strategy to enhance communication and learning in individuals with autism (Schepis, Reid, Behrmann, & Sutton, 1998; Ronski & Sevcik, 2001; and Cafiero, 2001).

According to two professional reviews in the literature (Schlosser & Blischak, 2001; Oxley & Norris, 2000), incorporating technology in teaching communication skills to individuals with autism is a warranted research need. The use of computers in instruction may provide consistency, motivation, reduced input and output demands, and enable more individualized instruction. The computer may also represent a controlled environment with consistent structure

and immediate feedback, and a computer with speech output can provide a “voice” to aid in instruction.

Computer assisted instruction has been used in conjunction with other treatment intervention areas in autism, adding promise to the use of technology in educating individuals with autism. A study completed by Hagiwara and Myles (1999) examined the use of a multimedia social story program with three students with autism. The use of social stories as an intervention for children with autism have some support (Gray, 1994; Kuttler & Myles, 1998) and involves using pictures to allow individuals to practice and learn social behavior through a social story. The study developed a system to learn social stories on a computer, and visual stimuli and sound were made possible by the computer system. Three elementary-age (7 years 11 months, 9 years 11 months, and 7 years 3 months) students diagnosed with autism were involved in the study. A multiple baseline design across settings was used. Each participant’s data were collected in three settings for one target behavior. The target behavior for two of the participants was hand washing. On- task behavior was the other participant’s target behavior.

The study involved several procedures to develop the social stories and incorporate them into a multimedia context. Procedures included training paraprofessionals and teachers in social story training, specifying target behaviors through a functional analysis, developing the multimedia social story programs, and implementing the multimedia story intervention. After the intervention, Participant I demonstrated improvements in hand washing across all three settings.

Participant II demonstrated improvements in two settings, and participant III demonstrated partial improvement in on-task behaviors in two settings. Although there was no consistent rate of effect across participants, all three participants increased in skill areas. The authors offer several possible causes for the variability of results: duration of the intervention; individual differences in participants; nature of the target behaviors; educational environment consistency; and enthusiasm for watching the multimedia story program. Because this study was the first of its kind, the authors argue that it could not be compared to previous research and future research in this area is warranted.

Romski and Sevcik (2001) conducted a longitudinal study (2 years) about augmented language development of youth with severe mental retardation using the system for augmenting language (SAL). There are five integrated components of SAL (Romski & Sevcik, 1996): (1) Electric computer-based speech-output communication devices are available for use in natural environments; (2) Appropriate, initially limited, symbol vocabularies with the printed English word above each symbol are placed on the devices; (3) Participants are encouraged, though not required, to use the device during loosely structured naturalistic communicative exchanges, using naturalistic teaching strategies; (4) Communicative partners are taught to use the device to augment their speech input to the participants with symbol input; (5) Ongoing resource and feedback mechanisms are provided to support the participants and their partners in their communication efforts.

The participants in the study were 13 males with moderate to severe mental retardation, a mean age of 12.3 months, and a mean mental age of 3.6 years. Because the participants had no functional expressive communication system, they were required to learn language through instruction in an alternative modality. The instructional approach used visual-graphic symbols with speech-output communication devices. Two primary measures were used for assessing language and communication. First, Communicative Use Probes (CUPs) provided data about the participant's use of SAL during daily communicative exchanges. Systematic nonverbal and verbal communicative samples were collected by a non participant observer. Information was provided about with whom, how, and what functions the communication served, and how successful the communications were. Using a language-transcript software program, further analysis of both the participants and their partners' communications was conducted. Second, Vocabulary Assessment Measures (VAMs) provided data about the participants' comprehension and production of symbols outside the setting of use. The VAMs consisted of monthly measures of the participants' vocabulary learning. A series of ten structured tasks were administered by the investigators.

The use of SAL was immersed in all environments, and the authors' findings suggest that youth with moderate and severe mental retardation can learn to communicate using systems for augmenting language. All of the participants acquired and used symbols during communicative exchanges in three areas of language skill development. All 13 participants used the SAL to communicate

along with natural vocal and gestural modes. Vocabulary was comprehended and used appropriately, and language-related outcomes surpassed the acquisition of a single symbol vocabulary in seven participants. Fifty-four percent of the participants had increases of intelligible spoken words. The authors also conclude that findings about language learning through augmented means can provide a way to view and increase a child's overall development.

Through a government initiative, students with autism in British Columbia schools received technology supports and provided data for a retrospective, exploratory study (Mirenda, Wilk, & Carson, 2000). The authors reviewed files of students with autism (217) who participated in this initiative over a five-year period. Technology was used for writing, expressive communication, and social interaction. Sixty percent of the students were assigned scores suggesting successful or very successful use, and their success did not appear to be related to cognitive ability. The majority of the students received technology for educational reasons but a smaller number received voice output communication aids.

The method to conduct the study consisted of an analysis of the database. First, students in the database that were diagnosed with autism were identified. A total of 217 students were identified and 170 met criteria of diagnosis according to DSM-IV and demographic information with regard to the student's age, gender, school, cognitive, and communication abilities. Annual follow-up reports about how the technology was used by the student during the school year were also used in the investigation. Three areas were targeted for analysis: cognitive abilities,

communication abilities, and use of computer technology such as a voice-output communication aid (VOCA). The information was compiled to answer specific questions using descriptive statistics. One hundred and twenty-six students received 131 computers to support educational goals over the 5-year period of the project. Sixty-three VOCAS were used with 58 students who had very limited speech. A method called Success Scores was used to determine whether the technology was effective. Anecdotal comments by school staff using a six-level scoring system were used to provide information and to analyze the success stories. The following scoring system was used: 0-The technology was not used at all; 1-little or no success with the technology; 2-limited success with the technology; 3-some success; 4-technology was successful; and 5-very successful.

Several interesting findings resulted from this study. Sixty percent of the scores fell into the successful-very successful range and were not related to cognitive ability. Students who received technology at a young age appeared to experience more success than those who received technology as adolescents. The majority of students received technology for educational reasons. The study suggests that both VOCA and computer software were used effectively to support the educational participation, especially in the areas of writing, expressive communication, and social interaction.

One purpose of this paper is to summarize research concerning communication and autism in order to construct a conceptual framework for the present study. The present study was designed to investigate the effects of an

intervention using computer-assisted instruction based upon the conceptual framework of a naturalistic teaching paradigm (Koegel, et. al, 1987). The natural language teaching paradigm is a procedure that focuses on the importance of incorporating motivational variables into the teaching context. The authors propose that the use of this paradigm result in accelerated, functional, and generalized language learning. Pivotal behaviors (e.g. motivation, joint attention, self-initiation of social interactions, response to multiple cues) are considered to be central to wide areas of functioning. The paradigm proposes that a change in a pivotal behavior will result in positive effects across many other behaviors and lead to generalized improvements (Koegel, Koegel, & Carter, 1999; Koegel, Koegel, & McNerney, 2001). The main rationale behind the natural language teaching paradigm contends that addressing pivotal behaviors can allow a child to make widespread gains whereas individualized treatments for each behavior would be lengthy, impractical, and unrealistic. Motivation is considered a very important and influential pivotal behavior in naturalistic teaching procedures as well as responding to multiple cues (Koegel et al, 2001).

The objectives for the present study were to increase communicative interactions and reduce disruptive behaviors for five adults with autism. The present study includes a review of the literature concerning issues related to the disability of autism beginning with *Aspects of Autism*, including defining autism. Second, *Methodologies in Treatment* including behavioral and interactional models, natural language paradigms, and assistive technology are reviewed.

Several current research studies in the areas of computer-assisted instruction, visual/graphic instruction, and the role of communication partners will be discussed. Following the literature review, Chapter III discusses the methodology and procedures for the present study. Chapter IV shows the results of the present study, and Chapter V presents a summary and discussion.

Purpose of the Study

The present study was designed to examine the effects of computer-assisted instruction using a naturalistic language paradigm intervention (independent variable) for five adult individuals with autism. Four of the individuals reside in a private residential care facility and one individual is currently in high school. The areas of learning the intervention targeted were responding appropriately to communicative interactions (nonverbal and verbal) and decreasing disruptive behavior. For the purposes of this study, communicative interactions are defined as responding to an interaction or initiating an interaction with a communication partner in a natural manner. Communicative interactions may include choice-making, responding to a question, or initiating interaction. The responding may be with appropriate gestures, pointing to a picture, or answering questions using yes and no switches or verbal speech. The focus of the communicative interaction is the process of participating in a reciprocal interactional manner with the communication partner during interactive sessions. Disruptive behavior is defined as any behavior that severely interferes with instruction (screaming, inappropriate self-stimulation, out of seat, grabbing

materials, etc.). Each participant used the mode of communication of his or her choice. The communication partner asked various questions using a yes/no question format to simplify responding and used simple directive statements and requests to encourage interaction. The dependent variables are communicative interactions (nonverbal and verbal) without physical prompts and disruptive behavior.

The questions addressed in this study are,

1. **Would an intervention using computer-assisted instruction and a naturalistic language paradigm increase the rate of communicative interactions (nonverbal and verbal) per minute during interactive sessions over time?**
2. **Would an intervention using computer-assisted instruction and a naturalistic language paradigm decrease the rate per minute of disruptive behaviors during interactive sessions over time?**

Significance of the Problem

Much of the research in learning communication and social skills involve learning concepts in natural environments. The 1997 amendments to the Individuals with Disabilities Education Act (IDEA, 1997) encourage opportunities for children with disabilities to participate in general education settings and in the general education curriculum so they can be educated in a more natural environment. The Annual Report to Congress on the Implementation of IDEA (Digest of Education Statistics, 1999), however, indicates a low percentage of

participation in the general education curriculum for the categories of multiple disabilities and autism. The percentage of students 3 to 21 years old receiving educational services in regular classes for the multiple disabilities category was 9.6 and the autism category was 14.4. The counts are based on reports from the 50 states and District of Columbia only. However, the categories of multiple disabilities and autism have demonstrated an increase in placements in resource rooms and separate classes and relatively high decrease in placement in separate facilities. In contrast, there has been a general downward trend in the percentages of children with other types of disabilities who were educated in resource rooms and separate classes and an increase in general education placement. Deficits in communication and behavior may be prohibiting the placement of students with multiple disabilities and autism into regular classes although the literature reviewed indicated many auspicious strategies or techniques to increase communication and language in natural environments. Putting research into practice in public schools so those students with multiple disabilities and autism can participate in regular classes is an area that may need more investigating. Utilizing technology to enhance communication and social behavior for individuals with autism is an important research need.

Examining the effect of an intervention to increase communicative interactions (verbal and nonverbal) and possibly decrease disruptive behaviors will contribute to research in the area of communication and language learning for individuals with autism. Multimedia computers have created options for

individuals with autism as well as a method of choice to facilitate communicative interactions. However, there is a need for more empirically based research specific to the effects of CAI interventions to increase communicative interactions for individuals with autism. Since autism is a very complex developmental disorder and involves using multiple approaches for instruction, a need exists to better understand the variability among individuals with autism and the role of technology in this process.

The greatest support for a need to conduct empirical research in this area comes from several thorough research reviews of autism treatment studies (Mirenda, 2001; Schlosser & Blischak, 2001; Ogletree & Oren, 2001; Moore & Taylor, 2000). The authors indicate that although augmentative and alternative systems have been used with individuals with autism in the last two decades, few studies of treatment efficacy have been performed. The use of computers combined with other effective methodologies to enhance communication skills instruction for individuals with autism warrants research because of several reasons. Since multimedia computers are commonly used in educational settings, computer-assisted instruction appears to be a practical way to teach communication skills and language to individuals with autism. The computer can provide immediate feedback, reinforcement, and sequential learning. The instruction can also be individualized within a classroom setting for various levels of instruction. Multimedia computers can provide multi-sensory instruction by stimulating the visual, auditory, and tactile senses. Synthetic speech has a

monotone sound and limited-affect quality and may be preferable to individuals with autism (Schlosser & Blischak, 2001). The use of computers can be used for recreational activities, and computers are age-appropriate for young and old alike.

The present study will add to the literature by reporting the effect of an intervention using computer-assisted instruction and a natural language paradigm conceptual framework for instruction in communication for five adult individuals with autism. This study also provides support for the provision of voice output communication aids (VOCAs).

Definition of Terms

Communicative Interactions: The term “communicative interactions” used in this study is defined as an individual’s ability to respond to a question, make a choice, or initiate communication either nonverbally or verbally in a reciprocal manner. Nonverbal communicative interactions are considered a response to a yes/no question, a request, or initiation indicated by pointing, pressing a switch, or using appropriate gesturing. Verbal communicative interactions are any understood verbalizations made in response by the participant to a question, request, or initiation during the interactive session. The communication partner will respond to any initiation of communicative interaction.

Disruptive Behavior: Any severe behavior that interferes with instruction (e.g. out of seat, screaming, inappropriate self-stimulatory behavior, grabbing/tearing materials, making noises, etc.).

Autism: A developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences. The term does not apply if a child's educational performance is adversely affected primarily because the child has a serious emotional disturbance (IDEA, 1997). Autism was added as a separate category of disability for Special Education in 1990 under P.L. 101-476.

Computer-Assisted Instruction (CAI): The use of a multimedia computer to provide immediate feedback (visual, auditory, and tactile) and structure for instructional lessons.

Speech-Output: The synthetic speech produced by the multimedia computer.

Write-Out Loud: A talking word processor software program. The speech output can be turned off or on, set to speak each letter of a word, the whole word, and the entire sentence or phrase. The speech output can be adjusted to various voice qualities and speed. Pictures can be added to the word processor software program to combine picture and text.

Tasks: The tasks used in the CAI sessions consisted of instruction based on the natural language paradigm concept. A vocabulary notebook was used during instructional tasks in the baseline condition. The notebook contained printed digital pictures of familiar places the individual has visited, meaningful experiences

in which the individual has participated, or any other pictures of objects that are meaningful and relevant to the individual. The individual was asked to choose pictures from the notebook to stimulate discussion for the baseline session. The experimenter (communicative partner) asked the individual yes/no questions and/or requested the individual to respond (e.g. Show me the...). The participants had access to a graphic symbol yes/no switch (with speech output), used appropriate gestures, or used their voice to respond. The instructional time varied between participants. Using a system of least prompts, verbal, model, and physical prompts were used as needed for instruction, but only independent choices or responses were counted as a communicative interaction. The sessions were video taped, and the tapes were used to observe and record the participant's communicative interactions and disruptive behavior. The number of communicative interactions and number of disruptive behaviors were counted and divided by the length of each session (difference between start and stop time) to yield a rate (frequency) of occurrence per minute. Natural reinforcement and verbal praise was used to reward any attempts as well as correct responses. During the intervention phase, the pictures of discussion was inserted into the word processor and words and phrases were typed into the talking word processor. Story pictures were printed and given to the participant at the end of the session.

Natural Language Paradigm: A training methodology (Koegel, et. al, 1987) that focuses on changing pivotal behaviors in children with autism (behaviors that affect several areas of functioning). Motivation and responsiveness to multiple cues are

the pivotal behaviors targeted. The question, instruction, or opportunity to respond should be: (1) clear, uninterrupted, and appropriate to the task; (2) interspersed with maintenance tasks; (3) chosen by the individual; and (4) include multiple components.

Chapter II

Literature Review

Aspects of autism

Defining Autism

Leo Kanner first characterized autism in 1943. Until this time, the disorder had not been recognized clinically. Kanner described 11 children in a psychiatric unit by their social withdrawal, difficulty in coping with change, and abnormal speech (Kanner, 1944). He felt the cause of this disorder was due to a cold and uncaring mother, but this theory has been discounted. Kanner described the symptoms of the disorder as abnormal development of social reciprocity, abnormal development of language, and a desire for sameness. The term sameness refers to an individual's inability to tolerate change and their preference to do things in the same way.

Hans Asperger also submitted a thesis for publication in 1943 describing very much the same disorder as Kanner except the individuals exhibited verbal speech. Not much was known about this disorder until 1991 when Asperger's original paper was translated from German into English and Asperger's syndrome was added to the DSM-IV (APA, 1994). The main difference between the disorders appears to be the level of intelligence of the individual and the ability in verbal communication (Wing, 1996). Autistic disorder, sometimes referred to as Kanner's autism, is usually accepted as the more severe form of autism.

Asperger's syndrome has been associated with improvement as the individual increases in age, more social approaches, and verbal rather than object-oriented routines (Eisenmajer, Prior, Leekam, Wing, Gould, Welham, & Ong, 1996). Great strides have been made in understanding the characteristics and diagnosis of autism, yet researchers are still searching for ways to make a more accurate diagnosis (Ethers, Gillberg, & Wing, 1999; Eisenmajer et. al, 1996; Wing, 1996; Waterhouse, Morris, Allen, Dunn, Fein, Feinstein, Ropin, & Wing, 1996).

Autism is often referred to as a spectrum disorder because the level of impairment varies greatly between individuals (Wing & Gould, 1979; Wing, 1996). The main commonality among the disorder, however, appears to be difficulty in social interaction. Researchers are suggesting an autism continuum rather than a definite boundary between classical autism (Kanner's type), Asperger syndrome, and autistic-like behavior ranging from high functioning autism (normal or above intelligence) to low functioning autism (mental retardation) (Waterhouse et al, 1996). Although individuals with autism may behave very differently from one another, the diagnostic criteria for this disability consists of a certain set of behaviors observed over time. The central impairment in autism, however, seems to be a lack of ability to connect with others and an inability to learn from natural interactive processes (Wing & Gould, 1979; Wing, 1996; Waterhouse, et al, 1996).

In 1979, Wing and Gould conducted an epidemiological survey that has contributed significantly to research regarding the diagnosis of autism and offered

a broadened definition usually referred to as a spectrum disorder. The authors conducted a study using an interview schedule that asked all the details needed to make a diagnosis of typical autism. Family, teachers, physicians, and significant others of 132 children identified through the Camberwell cumulative psychiatric and mental retardation register were interviewed using the Handicaps Behavior and Skills (HBS). Based on the data, they discovered a whole spectrum of disorders that overlapped with Kanner's (1944) typical autism. A common triad was found to exist in autistic spectrum disorders that included impairments of social interaction, communication and imagination, and repetitive behaviors. Wing and Gould referred to this as the "Triad of Social Impairments". The three areas of the triad appear to influence each other in many ways, suggesting that the inability to interact socially may prohibit the natural learning of language which may then lead to inappropriate behavior (Wing, 1996). They concluded that all children with autism have the triad of social impairments. This definition would permit the inclusion of children with the most subtle as well as those with the most obvious features of autism. The important point of their research findings in the Camberwell study suggests that there are no clear-cut borderlines between typical autism and other manifestations of the triad. Many children with the triad were severely or profoundly mentally retarded while others were in the normal range of intelligence. Wing and Gould also found strong evidence in the Camberwell study to suggest that the diagnosis of autism or related conditions should be made independently of intelligence, etiology or any associated conditions.

A taxonomic analysis to search for subgroups within the autistic spectrum was conducted by Prior, Leekham, Ong, Eisenmajer, Wing, Gould, & Dowe (1998). The data consisted of a large sample (135) of developmental history and current behaviors of high-functioning individuals with diagnoses of autism, Asperger's syndrome, or other related disorders. The information was analyzed using a cluster analysis by putting participants into groups based on autistic behavior derived from their scores from the Autism Spectrum Disorders Checklist. The checklist covers symptoms required for diagnosing autism according to DSM IV (APA, 1994) systems as well as descriptors from Kanner (1944), Asperger (APA, 1994), and Wing & Gould's (1979) triad of social impairments. The clusters were then examined using chi-square tests to determine the manner in which the clusters differed in autistic behavior, developmental history, and family variables. The cluster analysis produced three subgroups: (a) Cluster A contained 44 individuals (autistic-like), (b) Cluster B contained 55 individuals (Asperger-like), and (c) Cluster C contained 36 individuals (mild Pervasive Developmental Disorder or Pervasive Developmental Disorder-Not Otherwise Specified). The authors suggest that differential diagnosis based on particular symptoms could be justified from this representative sample and that differences in developmental history variables (especially language) did not discriminate between the subgroups. The results of this study suggest that the emergence of severity in social and cognitive impairment as the primary basis for any group differences and offer support for a spectrum of autistic disorders. These findings also support the

Eisenmajer, Prior, Leekam, Wing, Ong, Gould, & Welham (1998) study that did not find language delay to be a predictor in distinguishing between Asperger syndrome and autism.

Eisenmajer et al (1998) examined whether the presence or absence of early language delay was a predictor of symptoms of autism. One hundred and eight children were used in the study, and the number of children in each category are listed.

1. Autistic Disorder, 37
2. Asperger syndrome, 62
3. Pervasive Developmental Disorder (PDD) Not Otherwise Specified, 3
4. Semantic-pragmatic language disorder with autistic features, 2
5. Deficits in Attention, Motor control, and Perception, 1
6. Autistic features, 3

The data collection consisted of interviewing parents of the children using a structured questionnaire. Groups were compared (using t tests) by current receptive language scores, chronological age, and age at first diagnosis. The authors report that 46 (42.6%) of the participants were reported to have had a delay in language onset, and 62 (57.4%) were reported to have had a normal language onset. Based on the results of this study, the authors suggest that the use of early language delay as a valid discriminating variable between Pervasive Developmental Disabilities may not be justified in distinguishing Asperger syndrome from Autistic Disorder. The results of the study also found that

language-delayed children babbled less and did not show adequate imitation skills.

There are several aspects of autism which make the disorder complex and challenging for parents and professionals. The autism spectrum consists of children who meet behavioral criteria for autism but have other medical conditions to children who have normal development of language but difficulties with social communication and exhibit stereotyped interests and behaviors. Social interaction impairments make it difficult for the individuals to be involved in appropriate ways with their family, peers, and significant others (Ronski & Sevcik, 2001). Behavior may be inappropriate or abusive because the individual lacks the ability to communicate and interact with others (Bradshaw, 1998). Individuals with autism may have trouble expressing physical and emotional needs, which may cause frustration and lead to problematic behavior. They may have trouble making friends and responding in positive ways to their environment (Cafiero, 2001).

The individual with autism usually has a desire for sameness and often exhibits ritualistic behaviors, such as jumping up and down or flapping their hands. The occurrence of ritualistic behaviors has been associated with the individual's emotional state and tends to increase if the individual becomes emotionally aroused or upset (Koegel & Koegel, 1995). Some repetitive behaviors appear to be pleasurable for the individual (self-stimulatory), such as spinning, rocking, and obsessions with various objects. The individual may become extremely distressed when these behaviors are interrupted.

The lack of appropriate communication development is a very serious

deficit for an individual because communication is important for psychological development and affects the total development of the child (Ronski & Sevcik, 2001). Many individuals with autism may respond to their environment in a limited way, but they may not be able to initiate social interactions or communication with others and carry out spontaneous communication.

Spontaneous communication is defined as the ability to communicate in any situation, based upon the individual's choice to do so, without being prompted. The individual's preferences, desire, or need to communicate to another person is an important factor in spontaneous communication (Bradshaw, 1998). Because language development is usually severely delayed, the individual with autism often misses opportunities to explore the communicative environment and grow in social and cognitive skills. Performance on standardized intelligence tests can be limited due to a lack of productive language skills. The pattern may even continue into adulthood without appropriate interventions to increase communication and social interaction (Ronski & Sevcik, 2001).

Language functioning in autism often varies greatly between individuals (Prior et. al., 1998). Individuals may range from verbal to nonverbal and appear to communicate better using concrete thoughts rather than abstract problem solving. Young children with autism seem to be able to use social-communication gestures, such as pointing or waving a hand to request objects better than using simple gestures to initiate socially shared interaction. Requesting objects or other things of need tend to be more concrete while socially shared interaction may be more

abstract in thought and purpose.

Focusing on communication environments, the communication partners who interact daily with individuals who have severe communication disabilities, and using a functional curriculum are considered important strategies for students with communication disabilities (Bradshaw, 1998). The concept of a functional curriculum (teaching communication and behavior used frequently in the individual's everyday environment) and teaching skills in natural environments are basic to interventions that consider the communicative partner an important variable. Understanding the knowledge, expectations, and behavior of the individual as well as the persons who interact most often with the individual are considered extremely important when teaching communication (Bradshaw, 1998).

A research study completed by Bradshaw (1998) suggests a connection between communication and behavior and suggests that inappropriate behavior may result when appropriate communication skills are lacking. The study used an intervention that involved teaching a staff team visual modes of communication to use with an individual who had communication difficulties due to a hearing loss. This individual also exhibited challenging behavior in an institutional setting. The training and intervention were based on the premise that behavior could be changed by changing the communication environment and actions of the staff in order to increase their ability to communicate with the individual. The focus of the intervention was to train the staff in ways that would facilitate communication with the individual.

The study began with observations of the communication acts between the individual and the staff carried out on four separate occasions. The mode of communication used, the function of the communication, and whether the communication was within the individual's understanding were recorded as baseline data. The intervention involved four consecutive days of training the staff under the direction of speech and language therapists, an audiologist, and a learning specialist. The training also focused on skills in signed communication. The staff members were instructed to use verbal speech along with signing when communicating with the individual. The staff members were also instructed to understand that the individual had lived in an environment that did not adapt to his communication needs. The intervention lasted one year with frequent follow-ups. The results of 77 communication acts were observed, and the following results were reported.

The individual's communication acts were supported by signed key words (49%), the proportion of comments increased to 27%, and the amount of communication within his understanding rose to 98.5%. The individual's overall amount of communication increased and his behavior greatly improved. The study suggests that challenges in communication exchanges involve both the individual with communication difficulties and the communication partner and behavior improves as an individual learns to communicate appropriately.

The etiology of autism and why the deficits in communication and social interaction occur are unclear, and the problems unique to these individuals are

compounded because the disability is developmental and of primary concern (Prior et al, 1998). Research is still in the early stages for finding the cause of autism, but it is generally felt that it is a neurological disorder (Prior et al., 1998). However, a lack of sufficient data exist to connect the neuropsychological deficits identified in autism to underlying behavioral abnormalities, and the research in this area of autism is ongoing. The treatment of autism usually involves various interventions to improve communication, behavior, and social interaction.

Methodologies in Treatment

General Learning Theories

Communication appears to be the magnet that connects learning about the world and others through association. Since communication is considered to play an important role in the acquisition of behavior, learning to communicate is a major focus in the treatment of autism. Although there is no single theory of learning for autism, most treatments focus on the individual acquiring functional communication skills through a variety of interventions to improve communication, social interaction, and behavior.

The prognosis is generally poor for individuals with autism because of several factors. There is no cure for autism, the etiology is uncertain, the diagnosis is usually inconsistent, and the treatment is inconclusive. However, research suggests autism can be managed using comprehensive behavioral and educational treatment programs. A vast majority of research in the study of autism involves

exploring the outcome of various treatment approaches or interventions.

Intervention strategies to enhance communication, social interaction, and behavior as reviewed in the literature usually involve a behavioral model, an interactional model, or a combination of the two. Both models use prompts and reinforcement procedures as well as visual and/or augmented communication devices and strategies based on general learning theories. The main differences between the models appear to be child motivation factors, environmental factors, and the level of adult control (Cafiero, 2001; Koehler, 2001; Ronski & Sevcik, 2001). Both models seem to focus on the individual achieving or improving behavior along with communication.

The behavioral model uses many ideas based on B. F. Skinner's operant conditioning. According to B. F. Skinner, changes in behavior are the result of an individual's response to events that occur in the environment. The stimulus can be anything that creates a response from an individual. A response produces a consequence, and it is called a stimulus-response (S-R) pattern. When this pattern is reinforced, the individual is conditioned to respond again. The learning theory of B. F. Skinner is based upon the idea that learning is a function of change in overt behavior, and reinforcement is the essential element in changing behavior.

Reinforcement (a reinforcer) can be anything that strengthens a desired response such as verbal praise, a good grade or a feeling of increased accomplishment or satisfaction. The S-R theory also covers negative reinforcement, any stimulus that results in the increased frequency of a response when it is withdrawn (Skinner,

1971). The result of environmental experiences and the influence the environment has upon learning are basic to behavioral approaches.

Carefully sequenced and highly structured strategies are emphasized in the behavioral model along with the principles of operant conditioning and behavior modification based on B. F. Skinner's theory (Skinner, 1971). The behavioral model has been researched and used extensively in special education as well as in general education to facilitate learning and behavior and has been somewhat successful.

The interactional model appears to differ from the behavioral model in methodological aspects because the individual is encouraged to have more control in the learning situation, and the communication environment is considered an important variable. The basis of the model includes changing the learning environment to involve individuals in an interactive manner rather than a directive manner. Teachers are viewed as facilitators rather than controllers. The motivational element to the learner is emphasized, and feedback regarding responses are directive rather than corrective. Spontaneous incidents and incidental learning opportunities are taken advantage of to learn communication and interaction skills. The interaction-based approach involves learning language in naturally occurring settings and through naturally occurring events which are felt to enhance the generalization of learned skills into other environments. Individuals are supported in an instructional model that places them in an initiative role (Koegel & Koegel, 1995; Koegel, O'Dell, & Koegel, 1987; Ronski & Sevcik,

2001; Schepis, Reid, Behrman, & Sutton, 1998).

Behavioral and Interactional Models

Lovaas ABA Model. The behavioral model has influenced treatment and interventions for past research in autism and various components of behaviorism are still influencing current research. In 1966, Ovar Lovaas designed and employed a behavior modification procedure (based on Skinner's operant conditioning) utilizing reinforcement learning theory and shaping techniques to develop a program for language acquisition for children who were diagnosed as psychotic. The objectives of this program were to first extinguish behaviors that interfered with speech instruction, and then verbal speech was emphasized through intensive, controlled treatment (Lovaas, 1993).

In 1970, Lovaas created the UCLA Young Autism Project and used operant conditioning and discrete trial training (DTT) to decrease undesirable behaviors and increase verbal speech production in children diagnosed with autism. A discrete trial consisted of the presentation of a command followed by a response and a presentation of a reward for a correct response. The method emphasized verbal production and the reliance on discrete trial training instead of other aspects in behavioral therapy. Although the program used aversive techniques in the beginning, they have now been replaced with a firm "no" for incorrect responses (Lovaas, 1993).

A more recent study by Smith, Eikeseth, Klevstrand, & Lovaas, 1997, suggests that children given intensive treatment achieved clinically meaningful

gains relative to a comparison group of children. The study involved 21 children (19 boys, 2 girls, ages 46 months or less) with a ratio IQ of less than 35. The research design included an experimental group of 11 boys who received intensive treatment (30 hours or more of one-to-one treatment per week for two or more years) and a comparison group of 8 boys and 2 girls, who received minimal treatment (10 hours per week or less of one-to-one treatment for up to 2 years). An analysis of archival data from children seen at the UCLA Young Autism Project and by sites replicating the project was used to evaluate the intensive behavioral model. All children in both groups had received behavioral treatment. The treatment was designed to progress gradually and systematically from simple tasks (responding to basic requests made by an adult) to complex tasks (conversing and making friends with peers). The design of the treatment was based on operant conditioning principles, such as shaping, chaining, discrimination training, and contingency management using a discrete trial format. The treatment personnel consisted of student therapists, project directors, clinic supervisors, and senior therapists who were supervised by masters' level personnel who had at least two years of experience with the treatment model. Children in the experimental group received 30 hours per week of instruction in their homes and communities from treatment teams consisting of four to six student therapists and a senior therapist. In the comparison group, the children received only 10 hours per week of the same instruction.

At intake, experimental group children averaged 36 months of age and

comparison children averaged 38 months of age. The IQ's were also closely matched, with means differing by only one point. No child in either group spoke in words and behavior problems were similar in each group. The mean IQ of the groups was 28, yielding a sample that functioned in the range of severe mental retardation and included many autistic behaviors. The authors claim that the subject assignment procedures produced similar groups.

Follow-up data was conducted for each group. The experimental group children were 71 months of age at follow-up and the comparison children, 64 months of age. The mean IQ of the experimental group increased from 28 at intake to 36 at follow-up. In contrast, the mean IQ of the comparison group decreased from 27 to 24. According to the authors, the difference in IQ between the groups was statistically significant, $t(20)=2.30, p<.05$. Speech was also considered to have a significant difference between groups at follow-up, and 10 of the 11 children in the experimental group spoke in words at the follow-up compared to two of the 10 children in the comparison group. The authors suggest that the intensity of the treatment yielded the greater gains in the experimental group.

The Lovaas model is frequently referred to as the ABA model. Applied behavioral analysis (ABA) uses the basic behavioral principles of stimuli, responses, and consequences. Stimuli are the events within the environment that act as an antecedent or a consequence. Responses are the actions of an individual that follows the stimuli and are observable and measurable. Consequences are the results that follow the response. Positive reinforcement, negative reinforcement,

punishment, and extinction are also used. Positive reinforcement is anything that follows a response that increases the behavior. Negative reinforcement is anything that decreases a response when it is removed. Punishment is a behavior that is followed by a consequence that decreases a behavior's future rate of occurrence. Extinction occurs when a previously reinforced behavior is no longer reinforced and the rate of occurrence decreases (Ogletree & Oren, 2001; Lovaas, 1993).

In addition to these principles, other techniques, such as prompting, cuing, modeling, chaining, differential reinforcement, and fading are incorporated into the ABA intervention. Prompting and cues are aids or helps to ensure that the stimulus will bring about the desired response. Prompts are usually faded but cues remain as part of the natural environment. Modeling is used to demonstrate a desired behavior and prompt it to occur. Chaining is a sequence of behaviors occurring in a fixed order where one behavior affects another, and differential reinforcement is a process of the greater reinforcement of one response over another. Fading is the gradual removal of prompts and reinforcement (Ogletree & Oren, 2001; Lovaas, 1993).

Discrete trial training (DTT) is used extensively in the Lovaas ABA method. The process involves a trainer who attempts to control all aspects of the intervention by using imitation, prompting, shaping, and reinforcement. The program is very intense and involves two to three years of one-to-one training for the young child with autism. The training is conducted by a team of therapists who are trained in the Lovaas method. The program requires intensive training, usually

30-40 hours of intense therapy each week in addition to community and school treatment, completed by therapists trained to conduct the therapy. The training for therapists requires a minimum of nine months in a full-time internship. Much of the training is conducted with the child's parents in the home setting. The training program is quite expensive, ranging from \$12,000 to \$70,000 per year (Yell & Drasgow, 2000).

Operant conditioning techniques as utilized in the Lovaas ABA method are still being researched by Lovaas as an effective method for teaching pragmatic language skills or skills involving abstract concepts. Lovaas has conducted research in autism for approximately 30 years, and his ABA program model appears to be gaining interest in parents of children with autism while presenting controversy among educators, public schools, and researchers. The ABA intervention treatment controversy suggests there are still varying opinions and some confusion concerning the elements of effective instruction for individuals with autism (Ogletree & Oren, 2001).

The treatment procedures used by Lovaas may pose significant difficulties for professionals to implement due to the cost and intensity of the therapy. There also appears to be pressure upon school systems to incorporate ABA into the school program especially for young children with autism. Yell & Drasgow (2000) reviewed 45 published due process hearings and court cases (between 1993 and 1998) in which parents of children with autism challenged the appropriateness of a school district's educational program for their child. The cases involved requested

the school districts to provide, fund, or reimburse the parents for the Lovaas ABA treatment program for young children with autism. The authors examined how these cases affect the definition of appropriate special education programs. Some factors associated with winning or losing decisions are also discussed.

The authors conclude that 76% of the cases resulted in the school districts being compelled to reimburse parents for the in-home Lovaas treatment and fund the continuation of the treatment. Procedural errors required by the Individuals with Disabilities Act (IDEA, 1997) and not providing reasonable meaningful benefit from the Individual Educational Plan (IEP) goals and objectives for the child were usually reasons the school districts lost. The ABA program in these cases, however, was able to show gains in skills through adequate documentation. The procedural violations found in the cases involved five primary areas: parental participation, evaluation, the IEP, placement, and qualifications of personnel. The school districts that won their cases used experts in the area of autism to conduct student evaluations, consult with school personnel in developing educational programs, and served as expert witnesses to support the programming in the due process hearings. These school districts were also able to show that the child was making reasonable progress in meeting their (IEP) goals and objectives.

The results of these court cases provide several implications for school districts in regard to providing an appropriate education for students with autism or other disabilities. Probably the greatest insufficiency of local school districts was the lack of a qualified person to advise and consult with parents and school

professionals as an expert in autism. The greatest difference in the ABA program and many effective school programs appears to be the duration and intensity of the therapy as many educational interventions are based on some of the same behavioral principles as the Lovaas ABA, however, many of the court cases were won because the Lovaas ABA method could demonstrate documented progress (Yell & Drasgow, 2000).

The TEACCH Program. TEACCH is a program that involves a multi-modal intervention approach and the involvement of parents in the teaching process. Division TEACCH, Treatment and Education of Autistic and Related Communication for Handicapped Children, was established in 1972 by Erick Schopler, in cooperation with Robert Reichler, as a division of the Department of Psychiatry, University of North Carolina at Chapel Hill. The main philosophy of the program is based on the belief that parents are the main agent in recovery of their children and are viewed as co-therapists (Schopler, 1997). The program incorporates many effective methods for instruction that have developed through empirical research in the field of autism and severe communication disabilities (Schopler, 1997). The *structured teaching* approach TEACCH has developed is widely accepted by professionals in teaching individuals with autism. The curriculum used in TEACCH is based on a functional curriculum.

TEACCH is a university-based program and provides services, research, and multidisciplinary training for individuals with autism and related disorders. There are three critical aspects of the program: (a) helping families cope, (b)

providing educational services to students with autism and related disorders, and (c) providing assistance with the relationship of the individual to the community (Schopler, 1997). The theoretical orientation of the TEACCH program is cognitive and behaviorally oriented. The interactional approach to communication development and the management of antecedents are emphasized in treatment (Schopler, 1997). Antecedent management is provided through a process called *structured teaching* and is based on research that found individuals with autism exhibited more learning in structured settings than in nonstructural settings (Schopler, Brehm, Kinsborne, & Reichler, 1971). *Structured teaching* includes using visual strategies, such as visual schedules and work tasks to facilitate learning. The physical organization of the learning environment is also structured to facilitate the student to be more independent and compliant. The purpose of visual schedules is to provide the child with the opportunity to complete tasks independently by following visual instructions and sequence. The work schedules define a task or tasks to be completed, the amount of work to be performed, what is the completion of the task, and shows the reinforcement for completing the task (Schopler, 1997).

Schopler (1997) claims that the international reputation of TEACCH and the 281 books and articles published by TEACCH faculty represent the success and influence of Division TEACCH. The Individualized Assessment and Treatment for Autistic and Developmentally Disabled Children, Teaching Strategies for Parents and Professionals, Volume II (Schopler, Reichler, & Lansing, 1980), and

Teaching Activities for Autistic Children, Volume III (Schopler, Lansing, & Waters, 1983) are three resources that have been developed through the TEACCH Program to assist parents and teachers. TEACCH developed a communication curriculum that can be used in schools and at home.

Natural Training Paradigms. Natural training paradigms that address communication learning also involve many behavioral principles. The interventions used in natural training paradigms involve environmental arrangement, incidental teaching, and mand-model occurring in natural environments and routines. Environmental arrangement acts as a focused stimulus, incidental teaching allows for child initiations followed by prompts and cues, and mand-model refers to trainer-initiated training in arranged environments. A shift in control is also a major difference. Trainers usually use child-selected training materials and follow the child's lead in training, resulting in a more loosely structured intervention (Cafiero, 2001; Koegel, Koegel, & McNerney, 2001). Natural training paradigms emphasize child initiation and spontaneity, following the child's lead, building on the child's communication ability, and using natural activities and events. The paradigm focuses on enhancing spontaneous social communication by using varied and motivating activities. Multi-modal communication processes (speech, gesture, augmentative and alternative communication) are used to learn language in meaningful contexts (Ronski & Sevcik, 2001).

The natural language paradigm (NLP) (Koegel, O'Dell, & Koegel, 1987) is an approach to teaching speech to individuals with autism. This approach consists

of a set of language procedures that focus on increasing motivation and generalizations using loose structure and natural environments. Researchers using this paradigm tend to focus on both behavioral and cognitive techniques and have developed several promising interventions for individuals with autism. A study completed by Koegel, O'Dell, and Koegel (1987) attempted to improve verbal language acquisition for two nonverbal children with autism. Their ages at the start of the study were 4 years 5 months and 5 years 8 months. The purpose of the study was to assess whether nonverbal children with autism would increase their verbal responding in a language intervention program. Specific variables were manipulated in a natural language teaching paradigm and the strategies were designed to closely resemble normal language interactions. Training sessions were conducted two times weekly for two hours each. Generalization probes were taken in another room decorated as a living room. All the sessions were video taped and data was collected using a multiple baseline design using different lengths of time for each child (2 months and 19 months, respectively) using a traditional analogue clinic format.

The analogue teaching condition (Baseline) involved the therapist holding up the target object and speaking, "say ...(the desired child utterance)", then pausing and waiting for the child to respond. If the child failed to respond, the therapist prompted the child by touching the child's cheek, lips, or mouth area. The child was reinforced socially and with an edible if he/she imitated a correct approximation to the target response. Child 1 participated in this baseline condition

for two months. Child 2 participated in this condition for 19 months in order to control for the length of time in treatment.

The natural language teaching condition followed two months of treatment in the baseline condition for Child 1 and for Child 2 followed after 19 months in the baseline condition. Variables were changed from the baseline condition to resemble a more natural language speaking situation. Instead of the therapist selecting a stimulus item, the child selected a preferred item from a pool of items (by eye gaze, touching, pointing, etc.). The item was varied from trial to trial instead of being presented serially until the child learned its label. Instead of the therapist giving a command, "say....," the therapist played with the toy and modeled the target response. If the child failed to respond, the therapist repeated the strategy. In contrast to the Analogue Teaching Condition, the child was reinforced for any attempt to verbalize and was allowed to play with the object. However, attempts were not considered a correct response as the measures were the same in both conditions.

Imitative utterances, deferred imitative utterances, and spontaneous utterances were the dependent measures for both conditions. Observer reliability was determined by two observers using the three utterance categories. The number of agreements was divided by the sum of the agreements plus disagreements, then multiplied by 100. The percent agreement for the in-clinic probes averaged 80%, and the generalization reliability measures averaged 78% agreement.

The results of the study showed steady increases in both immediate and deferred utterances compared to the baseline condition. Both children demonstrated generalization to spontaneous utterances only with the natural language teaching paradigm. The authors suggest these results occurred because variables that parallel a more natural speaking situation increased the learning and generalization of these two children. The data from this study showed the children demonstrating a greater number of imitative utterances with the natural language teaching paradigm than with the analogue paradigm. Furthermore, the children demonstrated generalization to spontaneous utterances only with the natural language teaching paradigm.

Another similar investigation, Koegel, O'Dell, and Dunlap (1988), investigated aspects of motivation as a central target behavior for increasing motor speech production. The investigation involved four children, ages 3-3, 8-4, 9-0, and 11-9, with severe communication delays. The children functioned at a nonverbal level and exhibited severe disturbances in cognition, play, social interaction, and stereotypic responding. Reinforcement of motor speech vs. reinforcement of speech attempts was compared using a within-subject repeated reversal design. Each child participated in 3 to 6 alternations of treatment conditions, for a total of 13 to 24 treatment sessions per child. All treatment procedures were held constant except for the type of response-reinforcer contingency used during treatment. Successive approximations of motor speech sounds were reinforced in one condition (Motor Speech Condition), while any

verbal attempts to speak were reinforced in the other condition (Verbal Attempts Condition), whether or not they were correct motor productions. The children's affect and general conduct during the treatment conditions were recorded using a 6-point rating scale to rate the children's interest, enthusiasm, happiness, and general behavior. A second set of dependent variables involved the children's improvements in speech production from session to session in each condition.

The results of this investigation showed that the children achieved higher percentages of correct speech production and had more positive affect when they were reinforced for their speech attempt compared to only receiving reinforcement for correct speech production. The authors suggest that the children derived benefit from contingencies of reinforcement that focused on the motivation to respond and propose that motivation is critical if efficient speech learning can follow.

Although the two studies mentioned are not current literature, they are discussed because they have led to a current research experiment involving the concept of pivotal behaviors in learning communication. Koegel, Koegel, Shoshan, and McNerney (1999), completed an exploratory study to assess key pivotal target behaviors that may be important during interventions for children with autism. The study consisted of two phases. Phase I was to assess whether the presence of spontaneous, self-initiations would be associated with more favorable intervention outcomes. Phase II was to assess whether children who lacked self-initiations could be taught to initiate social communicative interactions as a pivotal behavior,

and whether positive outcomes would occur for those children. Ten children participated in both phases, and all were diagnosed as having autism. Six of the children were divided into two groups (Good Outcome Children and Poor Outcome Children). Archival data from three children who had exceptionally good long-term outcomes and three children who had poor long-term outcomes were analyzed to assess whether any differences relating to child initiations occurred at pre intervention. During pre intervention, archival data was collected for the children and graduate students met individually with the children, their families, their classroom teachers, and other service providers. The pre intervention archival data were then examined to assess whether the children had exhibited differences in social language use prior to the start of intervention.

The intervention (Phase I) consisted of initial in clinic and in home one-on-one teaching with the parents actively participating. The intervention was based on a modified discrete trial formal (prompt-response-reinforcing stimulus) with motivational factors (child choice, reinforcing attempts, interspersing maintenance tasks, the use of natural and direct reinforcers, and response to multiple cues). The anecdotal reports of differences in outcomes for six children were collected using post intervention videotape measures.

Post intervention involved pragmatic ratings based on 15 minute videotape samples using a 9 point Likert type scale for scoring. These pragmatic ratings were obtained from observers who had no previous experience with the children. The observers were instructed to assign one rating of the appropriateness of the

children's overall behavior during each 15-minute segment. Meaningful outcomes in social and community functioning were obtained for each child regarding school placement, academic achievement, social circles, living situation, and extracurricular activities. Post intervention adaptive behavior scales were administered at post intervention for each child. The objective was to assess whether spontaneous initiations were associated with good versus poor intervention outcomes.

Phase II intervention was similar to the intervention in Phase I except it focused on teaching a series of verbal initiations using child initiated verbal interaction rather than adult initiated verbal interaction. Four children with similar characteristics in terms of language age and the number of initiations as the children with poor outcomes in Phase I were used in this phase. The children were motivated with a variety of highly preferred objects. Following the child's question (What's that?), the adult opened a bag and showed the child what was inside. Prompts were gradually faded. Using the same procedure the child was taught to ask "Whose is it?." The adult would respond with, "It's yours," and then give the object to the child. The same dependent measures were recorded in both phases: the number of spontaneous child initiations and ratings of pragmatics by naïve observers.

The results in Phase II show the children had significant increases in the number of initiations and pragmatic ratings after the intervention when compared to pre intervention scores. The additional measures (Adaptive Behavior Scale

Scores and Social and Community Functioning) also showed dramatic gains as compared to pre intervention. Their gains compared favorably with the children in Phase I with good outcome children. The authors suggest that intervention programs would be enhanced if pivotal behaviors were identified. They also suggest social communicative initiations as a pivotal behavior. However, they indicate a need for future research in this area with more experimental control as this was an exploratory study rather than an experimental one.

Schepis, Reid, Behrman, and Sutton (1998) combined a voice-output communication aid (VOCA) and naturalistic teaching to increase communicative interactions across four children with autism and two classroom routines. The study involved children with scores between 18 and 24 month level on the Vineland Adaptive Behavior Scales. Two children used some words, and all children imitated simple sounds. Two children were five years of age and two children were three years of age. Based on the characteristics of each child, a VOCA known as Cheap Talk was selected for use in the study. Up to eight messages were recorded into the VOCA. Communicative interactions were scored if the child interacted with a new person. Several child behavior definitions were involved in the study. Child communication that was directed to another child was considered child-to-child communication. The child activating the VOCA by pressing the template was considered VOCA, and the teacher guiding some part of the target child's hand to guide a response was considered physically guided VOCA. Word vocalization was considered an utterance that was recognizable as a

word, and non word vocalizations were considered an utterance that was not recognizable as a word. A gesture was considered if the child extended his/her hand toward the teacher or object. Two behavior definitions were used for the teacher or aides. Communicative interaction was defined as any intelligible verbalization, other than verbal prompts to communicate, that was directed to the child. Verbal prompts to communicate included the teacher or aid specifically asking the child to make a communicative response.

Observations began during snack time when a child was seated at the snack table and ended when a child left the table. The snack time averaged 11 minutes in length. Play observations began after a child had completed a series of classroom tasks and the teacher told the child he/she had time to play. Playtime averaged 9 minutes in length. After baseline data was taken prior to the study, a training session utilizing naturalistic teaching and VOCA was conducted with classroom staff and one child. The experimenter also provided verbal and written presentations describing the main components of naturalistic teaching procedures in relation to VOCA use. The main features of the naturalistic instructional strategy as defined in the study included using child preferred stimuli available within the natural routine, using child-initiated responses, and providing verbal and gestural prompts with minimal use of physical guidance. The authors used a multiple probe design across time and across two participants in two routines and two participants in one routine to evaluate the effectiveness of VOCA use within a naturalistic teaching paradigm on child communicative behavior.

The number of communicative interactions per minute, including gestures, vocalizations, word vocalizations, and VOCA behaviors were graphed for each setting. All children demonstrated an increase in communicative interactions during the VOCA and naturalistic teaching condition from the baseline condition in each classroom routine. Different types of communicative interactions other than VOCA usage were observed per minute for each child, and the non-VOCA communicative behaviors did not decrease in frequency during the intervention. The teacher and aide communicative interactions during each of the routines were observed to increase over baseline. The results of the study support findings from other research examining the use of VOCAs for individuals with severe disabilities (Ronski & Sevcik, 2001). The authors suggest the results demonstrate the efficacy of using a VOCA and naturalistic teaching procedures to increase communicative interactions for individuals with autism.

A study to increase the social interaction skills of four preschool children with autism used a naturalistic language paradigm for an intervention (Kohler, Anthony, Steighner, & Hoyson, 2001). Four preschool children with autism and 35 of their peers along with four teachers in integrated preschool classrooms participated in the study. The children with autism were enrolled in separate classrooms and were ages 4.1 to 4.7 years of age. All children had notable deficits in social interaction. Experimental sessions were ten minutes in length and occurred during a 40-minute activity in which the children could play in six to eight different areas. All four teachers were introduced to the naturalistic teaching

approach prior to the beginning of the study. Teachers were instructed to use the naturalistic tactics to accomplish two important objectives: (a) stimulate the child's interest within the activity and (b) facilitate the child's communication and social interaction with others.

Experimental sessions were videotaped and then coded for a variety of child and teacher measures. A 6-second partial interval time sampling system was used to code three categories of child behavior. Social interaction, other active behavior, and passive responding were the three categories. A 6-second partial interval time sampling system was used to code three categories of teacher behavior (prompts for social interaction, other interaction, and passive behavior). A checklist was developed to monitor teacher's use of the naturalistic teaching tactics. Seven naturalistic teaching strategies were used (Use novel materials, Join in the activity, Invite the child to make choices, Use incidental strategies, Use comments and questions, Require expansion of talk, and Invite interaction with peers). Baseline consisted of a 45-minute training for teachers. Intervention involved teachers receiving daily technical assistance in the use of the naturalistic approach. Interrater agreement was assessed on at least 25% of each child's experimental sessions with agreement ranging from 80% to 90%. A multiple baseline across subjects design was used to examine the effects of various experimental conditions.

The results of the study indicated all four children displayed low levels of social interaction during initial baseline phase but exhibited higher levels of social

exchanges after their teachers received daily assistance (instruction, coaching, feedback, and encouragement) in naturalistic teaching. Some frustration in learning how to use the various naturalistic tactics was expressed by all four teachers because they often met with child indifference, avoidance, and even opposition. The teachers felt that it was difficult to “follow the child’s lead”, a unique feature of the naturalistic approach. The authors suggest a number of issues for future research. Researchers need to examine the benefits of naturalistic teaching tactics for children with autism and examine how teachers learn to incorporate naturalistic tactics into practice. The results of this study suggest that teachers required considerable support in order to learn to implement the tactics effectively. Future research might examine the acceptability of naturalistic tactics for both teachers and parents of children with disabilities.

A training manual was developed to teach parents and other caregivers how to teach pivotal behaviors based on the Natural Language Paradigm to children with autism (Koegel, Schreibman, Good, Cerniglia, Murphy, & Koegel, 1988). The suggestions offered in this manual are as follows: The Question/Instruction/Opportunity to Respond should:

1. Be clear, appropriate to the task, uninterrupted, and the child must be attending. Once the child is attending to the task, instructions that are clear and appropriate should be given.
2. Be interspersed with maintenance tasks. Maintenance tasks are tasks the child has already mastered. They are balanced with new and more challenging tasks to

increase child's motivation and self-confidence, enabling him/her to attempt novel tasks while still being successful overall.

3. Be chosen by the child. Having a role in choosing the topic of conversation encourages motivation. Sharing control allows the child to have a great deal of control. Turn taking is also included in sharing control. It requires a give and take interaction between the communication partners.

4. Include multiple components. Multiple cues refers to the child responding to two or more units within the environment. If the child is repeatedly exposed to multiple cues, the child will become more responsive to the vast number of cues present in the natural environment.

According to the training manual, the response to a behavior must be contingent upon the correct behavior or attempt. The response must be as immediate as possible after the child's response, be appropriate to the response, and must be dependent upon the response. It should be clear that the response depends on his/her behavior. If an incorrect response is given, the child should be prompted with the correct response and then reinforced immediately after he/she gives the correct response or attempt.

Reinforcing any attempt to communicate is encouraged in this paradigm. Any goal-directed attempt to respond to questions, instructions, or opportunities should be reinforced. The response, however, has to be a reasonable attempt. The child must be directing his/her attention to the task, the attempt has to be related to the task, and it has to be emitted with a reasonable amount of effort. The authors

propose the child will be more motivated to try. The reinforcer should be a natural consequence for the behavior. Since a child will normally receive a natural reinforcer in the natural environment, it is felt by the authors this procedure may promote generalization to other areas. Because language often manipulates the environment, the natural reinforcer maintains and strengthens language because it is successful.

Assistive Technology. Communication, language, and speech are complex areas of functioning yet can be differentiated between each other. Communication may be defined as the process that occurs between two or more individuals who exchange or share information. It involves some type of reciprocal interaction. The information exchanged may be in the form of gestures, verbal sounds or speech, or in an augmented manner. Language, however, involves the ability to communicate in a manner in which people understand the meaning of the communicative process, and speech is the natural mode or method in which people usually communicate. Augmented communication offers a different way to communicate and involves the use of pictures, signs and gestures, or computerized systems as alternative modes to verbal speech. Individuals with severe communication disabilities often use augmented systems because they are unable to produce intelligible speech. Augmented systems may enable individuals without verbal speech to acquire communication and language because they are provided an alternative mode to communicate (Sigafos, 1998; Cafiero, 2001; Ronski & Sevcik, 2001).

Technology has enabled many individuals with severe communication disabilities to communicate in functional and appropriate ways, and schools are required to provide assistive technology services to individuals with disabilities (IDEA, 1997). IDEA defines Assistive Technology Services as, “any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device”. School systems are required to evaluate the technology needs of the individual, purchase systems, and provide training as needed for individuals who may need assistive technology.

Since communication is a multi-modal process, the use of an augmented system may provide opportunities to exchange and share information. The augmented system may allow the natural progression of learning language to occur by providing the mode in which to communicate. Many times an individual will require the use of prompts while learning to use an augmented communication system. These prompts may be physical, verbal, or a combination of both. The prompts are usually phased out over time as the individual initiates the communicative intent on their own, but some individuals may become dependent upon prompts. The phasing of prompts is often referred to as a system of least prompts. Usually the reinforcement provided for the individual is some item that is acquired as a result of the communication (Koegel, O'Dell, & Koegel, 1987; Koegel, Koegel, Shoshan, & McNeerney, 1999; Ronski & Sevcik, 2001). The learning then proceeds to tasks that are more complex and other choice making activities. The ultimate goal for the individual is to use verbal speech or the

augmented system in spontaneous communication and in natural environments in order to interact in meaningful ways. Individuals usually progress at different rates depending on their ability, their motivation to communicate, and the quality of the interactive environment (Koegel & Koegel, 1995; Ronski & Sevcik, 2001).

Several studies suggest multimedia computers are effective tools for interventions for individuals with social and communication disabilities, including autism. The interventions often vary in the way the technology assists the learning situation. Mechline, Gast, & Langone (2002) conducted a study to evaluate the use of computer-based video instruction to teach generalized reading of words found on grocery store aisle signs and the location of the corresponding grocery items within those aisles. Four students (1 boy and 3 girls ages 9 years to 17 years) with moderate intellectual disabilities participated in the study. Several prerequisite skills were necessary before the students could participate in the study. They had to have the ability to see and to make selections on the computer screen and have verbal imitation for reading or signing words on lists and aisle signs. The participants had to be able to stay on task for 20 minutes and have the visual ability to recognize grocery products and verbally label/sign the names of the items. The students also had to have matching skills and answer yes/no questions. All students had had some experience with computer-based instruction and with the system of least prompts, stimulus fading, and stimulus shaping.

A multiple probe design across three sets of words which students used to enter the correct aisles of the grocery store and obtain items. The design was

replicated across the students and used to evaluate the effectiveness of using computer-based video instruction. Twelve grocery aisle sight words (three sets of four words) were individually taught to each student. Probe measures were conducted prior to instruction for all three sets of words over three sessions using both the photograph and typed word lists. After instruction on the first set of four words with the computer program, probe measures were again taken. When a particular student reached criterion (100%) correct, generalization probe measures at the three grocery stores were again collected on all three sets of words, using both the photograph and typed word lists.

All training and instruction was conducted through simulations using video instruction and took place two to three days per week at the school that each participant attended. Prior to any probe or training session, students were tested for expressive reading ability of the 12 grocery aisle sign words (Pretest). A posttest identical to the pretest was also administered after the final probe sessions in the three grocery stores. Following a pretest word list session, probe sessions using a photograph list followed by the typed word were conducted in each of the three grocery stores prior to the computer-program probe and training conditions. During the second grocery store probe, students used a typed-word grocery list. Each aisle was considered a training trial and students were prompted to continue with subsequent task steps. Students also received verbal praise on each trial for general attending and attempting to locate items.

Still photographs and videotapes taken of the three grocery stores were

imported into the computer-training program for instruction. The still images were scanned and imported into the computer as separate files. Video recordings were compressed one time using Apple Video Player and saved as video files. The desired segments of each video caption were accessed using the software program Hyperstudio 3.1 (Roger Wagner Publishing). This software enabled the instructors to individualize lessons using the still photographs and control the progression of each lesson based on the student's responses through touching the Touch Window from Edmark Corporation. Training involved touching aisle sign words on the computer screen and selecting target items on the aisle. Interobserver agreement data were collected during 33% of all probe and computer training sessions to determine reliability measures on dependent and independent variables and ranged from 75% to 100%.

The effectiveness of the computer-based instruction was based on the number of aisles entered correctly and items located correctly. All four students using the photograph list had an increase in performance using the computer-based video program. More substantial changes in performance were achieved by each student using the typed-word shopping list following training on each set with the computer-based video program. Performance levels using the word list in the grocery stores were consistently lower on all three-word sets for three of the four students because of reading ability. The results of the study indicate that following computer-based video instruction, students were able to generalize the reading of grocery aisle heading words and to locate grocery items when using both

photograph and typed word shopping lists. The four students in the study demonstrated gains in their correct responding within natural settings. The authors suggest that simulations on a computer can be created to teach multiple-step tasks effectively to students with moderate intellectual disabilities and future research is warranted in this area.

Hitchcock and Noonan (2000) completed a study with five preschool students with disabilities, three boys and two girls (age range 3 years 2 months to 4 years 7 months). All were identified as having an “early childhood learning impairment”. This is a broad disability category in Hawaii defined as significant delays in cognitive, language, or adaptive behavior skills. An Adapted Alternating Treatments Design was used and replicated across participants for each skill area (shapes, colors, numbers, and letters). The target behavior consisted of the child matching a stimulus card with the correct item in a display of the four to be learned. The two conditions were Teacher Assisted Instruction (TAI) and Computer Assisted Instruction (CAI). Manipulatives were displayed on the table in the TAI condition and computer images were used in the CAI condition. Instructional variables were held constant to ensure equivalence of instructional sets during the TAI and CAI alternating conditions. A constant time delay (target stimulus is presented followed by a delay period, 4 seconds) was used in the CAI and TAI conditions. The dependent measure was the percentage of correct matches on the selected skill in both phases. The number of trials under each condition was equal to control for a practice effect. The two conditions continued

until the results demonstrated a superiority of responding under at least one condition (a clear separation in the data or above 80% correct for two days). The sequence of instruction was varied over days to prevent an order effect. The results of the study suggest that CAI with constant time delay was an effective method to build early academic skills. The TAI condition was also effective, but CAI was superior across most skills in this study.

Bernard-Opitz Sriram, and Nakhoda-Sapmar (2001) completed a study to investigate the effectiveness of computer-assisted instruction on solving social problems. Eight different social problems were presented on a computer, along with possible solutions, and an option to produce alternative solutions. The study involved eight preschool children with autism (ranged in age 5.8 years to 8.5 years) and eight matched children without autism (ranged in age 4.0 to 4.9 years). The children with autism were required to have an autism score above 65 and an IQ in the normal range. The children were diagnosed using the Autism Behavior Checklist. The children were asked to provide solutions to animated problem scenes during the sessions. In the training sessions, problem solutions were first explained thoroughly by the trainer and then the explanations were illustrated using animations on the computer of the solutions. During the probe sessions, only the computer animations were used. The computer cued the children with a synthesized voice (e.g., "What would you do?). Two appropriate and two inappropriate options were given and reinforcement for appropriate solutions involved a praise by the computer voice and showed an animated happy end to the

conflict. Inappropriate solutions were ignored.

The main dependent measure in the study was the number of novel ideas produced during the probe and training sessions. The children went through 10 training sessions and six probe sessions. Repeated-measures ANOVA were conducted for the data from the training sessions and probe sessions with autism as a between-groups variable. The mean number of novel ideas across sessions was used in another repeated-measures ANOVA contrasting the two session types. The efficacy of autism in predicting production of novel ideas was contrasted with individual differences in non standardized scores on IQ and comprehension using multiple regressions.

The analysis revealed that performance in the probe sessions was lower than that in learning sessions (2.47 vs.4.57) for the group without autism and in the autism group (1.5 vs.3.4). The authors suggest that the increase may have been influenced by the training sessions. The findings demonstrate that each group benefited from the CAI instruction to solve social problems, suggesting computers may be a possible new area to enhance social problem solving for both groups. Since the study focused on the children responding during a computer program and not on generalizing into real life settings, future research is warranted in this area.

The strategy of using picture symbols as icons has been used by researchers as interventions to improve social and communication skills in children with autism and other communication disabilities (Kuttler & Myles, 1998; Siagafoos, 1998).

Symbols are used in structured teaching (Schopler, 1997) as well as incidental teaching and with or without the use of prompting. Visually cued instruction can be used to acquire daily living skills, teach organizational skills and behavior skills, as well as expand language and communication skills for social exchanges (Cafiero, 2001).

Cafiero (2001) completed a study that used a holistic, total immersion approach to augmenting language for a 13 year old boy with autism. Rather than use augmented systems to teach schedules and routines, interactive vocabulary was taught as input in relevant classroom activities. Based on the Natural Language Paradigm (Koegel et al., 1987), the focus of the intervention involved typical language interaction between communicative partners. Verbal cues were paired with corresponding symbols. The study used a single-subject design and combined the augmented system as a second language (a visual language) into a natural environment (the student's classroom).

The student in the study was 13 years old and was diagnosed with autism at age six. He demonstrated tantrum behaviors occurring at the rate of four to five per day and lasting 20 to 30 minutes at a time. The boy was nonverbal and used only five functional American Sign Language signs. He had been in a special school previously but entered a public school program at age 12. The intervention was designed to provide optimal support and language stimulation to the student in the classroom. A language board was used to teach vocabulary, and the staff was trained as communication partners. The staff used modeling to teach the

vocabulary on the communication board. Data was recorded on a duplicate language board. Vocabulary was graphed and analyzed weekly by tallying the number of symbols the student used appropriately on two occasions. Two symbols were considered “acquired picture language”. Initiations of communication were also measured. The data was collected during a 22-month period.

The results of the study showed that the boy increased from using 16 symbols in the baseline condition to 67 symbols after the intervention. Baseline was determined by the student using the board with communicative modeling. The study also recorded bolting behavior data for the student. The bolting behavior decreased with the intervention and the author suggests that improvement in behavior may be due to increased communication.

Kuttler and Myles (1998) completed a study to investigate an intervention using visual social stories to reduce tantrum behavior in a 12 year-old boy with autism. The authors used an ABAB design across two social environments. Two social stories were implemented and withdrawn and data was collected to determine the frequency of two behaviors, inappropriate vocalizations and dropping to the floor. The intervention was based on social story guidelines (Gray, 1995). The guidelines for social stories include descriptive sentences, directive sentences, and perspective sentences. The setting, the people, and their actions are information included in descriptive sentences. Directive sentences tell the students what they need to do in a given situation to be successful, and perspective sentences describe the feelings and reactions of others. Social stories may be

printed words alone or words paired with pictures. The social stories used in this study were paired with a corresponding visual icon. An event-recording system was used to record data. During baseline conditions (phases one and three) the traditional classroom intervention (classroom picture schedule, a sticker chart, and verbal and physical prompting from the staff) was provided. During intervention phase (phases two and 4) the social stories were read to the student immediately prior to the activity. The student had access to the stories whenever he wanted them. After the activity, the student was asked to refer to the social story and review appropriate behaviors.

The results of the study suggest that the intervention was effective in reducing the inappropriate behaviors. The mean frequency of the inappropriate behaviors during baseline was 15.6. During the intervention phase the inappropriate behaviors decreased to a mean of zero. When the intervention was withdrawn, the inappropriate behavior mean rose to 15.33. Although the study only used one participant and could not measure generalization, the authors feel the intervention was very effective for this student because it combined visual interventions along with directions, choices, and self-management strategies. The authors caution, however, that future research would be necessary to validate the effectiveness of this technique across other settings and other individuals.

Sigafoos (1998) conducted a study to assess the conditional use of graphic mode requesting in a six-year-old boy with autism and severe communication impairment. This study was the first attempt to teach this boy an aided visual

communication system. His receptive language was estimated at 10-11 months and his expressive language was limited to occasional babbling. The intervention was implemented in his classroom at a primary school for children with special needs. The procedures were implemented three times weekly, lasting approximately 20 minutes. Reaching and requesting were used as dependent variables in the study. Reaching was defined as actually touching the item within 3 seconds. A request was defined as pointing to a "want" icon with the word also printed on it. Opportunities to access preferred objects were arranged in a discrete and massed trial format, and the sessions consisted of 12 trials. The research was conducted using a baseline (A) and intervention (B) design. Objects were placed within and out of reach in a rapidly alternating basis. During the baseline phase, reaching was reinforced. During the intervention phase, items were placed out of reach, reaching was not reinforced, and the "want" icon was placed within his reach. He gained access to the item if he touched the "want" icon. Intervention trials were identical to those of baseline except access to the preferred item was contingent upon touching the "want" symbol. He received prompts to touch the symbol as needed. The boy showed rapid acquisition of the requesting response and obtained the 100% level by the fourth intervention session. The intervention suggests that pictures or symbols can be used to request items based on reinforcing the "want" icon response. Evidence of over generalization occurred during assessment sessions. With both item and symbol within reach, the boy would touch the "want" icon even if he could reach it. During the last assessment phase of the intervention,

the item was moved in and out of reach on a trial-by-trial basis, and he switched between reaching and requesting based on the placement of the item. The results of the study suggest the intervention procedures were effective in teaching the boy to request preferred objects by pointing to a graphic symbol.

Conclusion

Several changes have occurred in the field of special education in understanding why individuals with autism have deficits in communication, social interaction, and behavior. Various interventions and strategies reflect these changes and are concerned with finding effective treatments for this complex disorder, but currently not one isolated treatment is considered “best practice” (Gresham, Beebe, Frankenberger, & Mac Millan, 1999). Future research is needed in all areas of autism because of the unknowns existing in this complex developmental disorder. There appears to be an increase in the incidence of children with autism, there is no consensus about the etiology of autism, and there is no consensus about the best methodology for intervention. Some families are demanding Lovaas’ ABA intervention strategies be incorporated into public school programs. Although efficacy has not been fully demonstrated through empirical research, families appear to be more concerned with the hope it may bring to their situation. The cost of providing the intensive behavioral treatment may pose significant problems for public school systems. Contrary to the Lovaas ABA advocates, several prominent researchers have exhibited success with other types

interventions which are not high-cost and can be implemented effectively in public schools (Ronski & Sevcik, 2001; Cafiero, 2001; Kohler, et al, 2001; Koegel, et al, 2001; Bernard-Opitz, et al, 2001). These interventions seem to incorporate aspects of several methodologies to increase communication, behavior, and social interaction, perhaps defining a multi-modal approach to autism.

Intervention efforts appear to be focusing on fostering communication rather than acquiring traditional language. The focus in education for teaching communication skills seems to be changing from traditional practices of teaching the rules of “correct” or “standard” language usage to offering alternative modes of communication (Ronski & Sevcik, 2001). These alternative modes to communicate include sign language, communication boards, and augmentative devices for individuals who are nonverbal. The major concept supporting alternative modes of communication appear to be that communicative functions may assist the individual in by-passing the serious social deficits individuals with autism may experience without the ability to communicate with others. Current interventions appear to be concerned more with an individual’s desire to communicate than with how he or she communicates. The ability to request, reject, and comment spontaneously with other people in their environment seems to take more precedence than learning language in traditional ways and new areas of research in communication are opening up. Basic to this belief is that communication interventions should foster communication so students can be included socially in their natural environment and function to the best of their

ability in school, the community, and at home (Ronski & Sevcik, 2001). The greatest benefit of language is to communicate with others.

Both behavioral and interactional models suggest gains for individuals with autism, and research and practice suggest using elements of both models in interventions. The Lovaas ABA method appears to be growing in popularity, success has been demonstrated through the use of assistive technology as in Ronski and Sevcik (2001), and the methodologies using more natural language learning such as Koegel, et. al (1999), suggest effective learning. The TEACCH program (Schopler, 1997) has also demonstrated efficacy through the structured teaching approach. The controversy, however, still exists among parents, researchers, and educators in defining appropriate education because there are currently no definite standards for “best practices”. One important focus of the literature concerning autism, however, has definitely evolved. The practice of professionals and educators collaborating with families to shape the range and type of services needed for their child with autism is considered critical in the treatment of autism. A shift to a family-centered paradigm appears to be evolving in the treatment of autism and a trend to integrate various approaches and methodologies in treatment rather than to focus on one exclusive treatment for “best practices”. The integrating of approaches or methodologies should be based on individual child and family needs and involve matching child characteristics to the specific approach with the progress being monitored closely. This would involve consistency in the approach, behavioral measures of outcome, and a predictable

and structured daily routine. A need exists for research to examine effective interventions, including computer-assisted instruction, which will increase communication skills in individuals with autism. The multimedia computer may prove to be a useful tool in instruction for individuals with autism as many current research studies suggest (Cafiero, 2001; Schepis, Reid, Behrmann, & Sutton, 1998; Mechline, Gast, & Langone, 2002; Mirenda, Wilk, & Carson, 2000; Hitchcock & Noonan, 2000). Technology is an area open for investigation in areas of learning for all individuals, with or without disabilities, including autism. The use of technology is rapidly being incorporated in school systems, places of employment, and in homes, making it practical for any type of instructional purpose. A need exists to examine the effects of computer-assisted instruction on individuals with autism to increase communication, appropriate behavior, and social interaction because these areas are critical in the disability of autism.

Chapter III

Methodology and Procedures

Subjects

The participants in the present study were five adult individuals diagnosed with autism. Four of the participants live in a private residential care facility. One individual lives at home with his parents and is enrolled in a public school system. Selection of the participants involved notifying the guardians of 11 individuals diagnosed with autism and requesting participation in this study. The first five individuals for which consent to participate was obtained were selected to participate in the present study. Each individual participant was given a functional communication assessment by the experimenter prior to the study using the following instruments:

1. PPVT-R - Peabody Picture Vocabulary Test-Revised
3. ATEC (Autism Treatment Evaluation Checklist, developed by Rimland & Edelson, Autism Research Institute, 1999) filled out by someone familiar with the individual
4. An informal communication skills checklist
5. An informal interest inventory (filled out by someone familiar with the individual)

The PPVT-R was used to obtain a receptive language score. Expressive language scores were not assessed. The PPVT-R required the individual to point to a picture, responding to a request by the experimenter (e.g. Show me the bus).

The individual had to point to the correct picture out of four pictures on a page. This assessment for receptive vocabulary was chosen because the PPVT-R has norms for older populations.

The ATEC is an assessment developed by Bernard Rimland, PhD and Stephen M. Edelson of the Autism Research Institute in San Diego, California. The Autism Treatment Evaluation Checklist was specifically designed to assist researchers, practitioners, and parents in evaluating the efficacy of treatments. Normative data, which permit comparison of one individual with others, can also be obtained from the ATEC to indicate a level of severity of Autism. The ATEC checklist was filled out by an individual that knew the participant very well and the scoring was completed by the Autism Research Institute Web site: <http://www.autism.com/ari>. The higher the score on the ATEC indicates a greater severity of autism. The ATEC reports reliability measures using Pearson split-half (internal consistency) coefficient of .942. See Appendix A for the checklist used in this study.

The communication skills checklist (Appendix B) and the interest inventory (Appendix C) were developed by the experimenter. The informal communication skills checklist was used primarily to determine the participants' modes of communication. The interest inventory was filled out by asking individuals most familiar with the participant what areas were of interest to the participant. This information aided the experimenter in taking pictures of places and objects of interest to the individual.

A summary of the characteristics of the participants are listed in Table 1, and a narrative describing the participants at the start of the study are described.

Table 1

Characteristics of Participants Based on Assessment Conducted Prior to Investigation

Participant	Age	Sex	PPVT	ATEC Summary Score
Ernest	30	M	Below 1.9 Age	109 (Severe)
Don	20	M	2.3 Age	64 (Moderate)
Alish	20	F	1.9 Age	77 (Moderate/Severe)
Bee	33	F	Below 1.9 Age	71 (Moderate/Severe)
Connie	35	F	1.10 Age	89 (Moderate/Severe)

Ernest is a 30 year-old white male with a diagnosis of autism and profound mental retardation. He is ambulatory and requires no adaptive equipment. He has lived in a private care facility for 15 years, and he works in a sheltered workshop at the facility. He completes practice scenarios consisting of assembling and sorting. He listens to most staff and follows simple verbal and modeling prompts. He primarily communicates by vocalizations and by touching/pulling staff. Based on his last speech and language assessment, scores on the Non-Speech Test were 6-9 months of age in receptive language and 2-5 months of age in expressive language. The functional assessment given by the experimenter revealed a receptive language score below age 1.9 based on the PPVT-R, an ATEC score of 109 (Severe), no appropriate mode of communication, and very disruptive behaviors. It was difficult to assess his communication skills as he did not respond to questions and requests. He also kept grabbing the materials, trying to put them in his mouth. The staff

reported he liked radios and things that make noise. The staff reported he liked horses, lawn mowing, and walking outdoors. Ernest did not point to pictures or make choices. He has not had any computer-assisted instruction.

Don is a 20 year-old white male who lives at home with his mother and step-father and attends special education classes at a public high school. He is a very energetic young man diagnosed with autism. His school records indicated he has had a long history of developmental, learning, and behavioral problems secondary to autism but has demonstrated dramatic improvement in all areas the last few years. His teacher reports he is starting to show affection for teachers and friends and initiates many positive interactions during the day with familiar school staff and peers. His last school assessment indicated his vocabulary had increased from a dozen or so words and gestures to approximately 35 or more. His teacher observes that he is extremely selective, however, in his vocalizations. Although he has an augmented communication device at school, his teacher reports his intelligibility is still very limited. He is reluctant to use his communication device (Cheap Talk). When he is encouraged to use the communication device, he frequently becomes upset with it and throws it on the floor. In the classroom, however, he will show others what he is talking about in a journal notebook. He prefers to have others write things to say in his journal which he will then read back to them. He recognizes most words in his daily journal, but his teacher has been unable to get a grade equivalent on his reading due to his tendency to get very upset when tested. He perseverates (stays on one subject or phrase) during

communication and is very reluctant to use different vocabulary, often becoming very upset. He also has several ritualistic behaviors, such as rocking, humming, screaming, spitting, and throwing things. His teacher has tried to implement communication boards, but he tears them up or throws them in the trash. He prefers to communicate with his daily journal using written words or phrases. Don sometimes uses signs and gestures, but his signing is not standardized. A few of his signs were taught to the experimenter prior to the study. He could point to pictures and make choices somewhat consistently. His mother indicated his interests were in radios, television game shows, trucks, and mechanical gadgets. He has had some computer-assisted instruction, but his behavior becomes somewhat obsessive and impulsive at the computer. He often exhibits a lack of impulse control when he is at the computer, often grabbing the keyboard or banging on it. Because of his impulsive behavior, his computer time is extremely limited. His teacher reports that the computer appears to be too frustrating for him.

Alish is a 20 year-old white female diagnosed with autism and profound mental retardation. She is ambulatory, nonverbal, and very active. According to her last speech and language evaluation at the facility, she is not able to communicate all of her wants and needs successfully. She presents with a profound receptive and expressive language delay below the 6-month level of development. She primarily communicates through vocalizations, facial expressions, and ambulation although her oral-motor structures appear to be adequate and intact for

speech. She cannot communicate her wants and needs to an unfamiliar listener, but she appears to be very aware of her environment. According to the facility's records, she does not receive speech-language pathology services because of her level of mental retardation, chronological age, and limited response to the therapist. She has lived in a residential care facility most of her life, and she is currently working in the facility's sheltered workshop completing practice scenarios of assembly and sorting. The functional assessment given by the experimenter revealed a receptive language score of age 1.9 equivalency based on the PPVT-R, an ATEC score of 77 (Moderate/severe), no appropriate mode of communication, and severe disruptive behavior and self-stimulatory behaviors. During the assessment, she frequently tried to put the materials in her mouth and often chewed excessively on her shirt. It was very difficult to assess her functional communication because she did not respond to questions or requests. The staff reported that Alish liked to be outdoors and enjoyed physical activity. Alish did not point at pictures or make choices. She has not had any computer-assisted instruction.

Bee is a 33 year-old white female diagnosed with autism and severe mental retardation. She has lived in the private residential care facility for the past 23 years and works in their sheltered workshop completing practice scenarios of assembly and sorting. She is very active and can communicate verbally (usually one word utterance) only to the extent of getting some of her physical wants and needs met. She does not communicate with staff or peers other than constant chattering

with no apparent purpose. Bee displays some echolalia, often repeating words spoken to her. The staff report that she prefers to be alone rather than around others, and displays severe ritualistic behaviors. She frequently has outbursts when upset, sometimes physically hurting others around her. According to her last speech and language evaluation, she presents with receptive and expressive language scattered between the 11 to 16 month level and communicates through gestures and vocalizations. Speech and language services were felt not to be appropriate because she refused to participate in a structured task. The functional assessment revealed a below age 1.9 score on the PPVT-R in receptive language, a score of 89 (Moderate/severe) on the ATEC, some verbalization with echolalia tendencies, and mainly interests in food. She appeared to be very nervous during the assessment, frequently getting up and straightening chairs and yelling. Bee did not point to pictures or make choices during the assessment. She has not had any computer-assisted instruction.

Connie is a 35 year-old Native American female diagnosed with autism and severe mental retardation. She has lived in a private residential care facility for the past 16 years and works in their sheltered workshop completing practice scenarios such as assembly and sorting. According to the facility's speech and language evaluation, she is not able to communicate her wants and needs successfully. She presented with severely delayed receptive and expressive language skills. Her articulation, voice, and fluency could not be assessed because she was nonverbal. However, the staff reports that she can verbalize a few words, follow simple

commands, and participate in some very limited interaction. The staff also reports that she usually prefers to be alone and seldom interacts with others. She does not receive individualized, skilled speech-pathology services at the facility. The functional communication assessment indicated she could form words verbally but did so on a very inconsistent basis. According to the PPVT-R, she indicated a receptive language score of age 1.10 equivalent. The ATEC revealed a score of 71 (Moderate/severe), and she was interested in looking at magazines and pictures of food. She was very reluctant to respond to questions and requests and frequently stared at the experimenter. Connie did not point to pictures or make choices during the assessment. She has not had any computer-assisted instruction.

Setting

The setting for the study took place at the private residential care facility for Ernest, Alish, Connie, and Bee and at the local high school for Don. The computer-assisted instruction (intervention) took place at a computer station within a training room at the care facility and in a classroom at the public high school. Instruction was conducted individually with each participant in a room containing a computer station with two chairs placed around it. The experimenter (communication partner) facilitated interaction by asking questions about pictures of familiar places and objects in a notebook during baseline. The same pictures were used as the stimulus for interaction during intervention, but they were inserted into a talking word processor program with synthesized speech. During baseline, the computer was not at the computer station.

During the intervention condition, the monitor was placed in clear view of the participant. Two round switches, one for yes and one for no, were attached to the computer table with Velcro for those participants who needed this mode to respond. There was a printer attached to the computer so that the participant's pictures and stories could be printed at the end of the session. Each participant received one-on-one instruction at different times for a total of approximately 10-15 minutes daily for each individual. The sessions were video taped so that observations could be recorded more accurately and a second observer could be used to obtain interobserver reliability. A video camera on a tripod was used for the video recording. The experimenter turned the video tape on and off for each session. The participants were aware of the taping. The setting was quiet and appropriate for learning. However, there were some minor interruptions at various times but did not appear to interfere with the session.

Dependent Variables

The dependent variables in the present study are communicative interactions and disruptive behaviors. Communicative interactions are defined as the participant responding to a request, answering a yes/no question, or initiating a comment by pointing or verbalizing. Disruptive behaviors are defined as the participant engaging in a behavior causing a disruption in instruction (e.g. screaming, getting out of seat, hitting, grabbing materials, and inappropriate touching).

Tasks

The stimuli for interaction in baseline and intervention were several digital pictures taken of familiar places and objects. The pictures were based on each individual's interests. During instruction in baseline, the individual was asked to make a choice between two 5 x 7 inch pictures for the interactive session. Using the natural language paradigm for the style of instruction, the communication partner (the experimenter) tried to illicit interest from the participant to respond in a reciprocal manner to questions and requests. The communication partner also expanded on any communication initiated by the individual, and any attempt to interact was encouraged by verbal praise. The objective of the session was to have novel interactive communicating occur between the communication partner and the participant. Physical prompting to respond to questions and requests (showing the participant how to use yes/no switches or point to pictures) was used for instructional purposes only (both in baseline and intervention), and all attempts were reinforced with verbal praise. Only independent interactions or responses to verbal requests were recorded as an occurrence, however. If disruptive behaviors occurred, the individual was redirected by the communication partner to continue with the task. Sessions were discontinued if the experimenter felt the participant appeared frustrated and disruptive behavior might escalate further. The tasks and procedures were the same in baseline and intervention conditions for presenting the stimuli except a computer with speech-output with the same pictures stored on a floppy disc was used during the intervention. The same pictures were used

in the baseline condition but were printed and placed in a notebook. Two pictures from the floppy disc were inserted into the computer and viewed by the participant on the computer monitor. The participant was then asked to choose a picture for discussion. If the participant did not choose a picture, the communication partner selected one and copied it into the talking word processor. Various words, phrases, or simple sentences were typed into the word processor (based on the responses of the participant). The computer spoke words as the communication partner typed.

Observation and Recording

Direct observational recording from videotapes of each session was used by the experimenter and one-third of the sessions by another observer in order to achieve interobserver reliability. The observations of the dependent variables, communication interaction and disruptive behavior, were recorded from observing the videotapes (see Appendix D for recording sheet). The communication partner's initiation of interactions (number of questions asked and number of requests made during the session) were also recorded in order to establish consistent response opportunities for participants and sessions. The session length was also recorded because the session length varied due to the attention span of each individual. A battery-operated digital timer was used to calculate the exact session time. The timer was set at the beginning of each session and again when recording data from the video tapes so that the experimenter could calculate the exact length of each session. Each session for each participant was video taped in its entirety. The rate

(frequency) of occurrence per minute for communicative interactions, disruptive behaviors, and number of questions and requests by the communication partner were calculated for each session. The number of communicative interactions, disruptive behaviors, and number of questions and requests by the communication partner were divided by the length of the session (which varied between participants), yielding a rate of occurrence per minute (RPM) for the targeted behaviors for each session. This type of recording allowed a more accurate count of communicative interactions and disruptive behaviors as the number of interactive opportunities and the length of each session varied between sessions. This type of recording allowed the experimenter to follow the natural language paradigm, follow the participant's interest, and make use of incidental opportunities to interact. Keeping to a strict schedule of questions or requests (opportunities to interact) was not appropriate for the present study as it would interfere with the natural language process, and varying the session length between participants allowed more individuality. Since session lengths varied, the total time of each session was determined and used to calculate the rate of occurrence per minute.

Reliability Measures

The videotapes were reviewed for observations by the experimenter after each session, and a second observer was trained to carry out direct observation for interobserver reliability for one-third of the sessions. The experimenter trained the second observer by viewing some sessions randomly with her to determine the

definition of communicative interactions and disruptive behaviors. A checklist was made to reinforce the definitions of the dependent variables. Three practice/training sessions were conducted before the actual observations were completed by the second observer. Interobserver agreement was calculated by the two observers' independent records from video observations of the same sessions. For ease in observing, a copy of every third session was made on a separate tape and labeled as interobserver tape. The observers independently recorded the behaviors from the same sessions. Overall reliability was calculated using agreements divided by agreements plus disagreements multiplied by 100. Reliability measures on the communicative interactions (nonverbal and verbal) and disruptive behaviors (DV's) were obtained. Agreement was obtained by a comparison of the counting done by the two observers of whether or not the participant responded with a communicative interaction or exhibited a disruptive behavior during the matched sessions.

Observers

The first observer, the experimenter who designed the present study, is a doctoral student in Educational Psychology, Special Education, with twenty years teaching experience. The second observer is a special education teacher with 22 years of special education teaching experience. After training in the recording procedure, the second observer viewed approximately one-third of the sessions and recorded observations for the occurrence of communicative interactions, disruptive behavior, and the communication partner's number of questions. These

observations were compared to the observations from the experimenter for the matched sessions.

Experimental Design

A multiple baseline across subjects was employed to evaluate the effects of the computer-assisted instructional intervention on the participants' communicative interactions and disruptive behavior. This type of design was chosen because the multiple baseline design demonstrates the strength of the intervention and increases confidence in the intervention. The experimental control is demonstrated only when there is a positive change in both level and trend after the introduction of the independent variable. By applying the intervention or independent variable to one participant at a time, covariation in behaviors can be exposed. The multiple baseline design across subjects was well suited for the present study because of three reasons. First, the skill of communicating requires different participants to master the same skills. Second, individuals learn at different rates. Third, the results may be demonstrated across participants.

The objective of the intervention was to increase communicative interactions and decrease disruptive behaviors over time during interactive instructional sessions using computer-assisted instruction based on a natural language paradigm. Prior to the intervention, the experimenter became acquainted with the subjects, gathered materials needed for the intervention, and functionally assessed communication behaviors to determine the mode of communication used by each participant. Baseline conditions were conducted for each participant until

the data series maintained acceptable stability in level and trend. Criterion-level responding was based on the participant's rate of occurrence per minute to respond interactively for at least two occurrences per minute to stimuli presented. The conditions for the baseline measures were the same as the intervention procedure except for the way in which the stimuli for interaction (pictures) were presented. The natural language paradigm was the basis for instruction style used by the experimenter in baseline and intervention. The intervention used a multi-media computer with speech output as the independent variable. The computer-assisted instruction involved a program called Write-Outloud, a talking word processor, and digital pictures inserted into the word processor. Communicative interactions (nonverbal and verbal) and disruptive behaviors were the dependent variables. Two participants, Ernest and Alish, needed a mode to communicate because they were completely nonverbal and did not use gestures or signs, therefore having no appropriate means to communicate. Two switches with speech output, one for yes and one for no, were introduced during baseline and used through intervention for these participants. Each switch would speak either yes or no when the participant pressed on it. The switches were also available for the other participants if they wanted to use them.

Procedure for the Study

Baseline. Based on the interest inventory and conversations with staff familiar with the individuals, pictures of familiar places and objects were taken by the experimenter using a digital camera. The pictures were printed, placed in a

plastic cover, and placed in a notebook for each participant for use during baseline. The pictures acted as a stimulus for motivation to interact during the instructional sessions during baseline. The participants were asked by the communication partner (the experimenter) to choose a picture for the interactive session. Examples of pictures included 5 x 7 inch pictures of McDonald's, Braum's, horses, trucks, items of food, etc. Approximately 10-15 pictures were included in the notebook and stored on the floppy disc. Each participant had their own notebook which contained pictures based on their individual interests. After a picture was selected for discussion, questions using a yes/no response format and request statements about each picture were asked by the experimenter (communication partner) to motivate a response from the participant. The communication partner often repeated a question or request after an appropriate wait time for a response. The questions and requests were spontaneous, followed the interest of the participant, and gave the participants choices. For instructional purposes, participants were prompted physically by the experimenter to respond by placing their hand on a picture or a yes/no switch. Modeling was also used by the communication partner to show the participant what was expected. However, only independent responses were counted as a communication interaction. A verbal prompt (e.g. Show me the ____ or Tell me yes) was counted as an interaction if the participant followed the request by pointing or touching the picture.

Intervention. Conditions in baseline were the same as intervention for all participants with the exception of the use of a multimedia computer with voice-

output. The digital pictures were inserted from a floppy disk into the computer program and appeared on the monitor rather than the notebook used in baseline. The same pictures used in the baseline were used in the intervention. The participants were given a choice between two pictures. When a picture was selected, it was copied and pasted into the talking word processor. The experimenter would ask yes/no questions, wait for a response, then type in words that were relevant to the response. If the participant did not respond, the communication partner modeled a response. The talking word processor would then speak the words typed. The object of the typing was not to teach the participant to make stories, but to encourage them to become involved in the interaction. The goal of the typing and story writing was to motivate them to respond to the experimenter in a reciprocal manner using their preferred mode of communication.

The experimenter followed guidelines used in the natural language paradigm training methodology (Koegel, Schreibman, Good, Cerniglia, Murphy, & Koegel, 1988) during both baseline and intervention conditions. These guidelines involved encouraging communication in a natural manner by balancing new and more challenging tasks with maintenance tasks, follow the individual's lead by allowing choices thereby sharing control, using multiple cues by encouraging the individual to respond to multiple cues in the environment, and providing a natural reinforcement or consequence for interaction. Responding to multiple cues and motivation were the pivotal behaviors targeted for the focus of instruction during

baseline and intervention. The main difference between baseline and intervention was the introduction of the computer with speech output, the visual appearance of the pictures on the computer monitor, and the pictures were on a floppy disc rather than in a notebook. The participants viewed the pictures on the monitor.

Due to the limited abilities of the participants, maintenance tasks were difficult to develop. The request statement (e.g. Show me the picture of _____) was considered a maintenance response. Due to the cognitive level and communication skill levels of the participants, it was anticipated that it would be more difficult for them to respond to the yes/no questions or to initiate interaction. They were also praised for simply attending to the session.

The digital pictures taken for each participant were recorded on a floppy disk for each individual and incorporated into the computer program software, two at a time, so that the participant could choose a picture for discussion. The communication partner, based on the responses from the participant, would type simple words and sentences to go with the picture. Typing in words allowed the talking word processor to speak and provided the participant with an opportunity to have power of expression. The software used in the intervention was Write Outloud and is a talking word processor. The participants were asked which picture they wanted to write a story about. After a selection was made, the communication partner facilitated questions about the picture and typed a simple statement or word below the picture. The computer program then spoke the sentence using synthesized speech output. Other pictures were selected by the

individual during the session, and the process was repeated until the end of the session. The stories, words, or phrases constructed about the pictures during the sessions were printed for the individual to place in their notebook which they kept. The printouts made were used to motivate the participants to interact and served as a natural reinforcer for the interaction.

Treatment of the Data

The data were collected for each session from the recorded video tapes, converted to rate of occurrence per minute, and graphed for visual comparison. A mark was recorded for every observed occurrence of a communicative interaction or a disruptive behavior from observations viewed on the video tapes. The session was then observed a third time to record the number of initiations made by the communication partner for each session and converted to rate per minute to improve internal validity. The average rate per minute for each participant for each session was graphed using a two-line graph, one line for communicative interactions and one line for disruptive behaviors. Baseline and intervention average rates of occurrence per minute were compared within subjects using visual comparison of graphed data (see Figure 1). Due to the extreme performance variability of the participants, the results for each participant are explained.

Chapter IV

Results

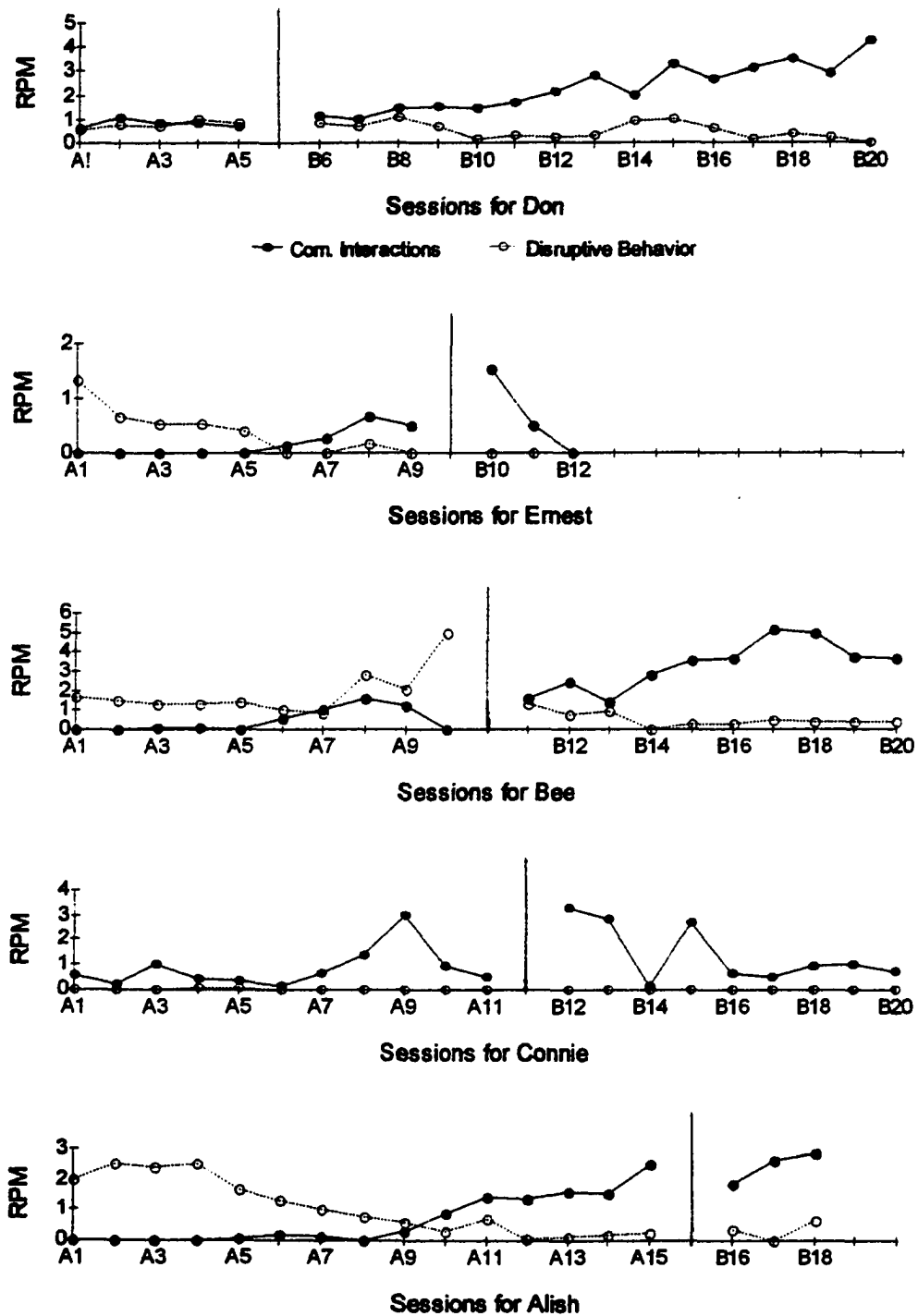
Reliability

Interobserver reliability was assessed for one-third of the observations during the study across each experimental condition for communicative interactions, disruptive behaviors, and communication partner. The reliability calculations yielded an average percentage agreement score of 77% (range 73% to 83%) across the five participants for the dependent variable Communicative Interaction. The dependent variable, Disruptive Behavior, yielded an average percentage agreement score of 71% (range 40% to 100%) across the five participants. The reliability calculations yielded an average percentage agreement score of 78% (range 65% to 90%) for the questions/requests made by the communication partner across one-third of the sessions for the five participants.

Dependent Variables

The results of the data collected during baseline and intervention conditions are displayed in Figure 1 to demonstrate changes in levels and trends across the five participants. The two-line graphs illustrate the daily session data points based on rate of occurrence per minute for communicative interactions and disruptive behaviors. The graphs are organized by the length of baseline for each participant, beginning with the shortest baseline and ending with the longest baseline to demonstrate the effect of the multiple baseline design across subjects.

Figure 1. Graphic Representation for All Five Participants During Baseline (A) and Intervention Conditions (B), Rate of Occurrence (RPM)



Chapter V

Discussion

The results of the present study demonstrate the effects of computer-assisted instruction on communicative interactions and disruptive behaviors in five adult individuals with autism. The computer-assisted instruction procedure employed in this study produced an increase in three participants' (Don, Bee, and Alish) communicative interactions and a decrease in their disruptive behaviors across time. Two participants' data (Ernest and Connie) indicated a great deal of variance between sessions and across time.

Don's graph indicates a positive change in level and trend in daily data points during the intervention phase. The data demonstrates an upward trend in communicative interactions and a downward trend in disruptive behaviors across time. Sessions 14, 15, and 16 indicate a slight increase in disruptive behavior. However, the increase was due to his excitement over the printer. He would try to grab the paper out of the printer before it had finished printing. He overcame the obsession to grab the paper as indicated in the decrease in disruptive behavior for sessions 17, 18, 19, and 20. Don also demonstrated an interest in typing his own words on the computer. Future studies for Don should include teaching him to type and express himself using the talking word processor and the digital pictures. This procedure could be varied to teach a variety of skills, language, etc. During the intervention, Don often communicated his desire to put three different pictures together to make a sentence by using one picture for a subject, one for a verb, and

one for an object. He expressed his choices through pointing, gestures, and voice. Don could benefit from using the talking word processor program to type words and construct sentences.

Ernest's data was difficult to interpret because he received some new medication during the study. During session 10 (the first intervention session), however, he demonstrated a substantial increase in communicative interaction. Prior to the yes/no switches (introduced in baseline session 6), Ernest had no appropriate way to communicate other than using his whole body. During baseline, his graph indicates an upward trend in communication and a downward trend in disruptive behavior. This pattern suggests he benefited from the use of the yes/no switches, making communicative interaction possible. He appeared to like using the computer and the yes/no switches. The medication was given to him after session 10 in an attempt to reduce his physical outbursts in his daily routine at the facility. During interactive sessions 11 and 12, he appeared extremely calm and too unresponsive to profit from the instruction. The sessions were discontinued. Future studies with Ernest are needed using augmented and alternative communication. The present study supports a need to examine whether or not Ernest could possibly benefit from augmented and alternative communication (AAC) if he had instruction with a device on a regular basis as well as in individual speech therapy.

Bee's graph indicates a positive level and trend change in the baseline condition until session 9 and 10. She was very moody and anxious during sessions

8 and 9 and session 10 indicates an extreme increase in disruptive behavior. During the intervention condition, a definite positive change in level and trend occurred. The graph establishes a steady upward trend in communicative interactions and a downward trend in disruptive behaviors much like Don's graph and Alish's graph. This pattern demonstrates that as communicative interactions increased, disruptive behavior decreased. Like Don's and Alish's daily data, Bee's data lines cross over and reverse the trend demonstrated in baseline, indicating that communication and behavior co-vary. During intervention, Bee demonstrated a substantial decrease in disruptive behavior and a significant increase in communicative interaction.

Connie's daily data on her two-line graph indicate data extremes from one session to another in communicative interactions, although disruptive behavior was never a problem with Connie. Some days she would often stare at the communication partner and was very reluctant to interact. During other sessions (9, 12, & 15) she increased in communicative interactions and used her voice to respond. Consistency of increase in communication might have continued in an upward trend with more time. When the intervention was introduced (session 12), Connie indicated a substantial gain in communicative interactions per minute. She continued with this increase for sessions 13 and 15, dropping very low for session 14. The graph indicates intervention was similar to baseline conditions and longer instruction was needed in order to establish a positive change in level and trend. Future studies for Connie are warranted in order to increase her motivation to communicate with her voice. She might also profit from instruction with an

alternative communication device. She appeared to really enjoy the interactive sessions in baseline and intervention.

Alish's graph indicates a positive change in level and trend during baseline and intervention. Daily data points for communicative interactions and disruptive behaviors reversed trends in baseline session 10 and continued until the end of the study. She was not making progress until the yes/no switches were introduced during session 5, indicating a need for a mode of communication. Alish had to learn how to use the yes/no switches through physical prompting and modeling. She appeared to like to use the switches. Before the yes/no switches, she had no appropriate mode to communicate. Other than screaming, she was completely nonverbal and did not point to pictures. She greatly improved in communicative interactions and disruptive behaviors in baseline and continued to improve in the intervention condition. Her progress was steady and consistent and follows an upward trend in communicative interactions and a downward trend in disruptive behaviors over time similar to Don's graph and Bee's graph. Future studies for Alish should include instruction using an augmented alternative communication device as she indicated an interest in and the ability to use the yes/no switches.

Interpretation of the effectiveness of the computer-assisted instruction can best be made through the individual participant's two-line graphs and the strength of the multiple baseline design across subjects. The data for Ernest and Connie do not support a functional relationship between the computer-assisted instruction and

increases in communicative interactions and decreases in disruptive behaviors. However, the data suggests a functional relationship for Don, Bee, and Alish based on the following factors.

The multiple baseline design across subjects indicated the intervention and behavior changes in communicative interactions and disruptive behaviors are functionally related for Don, Bee, and Alish. The design demonstrated the effect of the computer-assisted instruction assessed through successive applications across participants and behaviors measured across time. The effectiveness of the computer-assisted intervention was established by increases in communicative interactions and decreases in disruptive behaviors across time.

Secondly, data indicated that communication partner interactions were consistent throughout the study for each participant and across sessions, ranging from 3.18 rate of occurrence per minute to 5.83 rate of occurrence per minute. The investigator was consistent across conditions for each participant and controlled for extraneous variables such as increased trainer attention.

A third factor relating the computer-assisted instruction and the communicative behavior change was that the data for Don, Bee, and Alish indicates their apparent motivation to interact appeared to increase during the computer-assisted instruction. This suggests that the computer-assisted instruction motivated them to interact and is supported by their increase in rate of occurrence per minute for communicative interactions during intervention.

A final factor suggesting a functional relationship between the computer-

assisted instruction and the increase in rate of occurrence per minute for communicative interactions and decrease in rate of occurrence per minute for disruptive behaviors can be ascertained from anecdotal notes taken throughout the study based on observations of the participants. The information gathered through anecdotal observations warrants investigation into future research to determine other interventions to improve communicative interactions and decrease disruptive behaviors. For example, several questions arise from this investigation: What relationship does the ability to communicate have on disruptive behavior?; What role does the communication partner play in encouraging interaction?; Can disruptive behaviors be due to excitement or a lack of a mode to communicate?; and Can over-stimulation (too much excitement at one time) be regulated through repeated exposure?

Summary of Anecdotal Observations

Many anecdotal observations were noted from the video taped sessions. The digital pictures appeared motivating across conditions. The participants seemed to respond well to the individual attention from the communication partner. The participants often watched the communication partner as she spoke the words and typed them into the computer. The sessions appeared to be a very personal and special time for the participants.

Ernest and Alish had trouble putting enough pressure on the switch to activate sound so touching the yes/no switch was counted as a response. The sound in the switch appeared to be very motivating to Ernest and Alish based on

their facial expressions. All participants were observed looking away when the words or phrases typed in the word processor were activated to speak, yet they appeared to be aware and listening. Don, Alish, Ernest, and Bee appeared to exhibit disruptive behaviors due to over excitement. Alish really liked slapping choices in the notebook used in baseline. During intervention she liked touching the computer monitor.

The typing by the communication partner and the computer speaking appeared to reinforce learning and motivation. One time Connie asked the secretary in the training room to look at the computer. She kept saying, "Look". She repeated it often and appeared excited about the computer. Don became very excited about the words typed into the computer and sometimes had trouble waiting for the communication partner to type in his response. He wanted to go to another picture very quickly, indicating he had issues responding to multiple cues. The communication partner used a statement like, "Show me the picture of __," to get him back on task when he became too excited. About half way through the study he started combining three pictures together to make a statement like, "The big green truck gets gas and goes to McDonald's." He often wanted to make complex sentences on the computer, and he indicated his desire to do so through the initiation of gestures (pointing) from pictures to computer screen.

Don's sessions were much longer than the other participants because he was so motivated to attend to the task and able to do so. He often wanted to match the picture on the monitor with the picture in his notebook by pointing to

the monitor and then to a notebook. At first he wouldn't keep his printed stories in order in his notebook. He tried to carry them around loose often dropping, losing, or wrinkling them. Later on in the study, he kept them neatly in a plastic cover secured in his notebook. Don's mother often reported he talked to her a lot at home about the pictures and stories. He diligently carried his notebook wherever he went, even to church, and shared its contents with others. Don had to learn to wait for the printer which seemed difficult for him. He would get up and try to get a magazine or radio while he waited and appeared to have problems just sitting and waiting. He appeared to need something to occupy his mind while he waited. He used many verbalizations but most could not be understood by the communication partner. Communication was better with "his" signs, gestures, and pointing.

Some problems occurred during the sessions that warrant mentioning. The typing of the communication partner seemed to slow down the mood of the interaction, yet excitement seemed obvious when the computer spoke the sentence. As the study progressed, many of the participants expressed facial expressions of anticipation. The participants had to wait and this appeared to cause some frustration for them which was demonstrated through facial expression and other types of body language. The communication partner appeared to be very aware of the nonverbal body language exhibited by the participants and usually made a comment about what she thought might ease the participant's anxiety. At times the communication partner had some computer problems, such as the computer locking up or accidentally deleting something, appearing to cause frustration.

The observations of the communication partner during the sessions revealed several interesting issues about the style of instruction by the communication partner. At the beginning of each session the communication partner reviewed the topics of the previous session. The communication partner appeared to be very sincere about wanting the individual to interact. She would laugh, joke, as well as be serious. The communication partner appeared to use every opportunity possible to encourage interaction: prompting, modeling, following the individual's lead, redirection to task. Following the participant's lead seemed to encourage more spontaneous communication from the participant as well as the communication partner. Some anticipation was observed in participants because they appeared eager to get started on the story. The communication partner took advantage of every opportunity to interact. This was accomplished by rephrasing their communication, clarifying what she thought they said or meant, and typing it into the computer. The communication partner verbalized all of her actions when typing on the computer, then the computer spoke the word or phrase. Whatever was going on during the session or in the pictures was typed into the computer and then spoken by the computer. Often, the communication partner requested the participant to watch what she was typing and requested them to look at the printer. However, this was not counted as a request or a response during the session.

Some maintenance tasks involved the participant just looking at the pictures. The participant was praised for looking, but looking at the picture was

not counted as an independent response. The communication partner also used modeling, explained, related information and personal experiences relating to the pictures as well as asking the participant questions. Each session appeared to be more like a natural conversation with give and receive information rather than a structured instructional time. The communication partner attempted to give the participant control throughout the conversation by encouraging choices. The participants seemed to have more trouble responding to questions that involved likes, dislikes, and other choices rather than other requests. Finding maintenance tasks for these individuals was more difficult due to their limited cognitive abilities and severe deficits in attending and communicating. Usually the tasks involved a simple request like "Show me the ____". Sometimes verbal praise was given for simply paying attention. The participant appeared to enjoy novel conversation rather than more serious or factual conversation. The communication partner usually asked a question, waited for a response, and repeated the question if no response was given. She would then model an appropriate response.

The communication partner tried to get the participant to focus on the task and look at her when asking them questions. The computer seemed like a third party which was used to connect the communication partner and the participant in interaction. The role of the computer appeared to add to the interactive conversation, providing the individuals a safe reason to communicate and interact. The digital pictures in the notebook used during baseline also offered the same benefits. The main difference appeared to be the total immersion of the

senses (visual and auditory) while at the computer. The computer seemed to provide the two partners a commonality while providing excellent visual and auditory feedback. The communication partner's mannerisms seemed to provide a personal and social element while the computer provided a more factual and non emotional element, yet highly stimulating. The computer seemed to provide the stimulus to interact which motivated interaction in a cause and effect manner directed or facilitated by the communication partner. Everything was connected during the session and processed through the computer.

The communication partner tried to structure sentences or phrases very simply in two basic parts, Who/ did what? Before printing, the entire story was spoken by the computer to see if the participant liked it or wanted to make changes. The communication partner always asked the participants if they wanted to print the story. As the intervention progressed some disruptive behaviors increased and appeared to be due to excitement. These behaviors included jumping up, running around, and other self-stimulatory behavior. However, the facial expressions and other nonverbal behavior (smiling, laughing) clearly indicated some kind of enjoyment. These behaviors appeared to communicate good feelings even though they were also disruptive. Nevertheless, these behaviors were counted as disruptive behavior. After repeated exposure to the stimuli through ongoing sessions, these disruptive behaviors became regulated.

Conclusion

Clearly, the computer-assisted instruction procedure implemented in this study appears to be functionally related to the increase in David, Alisha, and Beth's rate of occurrence per minute of communicative interactions and decrease in rate of occurrence per minute of disruptive behaviors. However, the intervention procedure in the study consisted of a variety of components presented as a "package," providing a variation on other computer-assisted instruction utilized in past studies (Schepis, et al., 1998; Mechline, et al., 2002; Bernard-Opitz Sriram & Nakhoda-Sapmar, 2001). Any of the single components or combination of components of the computer-assisted instruction may have contributed to its apparent effectiveness.

First, the importance of developing a rationale for increasing pivotal behaviors (e.g. motivation) has been noted as a factor essential to the success of communication and interaction (Koegel, et al., 1999; Koegel, et al., 2001). In the present study, a rationale for motivating interaction was presented by the experimenter to each participant consisting of communication partner interaction, visual, and auditory stimulation. Specifically, computer-assisted instruction was presented as a motivator which would encourage the participants to interact in a reciprocal manner with the communication partner. Its use was suggested as enhancing the probability of increased motivation to communicate using a highly motivating multi-media computer and pictures of functionally relevant material as stimuli to discuss. Finally, printed stories with pictures were given to the

participants and appeared to be a positive reinforcement that provided a natural occurring reinforcement for interacting. The systematic development of this rationale may have contributed to the effectiveness of the computer-assisted instruction. Another component of the computer-assisted instruction which may have contributed to its effectiveness was the role of the communication partner and the style of facilitation used to encourage interaction. Bradshaw (1998) supports the importance of the communication partner.

Next, the use of reinforcement for any attempt to communicate during instruction has been indicated as a critical factor contributing to the effectiveness of an instructional program (Koegel, et al., 1999; Koegel, et al., 2001). The computer-assisted instruction employed in the present study provided a choice of pictures in which to discuss during instruction. Additionally, frequent social reinforcement, including verbal praise and smiling were delivered throughout the instructional sessions for any attempt at communication. Some learning effect may have progressed from one session to the next as prompts and modeling were used in instruction. A learning effect for the present study is supported by increases in communicative interactions during baseline.

Another component of the computer-assisted instruction which may have contributed to its effectiveness was the varied pictures used for the stimuli and giving the participant a choice of pictures. The use of the digital pictures of familiar places and objects may have contributed to the increase in communicative interactions observed in this study. The effectiveness of visual cues, pictorial cues,

and the communication partner, as stimuli for communication has been noted in other investigations (Bradshaw, 1998; Cafiero, 2001). An additional component of the computer-assisted instruction possibly accounting for its effectiveness was the manner in which the stimuli was presented to the participants. The stimuli was not presented in a rote-learning fashion during instruction. Rather, as in previously successful investigations, the participants were allowed to choose the topic for discussion (Koegel, et al., 1999; Koegel, et al., 2001). This training component may be an especially critical factor with individuals with autism who have severely limited communication and social interaction skills. The ability to choose the picture may have motivated the participants in the study to interact. Attempting to superimpose an external language on the participants, not within their repertoire, may not be as effective in producing a desire to interact (a pivotal behavior) and supports research using the Natural Language Paradigm strategy (Koegel, et al., 1999).

The computer-assisted instructional intervention implemented in the present study suggests effectiveness in increasing communicative interactions and decreasing disruptive behaviors for five adult individuals with autism, four of which have been institutionalized for many years. During the computer-assisted instruction, the rate of occurrence per minute of communicative interactions increased immediately and substantially for three of the five participants while the rate of disruptive behaviors decreased dramatically for four of the participants. One participant did not exhibit any disruptive behavior.

Implications

The present study presents the importance and ease of connecting technology with functional and relevant information for instruction for five adults with autism. Future studies with interactive software would provide valuable information for increasing communication skills with this population. A multimedia computer could provide a source of practice for individuals with autism before trying out skills in other settings. A touch window on the computer may be helpful as many participants would touch the monitor. This study suggests that the individuals involved with this study might actually learn to use the keyboard or use a switch to interact with a computer program.

The cost of the computer-assisted instruction as an intervention was minimal in terms of time and materials. The training procedure for the participants averaged about 10 to 15 minutes per session over a period of about four weeks by the experimenter. The procedure could readily be taught to other educators or support personnel and used as a daily instructional or leisure activity. Additionally, the computer-assisted instruction for each participant was brief, consisting of an average of 8.2 sessions, ranging from 3 to 15 sessions. The cost of required materials was minimal and could easily be affordable to schools, speech pathologists, and other individuals.

The participants in the present study appeared to be motivated to interact during the instructional sessions. Exit questionnaires completed by the two training staff who supervised the participants revealed the staff viewed the procedure as

effective for increasing communicative interactions and decreasing disruptive behaviors. A request to learn how to provide computer-assisted instruction was also expressed by the staff and administration of the facility and plans to develop training videos are being investigated. Apparently, computer-assisted instruction as a procedure to enhance interaction and reduce disruptive behavior has gained validity in the setting of the present study.

The use of computer-assisted instruction to increase communicative interactions and decrease disruptive behaviors could have direct application for individuals with autism in vocational as well as educational settings. Communicative interactions and appropriate social behavior are characteristics associated with successful employment and an improved quality of life. By maintaining appropriate communicative interaction skills, individuals with autism present a more socially acceptable appearance than by acting out inappropriately. Apparently, the likelihood of competitive employability or community living could be enhanced by increased communicative interaction and decreased disruptive behavior.

Computer-assisted instruction could be viewed as a technique with wide application across a variety of settings, behaviors, and populations. The present study found computer-assisted instruction to be effective for increasing communicative interactions and decreasing disruptive behaviors for three adult individuals with autism. Further research could attempt to isolate which of the components of the computer-assisted instruction used in this study contributed to

the effectiveness of the total training package. The role of the communication partner and style of instruction are areas of future research needs as well as the role of augmented and alternative communication. A follow-up study would provide interesting research. Additionally, subsequent investigations could explore modifications in the procedure which might facilitate generalization to other settings.

The present study provides an investigation of the use of computer-assisted instruction with five adult individuals with autism with very limited communication, social, and behavioral skills. Its effectiveness indicates older individuals with autism may be motivated to interact, need to have a mode in which to communicate, and may need a communication partner to facilitate and reinforce interaction attempts. Further investigations of the procedure could explore its application across a variety of behaviors with individuals with autism, perhaps using augmented alternative communication devices as a means to communicate and encourage interaction. The present study can add to the literature and indicates a need to address the many problems of individuals with communication difficulties. Many individuals may be in nonproductive employment because of an inability to communicate. The present study also raises important questions regarding the role of speech therapy and a need to address augmented alternative communication strategies.

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Appendix B

COMMUNICATIONS SCREENING CHECKLIST

STUDENT _____ DATE _____

I. Response Mode Selection

Check all responses that the individual makes voluntarily. Circle any responses that the individual makes frequently and consistently as well as voluntarily.

- _____ 1. Speaks words
- _____ 2. Speaks phonemes (e.g., "baba")
- _____ 3. Vocalizes sounds that are not recognizable phonemes
- _____ 4. Nods "yes" or "no" (does not have to be used correctly yet)
- _____ 5. Moves head other than nodding
- _____ 6. Focuses eyes on objects
- _____ 7. Focuses eyes on one picture or symbol in an array
- _____ 8. Uses fingers independently (e.g., "OK" sign, shows age)
- _____ 9. Points to objects
- _____ 10. Uses hands to manipulate objects (e.g., pulls up pants, feeds self)
- _____ 11. Moves arm and hand together across body and overhead
- _____ 12. Slightly moves arm and hand together a few inches
- _____ 13. Does not move hands, but can move other body parts independently (e.g., shoulder, arm, foot, knee) (State part that can be moved)
- _____ 14. Other observable voluntary responses (e.g., tongue clicking, eye blinking) (State response)

II. Symbol Selection

For each of the following symbol systems, check the appropriate column(s).

Symbol System	Responds to (yes/no)	Use (no. of symbols)	May use adaptations (yes/no)
1. Speech			
2. Printed word			
3. Bliss or other symbols			
4. Pictures			
5. Photographs			
6. Objects (e.g., points to)			
7. Manual signs			

III. Other

- _____ 1. Does the individual come from a bilingual or non-English speaking home?
- _____ 2. Should an electronic board be considered?

Appendix C**Personal Interest Inventory**

Name: _____

Where I live: _____

Schools I have attended: _____

My favourite teachers: _____

My favourite subjects: _____

The best field trip I went on: _____

My favourite food: _____

My favourite movie: _____

My favourite T.V. show: _____

My hobbies: _____

My family members: _____

Things I like to do with my friends: _____

Things I like to do with my family: _____

Pets: _____

Things I am good at: _____

Someone that is a role model to me is _____

Other things about me:

Appendix D

Recording Sheet for Observations										Condition:	
for Communicative Interactions and Disruptive Behavior										Baseline (A)	
										Intervention (B)	
X=occurrence		Observer:				Participant:					
Session											
		Communicative Interaction				Disruptive Behavior				Rate per min.	
Start:											
Finish:											
Total:											
		Communicative Interaction				Disruptive Behavior				Rate per min.	
Start:											
Finish:											
Total:											
		Communicative Interaction				Disruptive Behavior				Rate per min.	
Start:											
Finish:											
Total:											
		Communicative Interaction				Disruptive Behavior				Rate per min.	
Start:											
Finish:											
Total:											
		Communicative Interaction				Disruptive Behavior				Rate per min.	
Start:											
Finish:											
Total:											

Do not mark as an occurrence any response that was physically prompted physical prompts are for instructional purposes only.

Other Observations:	Behavior Definitions:	2. Disruptive Behavior
	1. Interaction: pointing	out of seat, screaming,
	responding, using yes/no	grabbing materials
		severe self-stimulation