Assessing the Effectiveness of Tactile Stimulation for Task-Related Behaviors and Language Comprehension on Two Children with Autism

Lynn A. Patterson
Eastern Illinois University
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Assessing the Effectiveness of Tactile Stimulation for Task-Related Behaviors and Language Comprehension on Two Children with Autism

BY

Lynn A. Patterson

THESIS

Submitted in partial fulfillment of the requirements for the degree of Master of Science in the Graduate School, Eastern Illinois University, Charleston, Illinois

1999

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Assessing the Effectiveness of Tactile Stimulation for Task-Related Behaviors and Language Comprehension on Two Children with Autism

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Abstract

Previous research has investigated the effects of tactile stimulation on autistic behavior in the realm of occupational therapy (McClure, & Holtz-Yotz, 1991; Zisserman, 1991); however, no studies were found which investigated the effects of tactile stimulation on autistic behavior within the realm of speech-language pathology. This study was conducted to examine the effects of tactile stimulation on task-related behaviors and language comprehension.

The subjects were two school-aged males with Pervasive Developmental Disorder (Autism) grouped for speech-language therapy. The subjects exhibited difficulties in modulating sensory input in the areas of tactile/proprioceptive functioning, as assessed by an occupational therapist. Both subjects were given tactile stimulation in the form of stress balls to use during a receptive/expressive language comprehension activity. The frequency of task-related behaviors was recorded, as judged by the number of off-task behaviors and extraneous physical behaviors, when tactile stimulation was provided and absent. In addition, language comprehension was assessed by recording the number of task-related verbalizations and non-task-related verbalizations when tactile stimulation
was present and absent. Finally, the frequency of appropriate and inappropriate utilization of tactile stimulation was recorded as well.

Results of the study revealed a significant difference between the frequency of off-task behaviors and the presence of tactile stimulation. When tactile stimulation was provided, the number of off-task behaviors decreased as compared to when tactile stimulation was not provided. In addition, a significant difference was found between the frequency of extraneous physical behaviors and the presence of tactile stimulation. When tactile stimulation was provided, the number of physical movements decreased as compared to when tactile stimulation was not provided. A significant difference was not found between task-related verbalizations and non-task-related verbalizations when tactile stimulation was provided. Finally, results revealed a significant difference between appropriate and inappropriate use of tactile stimulation, indicating that when tactile stimulation was provided it was used appropriately.

These findings suggest that the use of tactile stimulation could be successful in reducing the frequency of off-task behaviors in certain individuals with autism, which could, consequently, facilitate improved attention to educational tasks. In addition, when tactile stimulation is provided to individuals with autism, it could significantly reduce the
frequency of extraneous physical behaviors displayed; consequently, the amount of disruptions caused by the student and others around the student would be reduced. These implications could be of assistance to individuals providing educational related services to individuals with autism.
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Chapter 1
Review of the Literature

According to Webster’s dictionary, the word *pervasive* means to become diffused throughout all parts of the whole (Steinmetz, 1997). When utilized in defining the disorders of children and adults, the term *pervasive* connotes that all areas of functioning are affected. Pervasive developmental disorder is a term used to describe a group of rare developmental disorders characterized by communicative, cognitive, social, and behavioral impairments (Janzen, 1996). There is no single disorder called pervasive developmental disorder; rather there is an array of developmental disorders varying in diagnostic criteria. The most widely researched and recognized subset of pervasive developmental disorders is autism.

In 1943, child psychologist Dr. Leo Kanner described an enigmatic group of children with a distinctive set of features. The common behaviors Kanner noted included an exceptional inability to relate to others, mutism or atypical language and speech, an insistence on maintaining sameness in the environment, lack of imagination and playfulness, and certain isolated areas of ability. Kanner chose to term the children’s puzzling behaviors as *autism*. The derivation of autism is “self,” which accurately described the self-isolated behaviors of the children observed (Kanner, 1943). Although Kanner’s historical first descriptions of autism have undergone narrow refinement through years of research, his broad behavioral descriptions remain as the hallmark features of the disorder.

Due to the “syndrome” nature of the disorder, it is important to note that the definition of autism encompasses a composite of diagnostic criteria. According to *The Diagnostic and Statistical Manual of Mental Disorders,*...
Fourth Edition (DSM-IV, 1994), the minimum requirements for the diagnosis of autistic syndrome disorder include the following:

A. A total of 6 (or more) items from 1, 2, and 3, with at least two from 1, and one each from 2 and 3:

1. Qualitative impairment in social interaction, as manifested by at least two of the following:
   a. Marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction;
   b. Failure to develop peer relationships appropriate to developmental level;
   c. A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people;
   d. Lack of social or emotional reciprocity.

2. Qualitative impairments in communication as manifested by at least one of the following:
   a. Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture and mime);
   b. In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others;
   c. Stereotyped and repetitive use of language or idiosyncratic language. Lack of varied, spontaneous, make-believe play or social-imitative play appropriate to developmental level.

3. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:
   a. Encompassing preoccupation with one or more stereotyped and restrictive patterns of interest that is abnormal either in intensity or focus;
b. Apparently inflexible adherence to specific, nonfunctional
   routines or rituals;
c. Stereotyped and repetitive motor mannerisms;
d. Persistent preoccupation with parts of objects.

B. Delays or abnormal functioning in at least one of the following areas
   with onset prior to age three: (1) social interaction, (2) language as used
   in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett’s Disorder or
   Childhood Disintegrative Disorder.

Autism is often a debilitating, lifelong developmental disorder that is
evident in childhood. It occurs in approximately 15 of every 10,000 births
with a higher incidence in males (Autism Society of America, 1989). It
ranges in severity from mild to severe, and can occur either by itself or in
combination with other disorders. The etiology of autism is currently
unknown; however, research has substantiated neurophysiological and
biochemical etiologies of the brain in addition to sensorimotor and
perceptual motor processing deficits (Ornitz & Ritvo, 1976; Hopkins &
Smith, 1983; Powers, 1990). Despite the relatively low incidence of autism,
it has attracted the recognition of curious researchers, teachers, and other
professionals involved in the complex problems associated with
communication, learning, and social deficits.

As delineated in the DSM-IV, language and communication
impairments are salient features of autism; in fact, these deficits often yield
the first indications of the disability (Mundy, Sigman, & Kasari, 1990). Fay
and Schuler (1980) describe difficulties involving both the comprehension of
language and the utilization of language as the basic handicapping
conditions of autism. Specific difficulties include problems initiating or
responding to questions, poor turn taking and topic maintenance, and poor sustained attention (Ogletree, Fischer, & Sprouse, 1995; Rutter, 1978). Many researchers have hypothesized that behavioral problems are secondary as a result of the primary communication and language deficits within autism (Koegel, Valdez-Menchaca, & Koegel, 1994; Rutter, 1978). A vast amount of research has been conducted in the area of language and autism; however, continued research is needed in order to better delineate etiologies, deficit areas, and develop more efficacious treatments.

One of the concentrated areas in research of autism has been the suspected etiologies and the related treatments for autism. This research has progressed throughout the years in accordance with a greater knowledge of neurological bases and a greater understanding of the behaviors associated with the disorder.

Early literature on autism hypothesized in overextended psychological theories, such as unconscious hostility and parental rejection as the possible causes of the disorder. The term “refrigerator parents” emerged based on a belief that uncaring, cold parents were the source of autism in children (Nelson, 1984; Bettelheim, 1967). This theory resulted in psychodynamic therapy interventions focused on the resolution of underlying conflicts rather than toward known deficit areas, such as language behavior. These traditional therapies were based on the assumption that language disorders were secondary to emotional disorders. However, these therapies produced no substantial change in autistic behavior (Fay & Schuler, 1980).

Evidence of a cognitive-neurologic etiology generated new intervention approaches (Schopler & Mesibov, 1985; Powers, 1990. Consequently, interventions based upon behavioral theories emerged. As previously described, maladaptive behavior and communication deficits are
prominent features of autism; therefore, an abundance of programs focusing on the elimination of aberrant behavior and remediation of communication disorders through behavioral approaches were developed and advocated.

Behavior modification, also known as applied behavior analysis, is a method that arose from early operant conditioning models (Lovaas, 1977). This theory emphasizes the study of relationships between environmental stimuli and the resulting behaviors, which are directly observable events. Some studies, which have investigated this type of intervention, have shown marked improvements in the behavior of children with autism. For instance, in a study conducted by Ivar Lovaas (1987), 47% of the experimental group receiving intensive behavioral treatment for two years achieved normal intellectual and educational functioning, while only 2% of the control group achieved the same outcome. The results of this study and others are noteworthy; however, limitations are evident in the study such as questionable methodology and lack of replicability (Campbell, Schopler, Cueva, & Hallin, 1996). Lovaas (1987) even noted the restrictive nature of utilizing such controlled environments.

Although the intervention has proven beneficial in some cases, concerns about the functional efficacy of behavior modification are evident. Children who receive this intervention may have difficulty generalizing learned behaviors to different situations and environments (Schopler & Mesibov, 1985; Seibert & Oller, 1981). In addition, the treatment focuses sole attention on specific, observable behaviors in highly controlled environments, ignoring possible reasons prompting the behavior (Nelson, 1984). Although behavioral approaches may eliminate targeted behaviors, replacement behaviors often emerge which could be either negative or positive in nature (Fischer, Murray & Bundy, 1991). A major clinical
concern is that behavioral approaches treat the outward symptoms or behaviors, but do not investigate the underlying deficits of the disorder (Nelson, 1984). These problems do not necessarily belong to behaviorism alone; however, it is imperative that the symptomatology of the disorder is understood in order for intervention to be successful.

Treatment programs that focus on symptoms often fail because the programs do not eliminate the deficits associated with the disorder; therefore, if efforts are made to treat the covert deficits, the overt deficits will consequently be remediated. Some of the possible deficits associated with autism include the ability to process, organize, interpret and respond to sensory stimuli of the surrounding environment (Ayres, 1979). Ayres (1979) proposed a therapy strategy called sensory integration to address these deficits. Ayres defined sensory integration, which occurs at the level of the brainstem, as “the organization and processing of sensory information from different sensory channels for a specific purpose” (Ayres, 1979). The particular purpose may include perceiving the body or world, relating input from one’s sensory system to another, or producing some adaptive response to enhance the learning process. In order to understand the concept of sensory integration, a brief discussion of information processing is warranted.

For a normal child, sensory stimuli from the environment enter the body through the various sensory systems. The sensory systems include vestibular (balance), proprioceptive (movement)/tactile (touch), visual (sight), and auditory (hearing). Normal functioning allows the brain to organize and process sensory input by integrating sensory information received through all of our senses. If the sensory systems are working well, then motor development and higher functioning skills should develop
normally (Mailloux, 1987). This sensory input allows individuals to respond appropriately to the environment (Trott, Laurel & Windeck, 1993). On the contrary, if these sensory systems cannot function well together, it adversely affects the child's interaction with the environment and learning (Anderson & Emmons, 1996).

The neurological systems of children with autism often appear unable to utilize sensory stimuli effectively. The inefficiency often, but not in all cases, leads to sensory defensiveness in the form of disruptive, inappropriate behavior (Ayres, 1974). Wilbarger and Wilbarger (1991) define sensory defensiveness as the "tendency to react negatively or with alarm to sensory input that is generally considered harmless or non irritating". Thus, these behaviors represent a neurological reaction to overwhelming stimuli. Richard (1997) suggests that behavioral outbursts and poor attention problems, which are prominent in individuals with autism, could possibly be attributable to this phenomenon. As previously mentioned, communication deficits are prominent features of autism which may render individuals with autism incapable of describing their possible sensory deficits.

A majority of children with autism do not seem to be able to cope with certain sensory input received and possibly have difficulty organizing the information. According to Ayres (1979), the following aspects of poor sensory processing are observed in children with autism:

1. Neurologically, sensory input is registered through either a hypo- or hyper-reactive response;
2. Sensory input is not modulated correctly, which results in defensive reactions to stimuli;
3. Sensory input does not result in a positive behavioral response from the child.
These three neurological based deviances found in some children with autism can have negative implications on daily functioning. These negative impacts are often visibly evident in the form of the atypical behavior of individuals with autism.

Based on Ayres’ theory, abnormal behavior in autistic children can be directly related to their possible aberrant sensory responses. When the nervous system spends a large amount of time defending itself from sensations which are impossible to process and define as meaningful, the result is difficulty interacting with the world in an appropriate way. The child continues to seek ways to fulfill a biological need for sensory input or to lessen input; however, the fulfillment may be maladaptive in nature, thus causing aberrant behavior (Snider, 1991). Consequently, the uneducated observer often misinterprets behavior within an individual with autism. The observer, in turn, often treats the resulting behavior and does not understand the true source of the problem. Additionally, Ayres hypothesized in Sensory Integration and Learning Disorders (1974) that the learning difficulties associated with individuals with autism could be a reflection of their inability to process sensory information. She suggested incorporating sensory integration therapy as a supplement to academic teaching in order to help individuals modify their sensory processing deficits, which is the proposed underlying etiology of their learning difficulties. Thus, intervention is aimed at remediating the proposed cause and not simply the resulting symptoms (Ayres, 1974).

The sensory systems of children with autism often do not function in the same capacity as normal individuals. The presence or absence of aberrant sensory responses can be evaluated and interpreted by professionals knowledgeable in sensory integration assessment.
Assessment of sensory integration is completed by a certified and licensed occupational therapist utilizing standardized tests and informal observations. Tools such as the Sensory Integration and Praxis Test (Ayres, 1989), Sensory Integration Inventory for Individuals with Developmental Disabilities (Reisman & Hanchu, 1992), and the DegangiBerk Test of Sensory Integration (Degangi & Berk, 1983) are available to guide the occupational therapist in assessing the integrity of the child’s sensory systems. Interpretation of the findings produces a sensory profile of the child’s integrative strengths and weaknesses of the five sensory systems including vestibular, proprioceptive/tactile, visual, and auditory. Once the sensory system(s) affected are identified, intervention can begin. Of the five sensory systems evaluated in children with autism, the tactile system is often a system targeted in therapy for older children.

The tactile system is considered the most important of the senses for human growth and development (Montagu, 1971). Nerves beneath the skin’s surface send information to the brain for processing. This information is important in perception and adaptation to the environment. A disturbance of the tactile system can have negative effects on development and learning. Of the five sensory systems, the tactile system is often the most recognized system adversely affected within autism. From early infancy, the possible inability of individuals with autism to integrate tactile stimulation is evident. These possible problems result in the avoidance of touch and/or aversive responses to touch (Fischer, Murray, & Bundy, 1991). Ayres (1979) designated the term tactile defensiveness to represent “the tendency to react negatively and emotionally to touch sensations”. Often children with autism suffer from tactile defensiveness due to the neurological overreaction to sensory input (Ayres, 1974). However, due to the communication deficits
exhibited by the majority of children with autism, disorders within the tactile sensory system are not always reliably reported or acknowledged.

Many verbal individuals with autism have offered unique perspectives on the phenomena of living with a tactually defensive system, and offered insight regarding treatment for the disorder. Grandin, (1995) emphasized the importance of deep pressure and tactile input for their calming effects in persons with autism. Her invention of the “squeeze machine”, a padded device used to apply pressure to the whole body, was created to fulfill her intense desire for pressure stimulation and its calming effects (Grandin, 1995). Other verbal individuals with autism have also expressed calming sensations as a result of deep pressure and tactile stimulation (Williams, 1996; McKean, 1994).

It is hypothesized that the “calming sensations” experienced as a result of tactile stimulation in individuals with autism can facilitate focused on-task attention. An increase in on-task focus can provide beneficial effects within the realm of speech-language pathology. As discussed previously, speech and language disorders frequently accompany the disorder of autism; thus, speech-language pathology services often are sought for help in remediating the associated deficits.

There are reported studies in the literature, which support a relationship between possible sensory dysfunction and speech and language deficits (Reilly, Nelson, & Bundy, 1983; Bilto, 1971). Speech and language develop as a result of processing sensory input from the environment; consequently, sensory integration techniques should improve speech and language. Although pure sensory integration therapy is exclusively within the domain of a licensed occupational therapist, application of the theory through the subsets of sensorimotor and sensory stimulation activities can be
conducted by professionals within other disciplines (Fischer, Bundy, & Murray, 1991). Sensorimotor and sensory stimulation involve the manipulation of one of the sensory systems (vestibular, proprioceptive/tactile, visual, auditory) and their effects on certain behaviors can be analyzed. Adjunct therapeutic and educational providers, such as speech-language pathologists, special educators, classroom teachers, and parents can use similar principles in their treatment regimens for individuals with autism.

A review of literature revealed several studies conducted to evaluate sensory integration/sensorimotor/stimulation therapies and their effects on speech and language. Ayres and Mailloux (1981) studied the rate of language growth (based on receptive and expressive standardized test scores) in four preschool children, three boys and one girl diagnosed as aphasic. Three of the four children had received speech and language therapy, special education specific to aphasia, or both, before beginning the study. Baseline data were gathered on both receptive and expressive language and sensory integrative functioning. All children showed sensory integration dysfunction. The results after a year of sensory integration therapy indicated that all the children showed an increase in language comprehension that was greater than previous increases in speech and language therapy; two of the four children showed notable gains on expressive language measures. It is important to note that the study did not incorporate control subjects to differentiate maturation or historical influences (e.g., other teaching) versus treatment effects.

Magrun, Ottenbacher, McCue, and Keefe (1981) found vestibular stimulation (input of stimuli in the inner ear) to be an effective nonverbal intervention method for facilitating spontaneous language in a group of five
primary-age trainable mentally retarded children with a wide range of language abilities, and a group of five developmentally delayed preschoolers who showed severe language delays. Results showed an increase in spontaneous language use for both groups immediately after vestibular stimulation, which was more pronounced in the younger and generally more severely language-handicapped children. However, no evidence of long-term results was noted in the study.

Kantner, Kantner and Clark (1982) conducted a study of thirty mentally retarded children aged 5 - 14 years who were enrolled in both speech therapy and special education classes. The purpose of the study was to investigate the effects of vestibular stimulation as a supplemental therapy on language abilities. The experimental group, which received passive vestibulation in addition to speech therapy, showed increases in language productions. However, an analysis of variance did not reveal the differences between the groups to be statistically significant.

Reilly, Nelson and Bundy (1983) compared sensorimotor to fine motor activities in the elicitation of vocalizations of children with autism. The sensorimotor activities included in the experimental group consisted of vestibular and proprioceptive input. The fine motor activities involved selected tabletop activities in a fixed order. The study failed to find significant differences in spontaneous verbalizations within the sensorimotor activities. The authors did note that several methodological problems existed within the study such as a limited experimental time period, lack of clearly defined dependent variables, and no intrajudge reliability.

A review of the literature revealed many studies investigating the effects of sensory integration, vestibular stimulation, and sensorimotor stimulation on language. The literature reviewed was not conclusive, yet no
published studies were found on the utilization of tactile stimulation and its effects on language.

Without an empirical basis, informal observations and impressions are all that exist concerning the use of tactile stimulation within autism in the realm of speech-language pathology. Clinically, improved behavior has been observed when tactile stimulation is provided to individuals with autism. Despite the clinical anecdotes, no controlled research studies have investigated the effects of tactile stimulation on language-related tasks in individuals with autism. To examine this possible relationship, a pilot study was conducted in the context of a single subject research design. Two children with autism participated. Both were assessed by a certified occupational therapist as having difficulties modulating sensory stimuli of the tactile/proprioceptive systems. The pilot study investigated the level of appropriate and inappropriate task-related behaviors during a language comprehension activity in the presence and absence of tactile stimulation (Patterson & Gibson, 1997). Specifically, the dependent variables were (a) frequency of off-task behaviors, (b) frequency of on-task attention behaviors, and (c) number of responses. All dependent variables were compared under conditions when tactile stimulation was provided and when no tactile stimulation was provided. Analysis revealed increases in the frequency of on-task attention behaviors when tactile stimulation was provided and of off-task behaviors when tactile stimulation was not provided. Results suggested that the application of a tactile stimulatory component in speech-language therapy increased on-task attention to the language comprehension activity. In addition, the frequency of off-task behaviors decreased during periods of tactile stimulation, which also suggested that tactile stimulation facilitated attention to the language
comprehension activity. It must be noted that limitations existed, such as a small number of data collection periods and a language comprehension accuracy level was not obtained.

As discussed earlier, the potential benefits of tactile stimulation to facilitate language-related tasks have not been substantiated within the literature. In fact, no studies were found which investigated the effects of tactile stimulation on autistic behavior outside the realm of self-stimulatory behaviors (McClure, & Holtz-Yotz, 1991; Zissermann, 1991). This supports the need for evaluating current clinical practice of using tactile stimulation in controlled research studies. Although a pilot study was conducted to explore these effects, limitations were evident. Consequently, the present study was designed to measure the effects of task-related behaviors and language comprehension when tactile stimulation was provided to individuals with pervasive developmental disorder/autism. The following research questions were addressed:

1. Is there a significant difference in the frequency of off-task behavior when tactile stimulation is provided, as opposed to its absence, in an individual with autism during a language comprehension task?
2. Is there a significant difference in the frequency of extraneous physical behaviors when tactile stimulation is provided, as opposed to its absence, in an individual with autism during a language comprehension task?
3. Is there a significant difference in the frequency of task-related verbalizations when tactile stimulation is provided, as opposed
to its absence, in an individual with autism during a language comprehension task?

4. Is there a significant difference in the frequency of non-task-related verbalizations when tactile stimulation is provided, as opposed to its absence, in an individual with autism during a language comprehension task?

In addition, the following secondary research question was investigated:

Is there a significant difference between the frequency of appropriate ball use and inappropriate ball use when tactile stimulation is provided in an individual with autism during a language comprehension task?
Chapter 2

Methods

The effectiveness of tactile stimulation on various behaviors in two children with autism was investigated in this study. The independent variable for the study was the presence of tactile stimulation. The dependent variables were the frequency of off-task behaviors, the frequency of extraneous physical behaviors, the frequency of task-related verbalizations and the frequency of non-task-related verbalizations. Dependent variables were observed and recorded during a language comprehension activity facilitated by a graduate student in speech-language pathology.

Subjects

Two school-aged males grouped for speech-language therapy were the subjects for the study. Independent multidisciplinary professionals unrelated to the study diagnosed both with Pervasive Developmental Disorder (Autistic Disorder) in the absence of cognitive impairment. Both subjects were enrolled in regular education classes in the public school system with one-on-one aides.

Subject 1 was an eight-year old male diagnosed with Pervasive Developmental Disorder (Autistic Disorder) with associated language delay as assessed by several independent professionals unrelated to the study. His intelligence was judged to be within an average range as demonstrated by the Differential Ability Scales (Elliott, 1990). Receptive language on the Peabody Picture Vocabulary Test-Revised (Dunn, 1981) was below age level. The school speech-language pathologist noted articulation deficits. He did not engage in frequent or consistent self-stimulatory or inappropriate
social behavior. The subject was from a two-parent family with a younger female sibling, and was in good health. Hearing abilities were normal.

The subject's formal education began in an early childhood special education classroom. He attended a regular second grade classroom with a one-to-one aide assigned to work with him throughout the day. He received speech-language and occupational therapy during school, and private speech-language therapy two times a week at a university clinic.

Assessment of the subject's sensory integrative functioning was conducted by an occupational therapist through observation-based assessments using the Sensory Integration and Praxis Test (Ayres, 1989) as a guide. The subject exhibited difficulty in modulating sensory input in the areas of tactile/proprioceptive functioning. As previously described, this assessment is used by occupational therapists to identify the sensory system(s) affected and guides the development of intervention procedures.

Subject 2 was a nine-year old male. Evaluation by several independent professionals resulted in a primary diagnostic label of Pervasive Developmental Disorder (Autistic Disorder), Attention Deficit Hyperactivity Disorder, and associated language deficits. Intelligence was judged to be within a normal range as determined by the Wechsler Intelligence Scale for Children, Third Edition (Wechsler, 1993). Expressive and receptive language test scores were age appropriate with the exception of pragmatic and social aspects of language. He did not engage in frequent or consistent self-stimulatory or inappropriate social behavior. The subject was from a two-parent family with an older female sibling and was in good health. Hearing abilities were normal. The subject was on 60 mg of Ritalin per day for control of Attention Deficit Hyperactivity Disorder symptoms.
Subject 2 attended a regular third grade class with a one-to-one aide assigned to work with him throughout the day. He received speech-language and occupational therapy during school, and private speech-language therapy two times a week at a university clinic. Assessment of the subject's sensory integrative functioning was conducted by an occupational therapist through observation-based assessments using the Sensory Integration and Praxis Test (Ayres, 1989) as a guide. The subject exhibited difficulty in modulating sensory input in the areas of tactile/proprioceptive functioning.

Parental permission to participate in the study was obtained for both subjects (Appendix A). The Eastern Illinois University Grants and Research Committee to insure human subject research approval reviewed the research procedures (Appendix B).

Equipment

Sessions were recorded by a Panasonic SZPB four-head videocassette recorder, model AG-2530 on a tripod. Recordings were compiled on a Polaroid Supercolor Plus videocassette, then viewed on a RCA ColorTrak 2000 television. Two 2' X 2' carpet squares and two identical spherical stress balls were used during half of the data collection period. For audio development and projection of time interval recording, a 60-Minute Memorex cassette was used in a RQ 2101 Panasonic cassette recorder.

Procedures

Data were collected during one segment of each clinical session conducted at the Eastern Illinois University Speech-Language-Hearing Clinic over an eleven-week time period. Sessions were conducted two days
a week (Monday and Wednesday) for forty-five minutes per session. All sessions were conducted within the same room at approximately the same time of day. The original projected dates of data collection were February 2, 1998 through March 11, 1998; however, due to subject absences, the dates of data collection were extended from February 2, 1998 through April 15, 1998.

Data were collected during a receptive/expressive language comprehension activity in which both subjects were involved. The estimated duration of the data collection segment was approximately ten to fifteen minutes of the forty-five minute session. The subjects were positioned on individual carpet squares during the language comprehension task. The facilitator of the language activity was a graduate student clinician in speech-language pathology with previous clinical experience. The graduate clinician was naive to the purpose of the study and was supervised by a professor of speech-language pathology with a Certificate of Clinical Competence. The receptive/expressive language comprehension activity consisted of a book read by the graduate student clinician. The clinician would ask both subjects receptive and expressive language comprehension questions after reading each page of the book. The books read by the clinician and the questions asked by the clinician were not standardized or controlled in the study.

The independent variable for the study was the use of stress balls as a form of tactile stimulation. This form of stimulation was an accepted form of tactile stimulation as judged by a certified and licensed occupational therapist. The presentation of tactile stimulation consisted of the clinician giving the subjects the balls at the appropriate scheduled time (to be discussed later). The only explanation given to the subjects by the clinician
was “Just squeeze them”. No additional information was provided to reduce the effects of instructions. The clinician would then either begin or continue the language activity, according to the order of the independent variable for that day. No instruction was given to the clinician in regards to reminders.

The experimental independent variable of tactile stimulation was introduced by the clinician in the beginning of the language activity or at the midpoint of the activity, as judged by the clinician. To control for a possible sequencing effect of the independent variable, maturation of the subjects, and historical effects, the balls were presented in an alternating treatment design using a counterbalanced method of presentation. During the first data collection session of a week, the balls were presented at the beginning of the language activity and withdrawn at the middle of the activity. In the next consecutive data collection session, the balls were presented at the midpoint of the activity. For example, if “A” represented the presentation of the balls and “B” represented the absence of the balls, the order was AB in one week and BA the following week. The original proposed schedule of tactile presentation is charted in Table 1. Due to a misunderstanding of the presentation schedule and subject absences, the actual schedule of tactile presentation is charted in Table 2.
Table 1. Original proposed schedule of tactile presentation

<table>
<thead>
<tr>
<th>WEEK</th>
<th>MONDAY</th>
<th>WEDNESDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Beginning (A)</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Beginning (A)</td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Beginning (A)</td>
</tr>
</tbody>
</table>

Table 2. Actual schedule of tactile presentation

<table>
<thead>
<tr>
<th>WEEK</th>
<th>MONDAY</th>
<th>WEDNESDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Beginning (A)</td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 8</td>
<td>Tactile at Beginning (A)</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 9</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Beginning (A)</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>Data Not Available</td>
<td>Tactile at Middle (B)</td>
</tr>
<tr>
<td>WEEK 11</td>
<td>Tactile at Middle (B)</td>
<td>Tactile at Middle (B)</td>
</tr>
</tbody>
</table>
Entire sessions were recorded on videotape; however, only the language comprehension activity was utilized in the study. The dependent variables were assessed from the videotapes of the activity. The researcher, a graduate student in speech-language pathology, who viewed all recorded segments, conducted this assessment. The researcher developed a data collection form (Appendix C). Operational definitions of dependent variables were as follows:

1. **OFF-TASK BEHAVIORS**
   - Subject’s body or body part is outside of carpet square and interferes with task focus of subject or others. (Example: rolling around on floor)
   - Subject is generating verbal disruption that interferes with task focus of subject or others. (Example: yelling)
   - Subject exhibits disruptive/inappropriate physical behavior, which interferes with task focus of subject or others. (Example: hand flapping that disrupts task)

2. **EXTRANEOUS PHYSICAL BEHAVIORS**
   - Subject is on carpet square displaying physical behavior unrelated to the ball that does not disrupt task focus of subject or others (Example: subject is grasping curtains behind him, but is still focused on task).

3. **TASK-RELATED VERBALIZATIONS**
   - The subject displays verbal behavior related to the task.

4. **NON-TASK-RELATED VERBALIZATIONS**
   - The subject displays non-task related verbal behavior.
The following were secondary dependent variables that were recorded and analyzed:

A. **APPROPRIATE BALL USE-**
   - The ball is in the subject's control and is not in contact with another person. **NOTE:** Can only occur with the presence of tactile stimulation.

B. **INAPPROPRIATE BALL USE-**
   - The ball is out of the subject's control or is in contact with another person. (Example: rolls away, thrown out of possession)
   **NOTE:** Can only occur with the presence of tactile stimulation.

The measurement of the dependent variables was conducted using interval recording. An audiotape with ten-second observation intervals and subsequent five-second recording intervals was prerecorded and used by the researcher throughout the data collection process. The researcher recorded the occurrence of dependent variables noted during the observation times (both when the balls were provided and when they were not) on the data collection form (Appendix C). To guarantee equal amounts of presentation time with and without the tactile stimulation, an equal number of intervals were used when analyzing dependent variables. Remaining intervals were not analyzed. The observation and recording of dependent variables were conducted for one subject at a time. After dependent variable behaviors of Subject 1 had been observed and recorded, the video was viewed again and identical charting procedures were followed for Subject 2.
Analysis

Interjudge reliability was obtained by comparing the researcher's recordings of dependent variables to another speech-language pathology graduate student clinician's recordings. A one-hour training session was conducted by the researcher to establish the procedures for the dependent variable behaviors. Thirty-three percent (4 of 12 sessions) of the recorded videotape segments were reviewed, and dependent variables were recorded by the other clinician in order to establish interjudge reliability. Agreement assessment in each instance of observed behavior was made between the researcher and the other clinician using a Point-by-Point Agreement Ratio. The ratio, which evaluates agreement on a response-by-response basis, consists of the following ratio:

\[
\text{Point-by-Point Agreement Ratio} = \frac{A}{A+D} \times 100
\]

Where 

- \( A \) = agreements for the interval
- \( D \) = disagreements for the interval

A t-test (Watt & Van Den Berg, 1995) was used to assess the statistical differences within each of the dependent variables for both subjects. The statistic was designed to analyze parametric interval data involving small (n) samples. Utilization of the statistic allowed treatment effect generalizations to be made, given the same conditions are replicated. The test was performed using the Number Cruncher Statistical System (Hintze, 1995).
Chapter 3

Results

The purpose of this study was to measure the effects on task-related behaviors and language comprehension when tactile stimulation was provided and not provided to individuals with pervasive developmental disorder/autism.

A Point-by-Point Agreement Ratio (Kazdin & Tuma, 1982) was utilized to examine the interjudge reliability between the researcher’s recordings of dependent variables and another graduate student’s recordings of dependent variables. The ratios for each dependent variable and each subject are summarized in Table 3 and Table 4.

Table 3. Interjudge reliability for Subject 1

<table>
<thead>
<tr>
<th>Tactile Provided</th>
<th>Tactile Not Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-Task</td>
<td>100%</td>
</tr>
<tr>
<td>Physical</td>
<td>99%</td>
</tr>
<tr>
<td>Task-Related</td>
<td>92%</td>
</tr>
<tr>
<td>Non-Task-Related</td>
<td>93%</td>
</tr>
<tr>
<td>Appropriate Ball</td>
<td>100%</td>
</tr>
<tr>
<td>Inappropriate Ball</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 4. Interjudge reliability for Subject 2

<table>
<thead>
<tr>
<th></th>
<th>Tactile Provided</th>
<th>Tactile Not Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-Task</td>
<td>100%</td>
<td>99%</td>
</tr>
<tr>
<td>Physical</td>
<td>94%</td>
<td>97%</td>
</tr>
<tr>
<td>Task-Related</td>
<td>95%</td>
<td>93%</td>
</tr>
<tr>
<td>Non-Task-Related</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>Appropriate Ball</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Inappropriate Ball</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

A t-test (Watt & Van Den Berg, 1995) was used to examine statistically significant differences in each of the dependent variables when tactile stimulation was provided and when tactile stimulation was not provided. All data collection periods were combined into the individual dependent variables by subject.

The first t-test examined the difference in off-task behavior when the balls were provided as opposed to when the balls were not provided. The statistical differences for each subject are summarized in Table 5.

Table 5. Statistical differences between combined sessions off-task behavior for tactile stimulation provided (p) and not provided (n).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean (p)</th>
<th>Mean (n)</th>
<th>t-value</th>
<th>Prob</th>
<th>r/ = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>1.411765</td>
<td>3.470588</td>
<td>-2.3870</td>
<td>0.011534*</td>
<td></td>
</tr>
<tr>
<td>Subject 2</td>
<td>0.533333</td>
<td>1.733333</td>
<td>-1.9126</td>
<td>0.033039*</td>
<td></td>
</tr>
</tbody>
</table>

* p < 0.05
A probability of \( p < 0.05 \) indicated that a statistically significant difference existed between the mean frequency of off-task behaviors and the provision of tactile stimulation in each subject. That is, off-task behaviors increased when the balls were not provided in both subjects. To better illustrate, graphic representations (Graphs 1 and 2) of raw data show that there was a large difference in the frequency of off-task behaviors when tactile stimulation was not provided in both subjects. In addition, graphs of session-by-session data for each subject are located in Appendix D.

Graph 1. Subject 1 - Graphic representation of mean off-task behaviors for tactile stimulation provided and not provided

![Graph 1](image1)

Graph 2. Subject 2 - Graphic representation of mean off-task behaviors for tactile stimulation provided and not provided

![Graph 2](image2)
The second t-test examined the differences in extraneous physical behaviors when tactile stimulation was provided as opposed to tactile stimulation not provided. The statistical differences for each subject are summarized in Table 6.

Table 6. Statistical differences between combined sessions extraneous physical behaviors for tactile stimulation provided (p) and not provided (n).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean</th>
<th>t-value</th>
<th>Prob /r/ = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>6.82353 (p)</td>
<td>-1.9253</td>
<td>0.031558*</td>
</tr>
<tr>
<td></td>
<td>10.11765 (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 2</td>
<td>4.60000 (p)</td>
<td>-3.3420</td>
<td>0.001186*</td>
</tr>
<tr>
<td></td>
<td>9.40000 (n)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < 0.05

A probability of p < 0.05 indicated that a statistically significant difference between the mean frequency of extraneous physical behaviors and tactile stimulation provided was evident in both subjects. This signifies that when the balls were not provided to these subjects, the mean frequency of extraneous physical behaviors increased. Graphs 3 and 4 represent the raw data for each subject. Note that when tactile stimulation was not provided, the number of extraneous physical behaviors increased. Graphic representations of the session-by-session data for each subject are located in Appendix D.
The third t-test was computed from the total number of task-related verbalizations recorded by each subject when tactile stimulation was provided and when tactile stimulation was not provided. Table 7 displays the statistical differences.
Table 7. Statistical differences between combined sessions task-related verbalizations for tactile stimulation provided (p) and not provided (n).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean</th>
<th>t-value</th>
<th>Prob /r/ = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>7.764706 (p)</td>
<td>0.1879</td>
<td>0.573948</td>
</tr>
<tr>
<td></td>
<td>7.411765 (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 2</td>
<td>7.133333 (p)</td>
<td>0.4858</td>
<td>0.684558</td>
</tr>
<tr>
<td></td>
<td>6.466667 (n)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using a probability of $p < 0.05$, a statistically significant difference was not indicated between the mean frequency of task-related verbalizations when tactile stimulation was provided and not provided in both subjects. The raw data is summarized by subject in Graphs 5 and 6. Representations of session-by-session data for each subject are located in Appendix D.

Graph 5. Subject 1 - Graphic representation of mean task-related verbalizations for tactile stimulation provided and not provided.
Graph 6. Subject 2 - Graphic representation of mean task-related verbalizations for tactile stimulation provided and not provided

![Graph showing mean task-related verbalizations for tactile stimulation provided and not provided.](image)

The fourth t-test computed the statistical differences between the mean frequencies of non-task-related verbalizations recorded by each subject when tactile stimulation was provided and when tactile stimulation was not provided. Table 8 displays the statistical differences.

Table 8. Statistical differences between combined sessions non-task-related verbalizations for tactile stimulation provided (p) and not provided (n).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean</th>
<th>t-value</th>
<th>Prob /t/ = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(p)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 1</td>
<td>1.176471</td>
<td>-0.4077</td>
<td>0.343098</td>
</tr>
<tr>
<td></td>
<td>1.411765</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 2</td>
<td>0.533334</td>
<td>-0.7011</td>
<td>0.244506</td>
</tr>
<tr>
<td></td>
<td>0.866667</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using a probability of p < 0.05, a statistically significant difference was not indicated between the frequency of non-task related verbalizations...
when tactile stimulation was provided and not provided in both subjects. Graphic representations are shown in Graphs 7 and 8. Graphic representations of the session-by-session data for each subject are located in Appendix D.

Graph 7. Subject 1 - Graphic representation of mean non-task-related verbalizations for tactile stimulation provided and not provided

![Graph 7](image)

Graph 8. Subject 2 - Graphic representation of mean non-task-related verbalizations for tactile stimulation provided and not provided

![Graph 8](image)

A final t-test examined the differences between appropriate ball use and inappropriate ball use when tactile stimulation was provided. Table 9 shows the results for each subject.
Table 9. Statistical differences between combined sessions appropriate ball use (a) and inappropriate ball use (i) when tactile stimulation was provided.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mean</th>
<th>t-value</th>
<th>Prob</th>
<th>/t/ = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>15.47059 (a)</td>
<td>7.6241</td>
<td>0.000000*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.88235 (i)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 2</td>
<td>15.13333 (a)</td>
<td>9.6661</td>
<td>0.000000*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.86667 (i)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < 0.001

A probability of p < 0.001 indicated that a statistically significant difference between the mean frequency of appropriate ball use and inappropriate ball use did exist in both subjects when tactile stimulation was provided. In other words, when tactile stimulation was provided, the mean frequency of appropriate ball use was greater than that of inappropriate ball use. Graphic representations of raw data are shown in Graphs 9 and 10. In addition, graphs of the session-by-session data for each subject are located in Appendix D.

Graph 9. Subject 1 - Graphic representation of mean appropriate and inappropriate ball use for tactile stimulation provided
In conclusion, the presence/absence of tactile stimulation resulted in a statistically significant difference in both subjects for the following:

- frequency of off-task behaviors
- frequency of extraneous physical behaviors
- frequency of appropriate/inappropriate ball use

The presence/absence of tactile stimulation did not reveal statistically significant differences in the following:

- frequency of task-related verbalizations
- frequency of non-task-related verbalizations
Previous research studies have investigated the effects of sensory integration, vestibular stimulation, and sensorimotor stimulation on language (Ayres & Mailloux, 1981; Magrun, et. al., 1981; Kantner, et. al., 1982; Reilly, et. al., 1983). However, there were no published studies found on the utilization of tactile stimulation and its effects on language and task-related behaviors. Clinical impressions have suggested that tactile stimulation may have a beneficial effect on behavior and language comprehension in individuals with autism. Although informal impressions have been noted, these insights have not been substantiated with empirical research. The purpose of this study was to determine if a relationship existed between task-related behaviors or language comprehension and tactile stimulation in individuals with pervasive developmental disorder/autism.

Results of the study revealed statistically significant differences in the frequency of off-task behaviors when tactile stimulation was provided, as opposed to its absence, in both subjects during a language comprehension task. That is, when stress balls were given to the individual subjects during the task, the amount of off-task behaviors decreased as compared to when they did not have the stress balls.

The results of the study also revealed statistically significant differences in the frequency of extraneous physical behaviors when tactile stimulation was provided, as opposed to its absence, in both subjects during the language comprehension task. In other words, when the stress balls were given to the individuals, the amount of monitored physical movements decreased as compared to when they did not have the stress balls. During
the study, the subjects engaged in various extraneous physical behaviors, particularly when they did not have the stress balls. For example, both subjects shredded threads from the corners of their carpet squares, grasped the curtains behind them, rocked back and forth during the activity, etc. Although the subjects were still on-task, many times the behaviors resulted in distraction to the other subject and/or the clinician. In addition, the behaviors often escalated to a degree which eventually led to off-task behavior.

A statistically significant difference was not found in the frequency of task-related and non-task-related verbalizations when tactile stimulation was provided, as opposed to its absence, in both subjects during the language comprehension task. That is, when the stress balls were provided, the utterances made by the individuals were not found to be more on-task or less on-task as compared to when they did not have the stress balls. A possible explanation is that the non-standardized language comprehension questions asked during the task were not structured in a way that could detect a difference. For example, a majority of the questions asked by the clinician only required a yes or no response. This fact could have skewed the results in that the subject could answer the questions with minimal processing demand. In addition, this study did not research the accuracy of verbalizations within the two independent variables; therefore, it cannot be determined from the present study whether tactile stimulation was beneficial in improving language comprehension.

Finally, the results of the study found statistically significant differences between the frequency of appropriate and inappropriate ball use when tactile stimulation was provided for both subjects. In other words, when the stress balls were provided to the individuals, they used the balls
appropriately more than inappropriately. An obvious concern to a teacher would be an increase in disruptive behavior by providing a toy or stress ball to a child in the classroom. This study demonstrated that providing a stress ball did not escalate off-task behaviors, but in fact, curtailed them.

In summary, results of the study revealed statistically significant differences in the frequency of off-task behaviors, extraneous physical behaviors, and appropriate/inappropriate ball use when tactile stimulation was provided. This research supports the theoretical view of Ayres that sensory stimulation can help individuals with autism. For example, the frequency of off-task behaviors was found to increase when tactile stimulation was not provided, indicating a behavioral benefit from tactile stimulation. In the study, the off-task behaviors displayed were not only distracting to the other subject, but negatively affected the subject's own attention to the task as well. When the balls were provided, the frequency of off-task behaviors decreased. In addition, the study found that the frequency of extraneous physical behaviors increased when the balls were not provided. The extraneous physical behaviors that the individual engaged in were distracting to both subjects; however, when tactile stimulation was provided, the frequency of extraneous physical behaviors decreased. In other words, perhaps the individual's need for sensory stimulation was appropriately channelled into the squeeze ball. This indicates that the use of a stress ball during a language comprehension activity proved beneficial in decreasing inappropriate, distracting behavior for these subjects. Finally, the study revealed that when the tactile stimulation was provided, the subjects used the balls appropriately. This fact could be used as a rebuttal to arguments that tactile stimulation would be used inappropriately (e.g., throwing the ball).
The research findings of the present study can be utilized with a wide array of adjunct therapeutic and educational providers including speech-language pathologists, special educators, classroom teachers, and parents. Tactile stimulation could be successful in reducing the frequency of off-task behaviors in certain individuals which could, consequently, help focus attention on educational tasks. In addition, when tactile stimulation is provided to individuals with autism, it could significantly reduce the frequency of extraneous physical behaviors displayed; consequently, the amount of disruptions caused to the student and others around the student would be reduced. These implications could be invaluable to educational providers.

Several limitations may have affected the results of the investigation, including the possibility that the order of tactile stimulation presentation resulted in an ordering effect. Although the researcher’s original presentation plan accounted for order effects, the researcher did not closely monitor the presentation; consequently, the actual schedule of presentation differed from the original. Secondly, the language comprehension questions asked by the graduate clinician were not standardized. The lack of standardization could have affected the results of task-related and non-task-related verbalizations, as discussed previously. In addition, possible interaction effects between the two subjects could have been another limitation. For example, when one subject engaged in off-task behavior, the other subject often began displaying off-task behavior. Furthermore and finally, the small number and homogeneity of the subjects used in the study minimizes generalization to a larger population of individuals with autism.

Considering the implications of the present study, further research should investigate the following:
1. Generalization of the positive results with these two subjects should be investigated with a larger population of children with pervasive developmental disorder/autism who exhibit difficulty in modulating sensory input in the areas of tactile/proprioceptive functioning.

2. Generalization of the positive results with these two subjects to all individuals with pervasive developmental disability/autism, not just individuals who exhibit difficulty in modulating sensory input in the areas of tactile/proprioceptive functioning.

3. The effects of tactile stimulation on language accuracy should be investigated in further studies. Although the frequency of task-related verbalizations was not statistically different in the presence/absence of tactile stimulation, accuracy of responses was not evaluated in the present study.

In conclusion, the present study provides a foundation from which to further examine the relationship between tactile stimulation, task-related behaviors, and language comprehension in individuals with pervasive developmental disorder/autism who exhibit difficulty in modulating sensory input in the areas of tactile/proprioceptive functioning. This information can be of assistance to individuals providing educational-related services to individuals with autism. It is important that the utilization of tactile stimulation be considered in educational settings for individuals with autism to reduce extraneous interfering behavior and to increase on-task behaviors.
References


Appendix A

Parental Permission Form

I grant permission for my child, ____________________________,
(name)
g______________g______________, to participate in the research study,
(birthdate)
"Assessing the Effectiveness of Tactile Stimulation for Task-Related
Behaviors and Language Comprehension on Two Children with Autism."
The study will be incorporated into regularly scheduled therapy sessions,
and will not compromise therapy objectives. This study will be conducted
by Lynn Patterson, graduate student in the Department of Communication
Disorders and Sciences, at Eastern Illinois University, Charleston, Illinois
under the direction of Dr. Gail J. Richard.

I understand that information in the study will be reported
anonymously.

________________________
Parent Signature

________________________
Today’s Date
APPENDIX B
Memorandum

To: Gail Richard, Professor of CDS and thesis advisor for student Lynn Patterson

From: Bud May, Director of Grants and Research

Date: February 9, 1998

Re: Institutional Review Board (IRB) review of a thesis proposal involving human subjects

The project "Assessing the Effectiveness of Tactile Stimulation on Language Comprehension and Task-Related Behaviors of Two Children with Autism" received IRB review and was approved on February 5, 1998. The student submitting the proposal/thesis was Lynn Patterson.

Please feel free to start the research and best of luck with the project.

c:
1. IRB reviewers
2. File
## CODING SHEET FOR DEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>Subject 1: __________________________</th>
<th>Circle One:</th>
<th>Tactile First Half</th>
<th>Tactile Second Half</th>
</tr>
</thead>
<tbody>
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| Task-Related Verbal                  |            |                    |                     |
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| Extraneous Physical                  |            |                    |                     |
| Task-Related Verbal                  |            |                    |                     |
| Non-Task-Related Verbal              |            |                    |                     |
Appendix D
Graphic representations of dependent variables session-by-session

Graph 11. Subject 1 - Graphic representation of off-task behavior data session-by-session

Graph 12. Subject 1 - Graphic representation of extraneous physical behavior data session-by-session
Graph 13. Subject 1 - Graphic representation of task-related verbalization data session-by-session

Graph 14. Subject 1 - Graphic representation of non-task-related verbalization data session-by-session
Graph 15. Subject 1 - Graphic representation of appropriate and inappropriate ball use data session-by-session

Graph 16. Subject 2 - Graphic representation of off-task behavior data session-by-session
Graph 17. Subject 2 - Graphic representation of extraneous physical behavior data session-by-session

Graph 18. Subject 2 - Graphic representation of task-related verbalization data session-by-session
Graph 19. Subject 2 - Graphic representation of non-task-related verbalization data session-by-session

Graph 20. Subject 2 - Graphic representation of appropriate and inappropriate ball use data session-by-session