COLLATERAL NONVERBAL LEARNING IN A PEER-MEDIATED SOCIAL COMMUNICATION INTERVENTION FOR CHILDREN WITH AUTISM SPECTRUM DISORDERS

BY

C2008
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M.A., University of Kansas, 2005

Submitted to the graduate degree program in Psychology
and the Graduate Faculty of the University of Kansas
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

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Abstract

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The current study assessed collateral effects on the nonverbal communication behaviors of children with Autism Spectrum Disorders (ASD) during their participation in two peer-mediated text based verbal communication interventions. Data was obtained through coding videotaped intervention sessions. Participants were 7 school-aged children with ASD (6 boys, 1 girl). Four participants participated in each study; one child participated in both. Results indicated that prior to treatment, children with ASD have fewer eye gaze, gestures, and positive affect than typical peers; there were little to no pre-treatment differences in joint attention and nonverbal niceties, which were infrequent for both groups. Following treatment, positive collateral effects were observed for eye gaze, gestures, and positive affect, while joint attention and nonverbal niceties remained low. These collateral improvements were maintained at follow up. Interfering behaviors (stereotypic behaviors, off-task behaviors, negative and inappropriate affect) were higher for focus children compared to peers, but these behaviors were infrequent and remained low throughout the intervention. There is a link between verbal and nonverbal skills acquisition, which highlights a need to include direct teaching of nonverbal skills in combination with teaching of verbal skills.

Acknowledgements

I would like to thank my dissertation chairs, Dr. Kathy Thiemann, whose work sparked my own interest in Autism Spectrum Disorders and without whom this project would not have been possible, and Dr. Yo Jackson, for her valuable guidance throughout my entire graduate career. I would also like to thank my committee members, Dr. Nancy Brady, Dr. Matthew Reese, and Dr. Holly Storkel, for their astute and thoughtful suggestions. A special thank you to my program director, Dr. Michael Roberts, and to the CCPP faculty for providing me with the opportunity to be a part of the acclaimed KU Clinical Child Psychology Program. To my parents, a resounding *thank you*, for the countless sacrifices they have made and continue to make to help me reach my dreams in academia and in life. A deep thank you to my sister, Kim, who continues to inspire me in so many aspects. And last, but most definitely not least, I would like to thank my husband, Alexander Szerwinski, whose patience and unconditional support was everything I needed to nudge me through this project to the very end.

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Introduction

The term Autism Spectrum Disorders (ASD) refers to a wide range of diagnoses that fit within the general category of Pervasive Developmental Disorders. According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition – Text Revision (DSM-IV-TR; APA, 2000), characteristics of Pervasive Developmental Disorders include severe impairment in "several areas of development: reciprocal social interaction skills, communication skills, or the presence of stereotyped behavior, interest, and activities. The qualitative impairments that define these conditions are distinctly deviant relative to the individual's developmental level or mental age" (p.69). Specific classifications of Pervasive Developmental Disorders include Autistic Disorder, Rett's Disorder, Childhood Disintegrative Disorder, Asperger's Disorder, and Pervasive Developmental Disorder Not Otherwise Specified.

In general, individuals with ASD exhibit a range of severity in (a) social interaction impairments, (b) verbal and nonverbal communication impairments, and (c) repetitive and stereotyped behaviors, such as hand flapping or rocking. Social deficits such as these often inhibit the development of friendships, the ability to fully participate in school activities, and overall, the ability to relate to the outside world (Simpson, 2005; Woods & Wetherby, 2003). Observable symptoms may include aggression, self-injurious behavior, repetitive hand or body movements, echolalia, unusual obsessions with objects, difficulties dealing with changes in routines, and sensitivity to any one of the five senses (Simpson, 2005). Research on autism

suggests that behavioral interventions are effective in addressing the communication deficits and behavioral features characteristic of ASD (Maurice et al., 1996; Simpson, 2005).

Although these interventions may help improve communication skills, individuals with ASD continue to have difficulties with social interactions throughout their lifetime, particularly with nonverbal communication (McGee & Morrier, 2003). Therefore, it is important to understand the acquisition of nonverbal skills in children with ASD (e.g., rate and difficulty of acquisition, potential barriers) and how nonverbal skills may be related to the acquisition of verbal communication abilities in this population. Strong evidence supports the notion that in typical development, prelinguistic or nonverbal skills influence later development of linguistic skills (Kublin et al., 1998; Warren & Yoder, 1998). The development of a child's communication abilities is fostered by his or her capacity to produce "readable signals" that can in turn be observed and interpreted by others (Kublin et al., 1998). In typical child development, these signals begin to emerge during infancy in the form of preintentional communication (e.g., crying when hungry). It is the repetition of this signaling and its subsequent response from the caregiver that serves as the foundation of communication (Kublin et al., 1998). Intentional communication emerges around 9 to 12 months of age, during which nonverbal abilities have a clear impact. Warren and Yoder concluded that as an adjunct to any vocalizations by the child, nonverbal behaviors such as coordinated joint attention between the child and caregiver used with additional gestures (e.g., reaching or pointing), serve to clarify

the child's message to his or her caregiver. Clarity and frequency of communication are related in that the more frequent the child attempts to communicate, the more opportunities there are for the parent to respond and provide feedback, which in turn promotes further clarity in the child's communication. Thus, clarity and frequency are fundamental to intentional communication, and the frequency of a child's intentional communication is a likely predictor of his or her subsequent language development (Warren & Yoder, 1998).

For children with ASD, acquisition of prelinguistic abilities does not occur at the same rate and is often delayed and sometimes lacking compared to children without ASD. Intervention researchers have demonstrated that children with ASD can improve their nonverbal abilities (Hwang & Hughes, 2000; Woods & Wetherby, 2003) as well as increase the frequency and repertoires of verbal social communication skills (Kamps, Kravits, & Ross, 2002a; Kamps, Lopez, & Golden, 2002b; Kravits, Kamps, Kemmerer, & Potucek, 2002; Thiemann & Goldstein, 2001). However, few studies have directly examined and measured the direct effects of peer-mediated, school based interventions on children's nonverbal social behaviors. There is empirical evidence to support that peer-mediated interventions are effective in facilitating social interactions in children with ASD, particularly verbal communication (Rogers, 2000). Thus, it may be fruitful to continue exploring this type of intervention in relation to other aspects of social interaction, such as nonverbal communication. Occasionally, changes in secondary or collateral behaviors have been reported such as improved topic maintenance during

conversations (Thiemann & Goldstein, 2001), decreased stereotyped or inappropriate social behaviors (Morrison et al., 2001; Thiemann & Goldstein, 2001), and increased peer responsiveness and acceptance (Thiemann & Goldstein, 2004).

The majority of prelinguistic research focuses on the preschool-age population (Aldridge et al., 2000; Goodhart & Baron-Cohen, 1993; Hwang & Hughes, 2000; Kasari et al., 1990; Lord & Pickles, 1996; Phillips et al., 1992; Woods & Wetherby, 2003; Yoder & Stone, 2006; Young et al., 1994). Intervention research for school-aged children with ASD has primarily targeted verbal communication abilities (Garrison-Harrell et al., 1997; Kamps et al., 2002a; Kamps et al., 1992; Kamps et al., 2002b; Kamps et al., 1997; Kravits et al., 2002; Morrison et al., 2001; Robertson & Weismer, 1997; Thiemann & Goldstein, 2001, 2004). Few interventions seek to improve the nonverbal communication skills of school-age children with ASD. Research efforts focusing on nonverbal abilities of school-aged children with ASD have generally been observational, comparing their nonverbal behaviors to that of typical (often mental age matched) peers. Some findings in this literature indicate that children with ASD have difficulties recognizing or interpreting others' affect expressions (Begeer, Rieffe, Terwogt, & Stockmann, 2006; Fein et al., 1992; Loveland et al., 1997); experience impairments in eye contact or eye gaze (Ruffman, Garnham, & Rideout, 2001; Senju, Yaguchi, Tojo, & Hasegawa, 2003); and are less likely to use gestures (e.g., waving, eye contact) in greeting and farewell situations (Hobson & Lee, 1998). The consistent evidence across studies suggests that many

children with ASD continue to have difficulties perceiving and expressing appropriate nonverbal behaviors beyond their preschool years.

Mundy and Crowson (1997) suggest that because impairments in the ability to utilize nonverbal communication is integral in the early challenges associated with ASD, interventions for preschool children with autism should incorporate a focus on improving nonverbal abilities. It could also be useful to extend this focus into interventions for older, school age children who continue to have difficulties in nonverbal social communication. One study by Barnhill and colleagues (2002) was an intervention specifically targeting nonverbal affect expression in adolescents with Asperger Syndrome. However, there is a dearth of intervention studies that directly teach these and other fundamental nonverbal abilities in elementary school-age children. Perhaps this is an area of need that can be further explored, particularly via peer-mediated school based interventions. Fortunately, there is a generous amount of research evidence for the effectiveness of interventions designed to help children with ASD improve their conversational and linguistic skills. Understanding if and how these evidence-based strategies found to increase children's verbal communication abilities can concomitantly lead to improvements in children's nonverbal communication will allow us to design more effective and efficient school-based social interventions for this age group.

With that goal in mind, videotaped sessions of a successful evidence-based social communication intervention, occurring over the course of two school years (Study 1 and Study 2, by Thiemann and colleagues), were reviewed and recoded to

assess for frequency and quality of changes in nonverbal behaviors. Preliminary results from these two previous intervention studies (Thiemann, Goldstein, & Vuong, in preparation; Thiemann & Vuong, in preparation) indicated improved frequency of specific verbal communication skills following participation in the social intervention. Although nonverbal behaviors were not addressed during the intervention, direct measurement of these behaviors may provide insight into the connection between verbal and nonverbal skills acquisition in school-age children with ASD. The present study aimed to: (a) provide a brief review of the existing literature on the development of nonverbal and verbal skills in children with ASD in comparison to their typically developing peers, (b) highlight a peer-mediated text based intervention that targeted specific verbal social communication skills in children with ASD, and (c) report evidence of collateral effects on children's nonverbal communication following participation in the peer-mediated text based social intervention. If these children with ASD demonstrated collateral learning of nonverbal behaviors, results could expand the literature on nonverbal communication behaviors of school-age children with ASD, increase the current understanding of the relation between verbal and nonverbal communication behaviors in relation to autism, increase understanding of how to package interventions to maximize verbal and nonverbal communication gains, and guide knowledge of age appropriate social goals based on rates of nonverbal communication behaviors of peers without disabilities engaging in small group activities. The specific research questions and predictions were:

1. Were there pre-intervention differences in the rates of nonverbal communication behaviors between the focus children with ASD and their peers without ASD? It was predicted that children with ASD would exhibit lower pre-treatment rates of nonverbal communication skills compared to their peers without ASD.
2. Did the school-aged children with ASD in this study exhibit collateral improvements in nonverbal communication skills (e.g., increased frequency of eye gaze with peers) following participation in a peer-mediated text based social communication intervention? It was predicted that there would be some collateral improvements in their rates of nonverbal communication following treatment.
3. Did children's rates of inappropriate nonverbal behaviors (i.e., behaviors that may interfere with group participation and positive interactions) change after treatment? It was predicted that the rates of inappropriate behaviors would decrease following treatment.
4. What was the general relation between gains in verbal and nonverbal abilities? It was predicted that if verbal skills improved, nonverbal skills would improve as well.

Nonverbal communication

Joint attention. Joint attention is the coordination of attention with others toward a referent object of mutual interest (Bakeman & Adamson, 1984; Mundy &

Willoughby, 1998). To elicit joint attention, an individual can engage a social partner by sharing or showing the object in attempts to share awareness or enjoyment of the object (Mundy et al., 1986). In typical development, the foundation of nonverbal communication skills begins forming soon after birth, when the primary mode of interaction between infants and caregivers is dyadic, or face-to-face (Mundy & Willoughby, 1998). During this time, infants develop the ability to engage attention of their caregivers by looking at their faces and making eye contact. By the time children reach approximately 18-months-old, triadic interactions begin to emerge (Bakeman & Adamson, 1984) and they are able to bring attention to a referent object into their interactions with caregivers or peers. For instance, a toddler may indicate his or her desire for a cookie by pointing to the cookie jar while making eye contact with his or her caregiver. Thus, eye contact and gestures such as pointing are acquired early on in child development and are important components of a child's social-communicative interactions.

Children with ASD have significant impairments in their ability to engage in joint attention. For example, these children have difficulties following a social partner's gaze or point, indicating a deficit in the ability to share attention (Dawson et al., 1998). In a study of 20 preschool-aged children with autism, 20 children with Down Syndrome, and 20 typical children, Lewy and Dawson (1992) found that children with autism exhibited significant deficits in joint attention in comparison to the other two groups. During play, these children were more attentive to objects and were less socially engaged (e.g., spent less time watching their play buddy) than the

control group. Hobson and Lee (1998) found that in the context of greetings and farewells, participants with autism generally failed to initiate these gestures. They also used fewer spontaneous verbal and nonverbal gestures, smiled less, and were less likely to wave good-bye or use eye contact. Even after prompting with a verbal "good-bye" from the researcher, none of the participants in the autism group used a combination of farewell gestures (i.e., eye-to-face contact, smile, and verbalization) whereas 37% of participants without autism did. Results may be indicative of difficulties that individuals with ASD have with integrating or coordinating actions and expressions (e.g., using a combination of nonverbal and verbal behaviors) and their difficulties with interpersonal engagement (Hobson & Lee, 1998). It is not the case that children with ASD have an absolute lack of ability to engage in joint attention because they do exhibit joint attention behaviors to some degree. However, children with ASD engage in joint attention less frequently, have difficulty with point following (i.e., rather than looking at where the person is pointing, children with ASD more frequently looked at the pointer's finger, hand, arm, or body), and would less likely combine joint attention with eye contact or eye gaze when compared to same-age typical peers (Warreyn, Roeyers, Wetswinkel, & DeGroote, 2007).

Eye contact and eye gaze. Current research with typical children indicates that a multitude of factors are influenced by an individual's use of eye contact and eye gaze: attraction, attentiveness, competence, social skills, mental health, credibility, dominance, and the communication of feelings (Kleinke, 1986). Some suggest that eye contact is the most crucial component of relating interpersonal

meaning via nonverbal communication (Groffman, 1998). If not the most crucial, eye contact certainly seems to be among the most fundamental nonverbal communication behaviors. For joint attention to occur, appropriate eye contact between individuals and shared eye gaze toward a referent object must take place.

Kleinke (1986) summarized several 'looking' behaviors defined in the literature. *Face-gaze* refers to one person looking directly at another person's face. Two people directly looking at each other's faces is *mutual gaze*. Similarly, *eye-gaze* refers to looking directly at another person's eyes. When two people engage in direct eye gaze or look at each other's eyes, this is *eye contact*. In contrast to looking in someone's direction, whether at his/her face or eyes, *gaze avoidance* refers to the intentional avoidance of eye contact. The failure to look directly at someone entirely, without intentional eye contact avoidance, is the definition of *gaze omission*.

The difficulty engaging in eye contact and the lack of sensitivity to another person's eye gaze are characteristic features of ASD (APA, 2000). As a result, individuals with ASD generally fail to accurately process (or process at all) the visual, nonverbal cues exhibited by others in their facial expressions, body language, and gestures. In a study of 9- to 14-year-old children with autism and matched typical peers, there was a significant difference in their ability to detect direct versus averted gaze (Senju et al., 2003). Typical children were able to detect direct gaze, whereas children with autism could not differentiate between direct gaze and averted gaze.

Results from a study by Phillips and colleagues (1992) illustrates the degree of delay that children with autism experience. Participants in this study were 18

children with autism (ages 3 to 5), 18 children with mental handicaps (ages 3 to 5), and a control group of 18 typically developing infants (9 to 18 months old). The objective was to determine how these children use eye contact in reaction to an adult's ambiguous or unambiguous action toward them. For the typical infants and the children with mental handicaps, reactions differed between conditions. In the ambiguous condition, they immediately engaged in eye contact following the ambiguous action; and they rarely engaged in immediate eye contact following the unambiguous action. For children with autism, their rate of eye contact was low in both conditions. Skin conductance response research also indicates that children with ASD experience enhanced arousal in response to direct eye contact from others, which may help to explain the abnormal eye gaze behavior characteristic of ASD (Kylliainen & Hietanen, 2006).

Together, these results suggest that preschool and school age children with autism experience significant difficulties in eye gaze—a fundamental nonverbal communication behavior typically acquired during infancy. These deficits can interfere with understanding mutual reciprocity, and interrupt potential opportunities for engaging in the back and forth behaviors inherent in interpersonal communication. However, if notable gains are achieved in the back and forth reciprocity in verbal communication skills (as was demonstrated by results from Studies 1 and 2 by Thiemann and colleagues, in preparation), it would be valuable to test how this skill acquisition is related to areas of nonverbal communication (such as eye gaze) that also require this mutual reciprocity.

Gestures. In general, gestures are a mode of communication often utilized in combination with eye contact and vocalization to relay meaning to someone. Gestures can employ parts of the body (e.g., pointing using an extended arm and finger) or the entire body (e.g., galloping like a horse). Gestures can also incorporate facial features for communicating an idea (Iverson & Thal, 1998). Iverson and Thal (1998) summarized two types of gestures and their respective sub-categories: (1) deictic gestures, which serve either a proto-imperative or proto-declarative function, and (2) representational gestures, which encompass object-related (i.e., symbolic) gestures or culturally defined conventional gestures. Deictic gestures are behaviors aimed at calling another person's attention to an object or event—gestures such as showing an object, giving someone an object, pointing toward something, and reaching for something.

The idea of proto-imperative or proto-declarative functions of deictic gestures was originated by Bates and colleagues (1975). Proto-imperative gestures refer to the use of another person (e.g., a caregiver) to obtain an object, while proto-declarative gestures serve to engage in the sharing of interest or attention with another person. Proto-imperative skills (seen around 9 months of age) are said to develop prior to proto-declarative skills (appearing by 14 months of age) (Goodhart & Baron-Cohen, 1993; Iverson & Thal, 1998). Representational gestures are more abstract in that they are associated with fixed semantic content (Iverson & Thal, 1998). Object-related gestures (e.g., pretending to operate a steering wheel to indicate reference to a car) are movements intended to symbolize a referent object. Culturally defined conventional

gestures are also used referentially and include movements such as nodding to represent "yes", shaking one's head for "no", and waving goodbye.

The ability to engage in pointing gestures, characteristic of typical early development, is lacking in children with ASD (Goodhart & Baron-Cohen, 1993). Findings indicate that for young children with autism, proto-imperative pointing (e.g., pointing to a desired out of reach object) is present to some extent, while proto-declarative pointing (e.g., pointing to a funny picture in a book in combination with eye contact, as a means of sharing enjoyment) is absent (Baron-Cohen et al., 1992). The literature suggests that proto-declarative pointing is a precursor to other nonverbal and verbal communication abilities such as joint attention and dialogue (Goodhart & Baron-Cohen, 1993). This could further explain why children with ASD have difficulties relating to others and to their environment. That is, these children experience significant deficits and delays in the fundamental building blocks of communication, which prohibits later development of more complex social-communication skills. However, results from the two studies by Thiemann (in preparation) indicated improvements in verbal abilities—the more complex of the social-communication skills. If there is a connection between the verbal and nonverbal abilities of children with ASD, as there is in typical children, perhaps these verbal communication gains provide some promise for potential nonverbal gains as well.

Affect expression/sharing. Social-affective sharing in joint attention refers to the sharing of one's own emotions with others (Kasari et al., 1990) as well as the

elicitation of more subtle communication responses (e.g., eye contact, social smiles, laughter, or general comments) from others relative to an object or event (Bates et al., 1979). Stern (1985) described affect sharing as the "most pervasive and clinically germane" component of an individual's capacity to relate to others. Difficulties recognizing and understanding the affect expression of others may contribute to deficits in social communication because the sharing of affect is an important aspect of joint attention. Individuals with ASD tend to lack the general ability to accurately gauge another person's affect, whether through facial, vocal, or bodily cues (McGee & Morrier, 2003). Research indicates that although children with ASD may have a general understanding of 'happy' and 'sad', more complex emotions such as surprise, embarrassment, or pride are most difficult for them to comprehend (Loveland et al., 1997; McGee & Morrier, 2003). They also have difficulties matching emotions to appropriate contexts (Fein et al., 1992), correctly identifying emotional facial expressions (Gross, 2004), and generally, they themselves display emotions incongruent to their immediate context (McGee et al., 1991).

Children with ASD spend less time in dyadic social interactions, and when they do engage in joint attention, they display significantly less positive affect in comparison to typically developing peers (Kasari et al., 1990; McGee et al., 1991). In an observational study, McGee and colleagues (1991) videotaped the interactions of five typical children and five children with autism in a preschool classroom. This particular classroom was designed to promote the incidental teaching of social skills, language skills, and school readiness skills. Each child's natural classroom

interactions were videotaped in randomly scheduled 5-minute segments, five times each week. Researchers analyzed happiness, sadness, and anger—the three primary emotions most prevalent in preliminary observations of this group. Results indicated that when comparing children with ASD and typical peers, there were no between group differences in the amount of time these children displayed emotional facial expressions. The actual rate of expressing happiness, sadness, and anger also did not differ significantly between groups. Both groups expressed happiness most frequently, followed by some observations of sadness. Expressions of anger were rarely observed in either group. However, when considering the contextual situation, between group differences emerged in observations of "happy" facial expressions. The typical children expressed higher levels of happiness when interacting with teachers and peers, while happiness was rarely observed during their solitary play. In contrast, children with ASD exhibited more happiness while playing alone, whereas during their interactions with teachers and peers, facial expressions of happiness were much less likely.

Research in the area of affect comprehension in children with ASD also supports the theory that they have impairments in processing social cues. Fein and colleagues (1992) conducted a study examining the comprehension of affect in adolescents with ASD in comparison to mental age matched typical children. Participants were asked to do two matching tasks. One task was a simple object-matching task unrelated to emotional expression. The other task required the children to match cards (indicating happy, sad, angry, or scared) to 16 different affect

situations. Both tasks were designed to be equally difficult. Performance on the object-matching task was identical between groups. There was a slight, but nonsignificant between group difference on the context-affect matching task. However, significant within-group differences emerged. The typical children performed equally well in both matching tasks. For the adolescents with ASD, the difference between their task performances was significant. They had more difficulty matching the context to the appropriate affect expression. Results also indicated that for the ASD group, performance on the context-affect task was significantly correlated to the development of normal social skills, as measured by the Socialization score on the Vineland (Sparrow et al., 1984).

An intervention study by Barnhill and colleagues (2002) was specifically geared toward helping adolescents with Asperger Syndrome improve their recognition of others' affect expressions. The intervention consisted of 1-hour, weekly meetings over the course of 8 weeks. All participants met in the same classroom for direct social skills instruction. The first 4 sessions focused on paralanguage (e.g., distinguishing between voice intonations, rates of speech, and word emphasis). The final 4 weeks targeted appropriate responses to others' facial expressions. Following each instruction session, participants engaged in a community recreational activity for 2 to 3 hours and were reinforced for appropriate responses to others' nonverbal behaviors. Some nonverbal communication gains were acquired (e.g., awareness of the importance of eye contact), but those results were not compelling. However, it was reported that these adolescents developed and

maintained social relationships as a result of participation in the intervention. Following the intervention, some of the adolescents were better able to recognize and read others' facial expressions, although in natural settings, they failed to respond appropriately to others' expressions.

It seems that not only do children with ASD experience difficulties processing and understanding the social signals and nonverbal cues in their environment, they also have deficits in generating their own readable social signals that others can accurately understand. In a study comparing the nonverbal behaviors of 15 children with autism (ages 3 to 13 years old), 14 children with developmental language delay (ages 3 to 13 years old), and 13 typical children 25- to 37-months-old (matched on nonverbal mental age), the children with autism were less responsive to gestured attempts to get their attention. These children also used fewer gestures (e.g., pointing) and more echolalia in their attempts to direct attention (Landry & Loveland, 1988). It may be that the integration of nonverbal and verbal expressions is more challenging to children with ASD due to the fast pace of expression and the subtle changes necessary. Or perhaps the integration of multiple social communication skills is the challenge in itself.

The combined use of nonverbal skills. Integrating the use of eye contact, gestures, and affective signals are crucial to participating in typical social interactions. These skills are fundamental to one's ability to initiate and maintain turn-taking episodes or the give and take of information exchange, whether verbal or nonverbal, between the self and others (Bruner & Sherwood, 1983). For example, in

addition to the ability to engage in eye contact and to point to desired objects, other nonverbal communication skills may include varied joint attention gestures (e.g., reaching, showing, tapping someone on the shoulder, head nodding/shaking), face recognition, emotion perception of others, and facial expression of own affect (McGee & Morrier, 2003; Mundy & Willoughby, 1998). Nonverbal behaviors, particularly joint attention skills, are related to an individual's capacity to spontaneously initiate and engage in shared experience (of an object or an event) with others or to seek help from others (Mundy & Sigman, 1989; Mundy et al., 1993; Mundy & Willoughby, 1998). Because children with ASD typically experience deficits in multiple areas of nonverbal and verbal communication, they have difficulties initiating, maintaining, and participating in typical social interactions with peers. This subsequently presents as a barrier to the development of peer interactions and friendships, participation in school activities, and general engagement toward others. Fortunately, intervention studies are growing that target specific communication skills with the goal of closing the social gap between children with ASD and their typical peers (Garrison-Harrell et al., 1997; Kamps et al., 1994; Kamps et al., 2002b; Kamps et al., 1997; Kamps et al., 2002c; Krantz & McClannahan, 1993; Mesibov, 1986; Morrison et al., 2001; Robertson & Weismer, 1997; Thiemann & Goldstein, 2001, 2004).

Typical development of prelinguistic and linguistic skills

In typical development, signs of reciprocal communication emerge as early as infancy, albeit it is usually parents who assign meaning to their infant's behaviors despite the likelihood that the infants are capable of intentionally communicating during the first few months after birth (Stoel-Gammon, 1998). At this stage, infant vocalizations and gestures are considered to be preintentional. As these patterns of interaction become routine, infants gradually become cognizant that their behaviors can influence events in their environment (e.g., parental response to crying). As the connection between their behaviors and the behaviors of caregivers strengthens, the infant's preintentional communication develops into functional, intentional communication. Although much of the infant's vocalizations are considered babble, the babble may serve specific functions and can include calling, greeting, requesting, showing, protesting and commenting (Stoel-Gammon, 1998; Wetherby et al., 1998). This transition from preintentional to intentional communication typically occurs around 9-months to one year of age (Stoel-Gammon, 1998; Warren & Yoder, 1998).

It is also during parent-infant dyadic interactions that infants develop the ability to coordinate attention—a skill essential to social communication. This prelinguistic developmental milestone emerges around 6 months of age and is solidified by approximately 13 months of age (Bakeman & Adamson, 1984). Around 11 to 15 months of age, children begin to use gestures more frequently and in conjunction with joint attention (Wetherby et al., 1998). By the time typical children reach 2 years of age, they have acquired symbolic communication and transitioned

from prelinguistic to linguistic communication where gestures and spoken words are used in combination (Wetherby et al., 1998). Not only do children become better communicators at this age, they have an emerging ability to comprehend the communication of others through understanding others' nonverbal cues (e.g., gestures, eye gaze, and facial expressions), situational or contextual cues (e.g., being aware of the environment and knowing how to respond in a particular situation), and paralinguistic cues (e.g., the intonation of a caregiver's voice) (Wetherby et al., 1998). In general, it appears that typical children develop the ability to use both verbal and nonverbal modes of communication rather early in their childhood.

Prelinguistic and linguistic development in children with ASD

In comparison with typical peers, children with ASD exhibit varying degrees of delayed communication skills. Some children are more verbal than others and are able to have simple conversations, some have more difficulty with prelinguistic forms of communication (e.g., eye contact, gestures), while others are nonverbal. Lord and Pickles (1996) investigated the relation between expressive language and the development of nonverbal social-communication behaviors in children with autism, focusing on nonverbal behaviors typically seen in children younger than 18 months of age. The sample consisted of 51 children with autism and 43 mentally handicapped or language impaired (nonautistic) children ages 2- to 5-years-old. Groups were closely matched on chronological and mental age, development, and nonverbal IQ. Administration of a range of standardized developmental tests indicated that for

children with and without autism, deficits in nonverbal communication and social behaviors were related to absent expressive language. The children with autism also exhibited more severe language delays than their peers without autism. There were also significant between group differences in direct gaze, attention, facial expression, sharing behavior, and stereotyped mannerisms—confirming the diagnostic behaviors characteristic of children with ASD. In a summary of findings, Rice, Warren and Betz (2005) reported that for nonverbal children with autism, linguistic delays were congruent with delays in nonverbal behaviors. For these children, communication on either a prelinguistic or linguistic level was challenging. However, verbal children's nonverbal skills resembled that of their typical peers.

Altogether, there seems to be some evidence for a connection between nonverbal and verbal communication in children with ASD in that a greater level of ability in one mode of communication is related to a greater level of ability in the other. Given this relation, it is natural to assume that improvements in one area can potentially lead to improvements in the other, particularly when improvements are occurring at the linguistic level of communication. Although some intervention studies addressing verbal communication skills mention collateral or secondary improvements in nonverbal skills (Morrison et al., 2001; Thiemann & Goldstein, 2001, 2004), few studies have directly examined and measured specific nonverbal abilities. But there is emerging evidence in support of social communication improvements in children with ASD. If there is evidence that these social communication improvements are related to improvements in nonverbal abilities,

incorporating a nonverbal teaching component into an effective verbal communication intervention may serve to maximize a child's social communicative gains. The following section highlights current evidence-based interventions found to improve social communication in children with ASD.

Existing social-communicative interventions for children with ASD

In a summary of the current intervention research, Woods and Wetherby (2003) identified naturalistic behavioral approaches, developmental approaches, a general speech language approach, functional communication training, social communication training, and interventions to increase initiations as existing methods of treating children with ASD. Of the available research in the literature, four major findings have emerged: (1) between naturalistic behavioral approaches and traditional discrete trial approaches, naturalistic behavioral approaches are more effective in promoting generalization of language improvements across settings, (2) due to the absence of an intervention that is equally effective with all children and the varying severity of ASD diagnoses, there is no one approach best suited for treating all children, (3) there is a need for researchers to find more ecologically valid methods of measurement, e.g., measuring changes within the child's natural environment, particularly the rate of the child's spontaneous initiations in communication and the generalization of any gains across settings and activities, and (4) there is a growing body of research supporting the premise that the earlier the age at intervention, the

better the outcome for the child. This translates to a sense of urgency for early identification and intervention for children with ASD (Woods & Wetherby, 2003).

Peer mediated interventions. Providing preschool children with ASD the opportunities for peer interactions has been a focus of treatment efforts for nearly 30 years (Mesibov, 1986; Strain, 1983; Strain et al., 1979; Williams, 1989). Typically developing peers serve as appropriate models of several facets of social behavior (e.g., communication, play, social strategies), which help to enhance the social and communication behaviors of children with ASD (Prendeville, Prelock, & Unwin, 2006). Research efforts for the past 10 to 15 years were geared toward refining peer mediated intervention techniques, particularly for school-age children with ASD. The literature stemming from this and past research suggests that the inclusion of peers helps improve social communication skills in children with ASD (Goldstein, Schneider, & Thiemann, 2007; Kamps et al., 2002b; Kamps et al., 1997; Kamps *et al.*, 2002c; Morrison et al., 2001; Robertson & Weismer, 1997; Thiemann & Goldstein, 2001, 2004).

Peer-mediated interventions train typically developing peers to be the teaching agent, which encourages the children with ASD and their peers to interact in structured social situations, while at the same time providing the children with ASD with direct instruction and peer modeling of appropriate communication behaviors. Specific effective techniques include the use of scripts and script fading, adult prompts, peer prompts, peer modeling and tutoring, role-playing, visual cueing systems, social stories, self- and peer-monitoring strategies, picture exchange

systems, video feedback, and social skills groups (Carr & Darcy, 1990; Johnston et al., 2003; Kamps et al., 1994; Kamps et al., 1997; Krantz & McClannahan, 1993; Strain et al., 1994; Thiemann & Goldstein, 2001). Peer interventions have also been conducted in a variety of settings such as play groups, tutoring groups, lunch bunch, recess, center activities within the classroom, and game groups outside the classroom (Kamps et al., 2002a; Kamps et al., 2002b).

Lord (1995) highlighted five underlying principles of peer mediated interventions. First, peer interventions must occur in a positive environment that fosters pleasurable interactions between focus children (i.e., children with ASD) and age-appropriate peers. In this first point, the interaction piece is key. The focus child must be directly interacting with their typical peers and the activity should gauge the interests of all children involved (e.g., providing novel materials so typical children do not become bored). Second, peer interactions should be spontaneous rather than directed by researchers. Peer interactions with the focus child should be positively reinforced and supported without direct guidance of the peers' behaviors. In short, interactions should flow naturally. Third, the needs of group members dictate the structure of the group. Specifics to consider include: (a) following a standard schedule, (b) structuring the space for various activities to foster optimal interaction, (c) providing themes for each session, (d) designing activities that promote cooperation, shared attention, or shared objectives, (e) finding activities that do not require complex language or complex fine and gross motor abilities, (f) keeping activities brief (i.e., between 5-30 minutes; the shorter the better), and (g) helping the

group develop routines. The fourth principle requires that children with ASD do not comprise more than half of the group. Fifth and finally, goals should be catered to the specific needs of each focus child and progress should be monitored regularly (Lord, 1995).

Knowledge from previous research has informed the following six principles for selecting peer-mediated intervention strategies:

1. Strategies should include behaviors observed in high-quality interactions among children generally.
2. Strategies should have a high likelihood of inducing subsequent socially responsive behavior.
3. Strategies should not include behaviors that tend to place children with disabilities in subservient roles.
4. Strategies should not include behaviors that take a great deal of time and effort to teach.
5. Strategies should have the potential for producing reciprocal interactions that may be reflected in balanced and sustained interchanges.
6. Strategies should optimize rather than simply typify social interactions among children with and without disabilities. (Goldstein et al., 2007, pp. 187-188)

Existing research targeting the social-communicative skills in children and adolescents with ASD generally support that peer-mediated interventions do improve the frequency and quality of children's verbal communication (Kamps et al., 2002a; Kamps et al., 2002b, Thiemann & Goldstein, 2001, 2004). For example, children with ASD have demonstrated improvements in frequencies of initiations to peers and using skills such as asking questions, making comments, and sharing with peers (Morrison et al., 2001), maintaining conversational topics and securing someone's attention (Thiemann & Goldstein, 2001), and the duration of time these children

remain engaged in social interactions with their peers has also increased (Garrison-Harrell et al., 1997; Kamps et al., 1997).

Collateral improvements in specific social behaviors also have been discussed. Children with ASD became more accepted by their classmates, were better able to maintain conversation topics, and were less likely to engage in stereotypic behaviors (Morrison et al., 2001; Thiemann & Goldstein, 2001, 2004). Unfortunately, very little is known about changes in the quality or quantity of children's nonverbal communication following participation in interventions targeting verbal communication. Because nonverbal, prelinguistic skills are integral to successful social exchanges with peers, it would be beneficial to evaluate the collateral effects of a successful peer-mediated social communication intervention on specific nonverbal communication skills.

Objective of the current study

The literature suggests that nonverbal communication skills are closely linked to the acquisition of verbal communication abilities (Kublin et al., 1998; Warren & Yoder, 1998), which in turn can have a great impact upon an individual's ability to interact with peers. Because children with ASD have significant deficits in both verbal and nonverbal communication domains, it is possible that peer-mediated social communication interventions could also target and measure nonverbal behaviors. At this time, no studies have tested the role of peer-mediated interventions to improve the nonverbal functioning of school-age children with ASD. Thus, the primary

objective of this study is to determine whether children with ASD, who participated in a peer-mediated intervention focusing on increasing specific verbal communication skills, also demonstrated secondary improvements in nonverbal behaviors. To review, the research questions of this study are as follows:

Question 1. What were the baseline levels of nonverbal communication skills used by the focus children with ASD in comparison with their same-aged peers without disabilities?

Question 2. Following their participation in a verbal communication intervention, did the children with ASD experience any collateral learning of nonverbal communication skills (as evidenced by a change in the frequency of their use of these skills at baseline, treatment, and follow-up)?

Question 3. Were there any observed collateral changes in negative social behaviors (e.g., stereotypic, inappropriate, off-task)?

Question 4. What was the relation between observed gains in verbal communication skills and nonverbal communication skills?

Method

The data for this study were derived from two intervention studies (Thiemann, Vuong, & Goldstein, in preparation; Thiemann & Vuong, in preparation) that focused on increasing the verbal communication skills of seven elementary school-aged children with ASD. Each project was implemented over the course of one school year, with a total of 7 focus children and 47 peers without disabilities. The 'pool' of

potential skills measured and taught to the groups during both interventions included: (1) securing someone's attention, (2) talking about turn-taking, (3) making suggestions, (4) commenting, (5) asking questions, and (6) social niceties (i.e., talking nice, helping, and sharing). Nonverbal behaviors were not specifically targeted or recorded during the original data collection in either study. For this study, nonverbal communication data was acquired through the review and recoding of videotaped interactions of children with ASD and their typical peers. Data was coded from interactions across baseline, treatment, and maintenance phases of both studies.

Study 1

Participants

Focus Children. (Table 1) Participants in Study 1 were four elementary school-aged boys ages 6 to 11 years (m = 8 years). Three children were Caucasian and one child was South Asian. The children had existing diagnoses of ASD based on evaluations by a school psychologist or a psychiatrist. Social impairments were confirmed through parent reports on the Vineland Adaptive Behavior Scales (Social and Communication domains) (Sparrow et al., 1984), Childhood Autism Rating Scale (CARS; Schopler et al., 1988), and parent and teacher reports on the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). These measures were completed as a component of the study. All four children were considered to be higher functioning and were fully integrated in regular education classrooms. Three children had a paraprofessional who provided classroom academic and behavioral support. The

children were recruited based on the following criteria: (1) fully or partially included in regular education, (2) verbal communication skills (e.g., use of complete sentences to communicate for different social purposes), (3) emerging or acquired decoding and word recognition skills, and (4), diagnosis of ASD and/or parent and teacher report of characteristics of ASD with limited peer interactions.

Peer Buddies. Five to six peer buddies were recruited for each focus child via teacher nominations and the peers' interest in participating. A total of 23 peers participated during Study 1. Teachers nominated peer buddies based on: age-appropriate social skills, well liked by other classmates, and consistent school attendance. These peers were nominated due to their potential to be effective models for the focus children. Because all peers were from the focus children's classrooms, they were matched in age and grade.

Teachers/Support Staff. Each child's regular education teacher provided intervention support by nominating peer buddies, completing pre- and post-treatment questionnaires, and assisting in scheduling sessions and activities. When possible, paraprofessionals and special educators (e.g., the school's speech-language pathologist) were involved in treatment implementation. This included scheduling social opportunities, assisting during teaching sessions, prompting skill use during treatment sessions, and providing additional supports beyond the intervention setting. All four regular education teachers and three paraprofessionals also attended a pre-treatment 90-min in-service provided by the primary investigator of the study.

Settings and Sessions

Baseline and treatment sessions took place in two settings for each child: table games (in the class or pod area) and recess, with each social activity or game lasting 6-min. This was designed to assess social interactions in both a structured environment and one with less structure. For one child, TC, these two settings were combined into one structured 12-min activity. Due to significant behavioral difficulties during the unstructured recess setting, the primary researcher and teacher decided to increase amount of direct instruction time in a structured activity. Present at each activity were the focus child and two peers (i.e., always a triad). Sessions were scheduled three days per week, with two 6-min activity sessions per day, giving the peers a chance to take turns and rotate in their participation. Settings remained consistent from the beginning to the end of the study. There was an average of 21 treatment sessions (range = 19-24) across the 4 focus children. The average treatment period was 10 weeks.

During table games, the focus child and two peer buddies were given a choice between two age-appropriate social board games (e.g., Kerplunk, Trouble, Go Fish, ABSeas). Games and activities choices for the children in Kindergarten also focused on early reading and math concepts. During recess, the children were also given a choice of two playground activities (e.g., jump rope, four-square, basketball, or Frisbee).

Measurements

Dependent measures. The conversation skills measured in this study were: (1) securing someone's attention, (2) talking about turn-taking, (3) making suggestions, (4) commenting, (5) asking questions, and (6) social niceties (i.e., talking nice, helping, and sharing) (refer to Table 3 for behavioral definitions). Also coded were 'Other' utterances, which included those unrelated to the conversation topic and stereotyped or inappropriate vocalizations (e.g., echolalia, yelling at a peer). Conversational episodes were coded as well as how many turns the focus child took in a given episode. Conversational episodes were defined as a series of back and forth exchanges of appropriate utterances where at least one person takes two alternating turns (e.g., focus child initiates, peer responds, focus child responds; or peer initiates, focus child responds, then peer responds).

Peer comparison. Prior to the focus child's involvement in the project, data was taken on the typical peers' conversational interactions with each other. The peers participated in game activities in groups of three. Each peer buddy participated in two 6-minute sessions, for a total of 72 minutes of peer comparison data. For each session, researchers gave the group a choice between two board games, explained the general rules of the game (if necessary), told the peer group to begin playing the game, and coded their verbal communication during the entire 6 minutes of interaction. During peer comparison phase, researchers did not intervene during the 6-minute activity. The peers' average rates of dependent social communication skills were also coded for 25% of the baseline sessions, which then served as target rates for

the focus children's use of the same communication skills in treatment. Peer averages were also taken for 25% of the treatment and maintenance phases.

Peer Acceptance. Peer acceptance ratings were obtained pre- and post-treatment. Peer acceptance ratings were assessed by trained and untrained peers from the focus child's classroom. Five nonparticipating classmates were randomly selected to be rated, along with the focus child. The remaining students, those not being rated, were asked to complete the Peer Acceptance Questionnaire. This questionnaire consisted of six questions pertaining to how much time the respondent spends playing with and talking to the child, what activities he or she does or would like to do with the child, if he or she considers this child a friend, and if he or she would invite this child over to play. Responses are on a 5-point Likert scale (1 = Never, 2 = Not Usually, 3 = Sometimes, 4 = Most of the time, and 5 = Always). Raters were asked to respond to these six questions for each of the five randomly selected children and for the focus child. The focus child's peer acceptance averages and change scores between pre and post assessments were compared to scores from the five rated peers. Most children were generally able to complete these measures on their own. However, researchers individually read the questionnaire to raters in the kindergarten classroom.

Reliability. Prior to coding for reliability, all coders in this study reached a level of at least 85% reliability on three different observations, practicing with videotaped sessions from a similar study. Once the 85% criterion was established,

coders were expected to maintain interobserver agreement of at least 80% for 30% of the total number of sessions coded.

Coding was done individually by each coder, after which both coding sheets were gathered for analysis. For each agreement in coding, a plus (+) was assigned; for each disagreement, a minus (-) was assigned. Disagreements were scored if the coders did not agree on the categorization of the behavior or if one observer coded a behavior that the other observer did not notice. Interobserver reliability was calculated by dividing the number of agreements by the sum of agreements and disagreements, then multiplying the value by 100.

Procedures

Prior to the start of the study, parents of the focus children and peers were provided detailed information about the nature of the project. Written consent was obtained from parents of the focus children and peers. Verbal assent of the focus children and their peers were also obtained prior to their participation in the project.

Baseline. Baseline coding began after obtaining data for peer comparison. Sessions and days for data collection were coordinated with teachers' and student's schedules. Two settings were selected for each focus child and peer dyads were assigned to participate one day per week across both activities. The baseline procedure was identical to the peer comparison procedure, with the exception of inclusion of the focus child. The focus child and two peers were given a choice between two activities. Following the selection of the game and explanation of rules,

the group was instructed to simply play the game. Once per minute (six times total), the focus child received a general adult prompt to, "talk to your friends about the game". Live coding occurred during the group's interaction. The sessions were also videotaped for reliability coding.

Teaching sessions. Based on the focus child's areas of need as indicated by his or her low communication performance during baseline, three communication skills were selected for each child as targets of treatment. During the teaching phase of the study, the primary author taught each skill one at a time in 30-minute sessions over the course of one week. These sessions involved each focus child and all of his peer buddies (e.g., total of three teaching sessions for each of the 4 groups). These instructional sessions incorporated evidence-based strategies for teaching social communication skills (Thiemann & Goldstein, 2001, 2004). Selected strategies included: explanation of and discussion of the importance of targeted skills (including a review of previously discussed skills), reading of social stories pertaining to that target skill, encouraging the children to generate examples of skill use, and through the use of actual games and activity materials, the children were encouraged to role-play social interactions using the targeted skills.

Treatment. Following the three instruction sessions, collection of treatment data began. The 6-minute activity sessions resumed as was done during baseline. In the treatment condition, visual cues outlining each of the three targeted skills were provided. There was random assignment of scripted versus nonscripted treatment days. During scripted days, the focus child received a verbal prompt prior to the start

of the activity, reminding the child of the targeted skills. The child was asked to read the text cues, which were then left in front of the child or worn around the child's neck (during recess). If the focus child had difficulties using the skills, adult prompts were provided no more than once per minute when necessary. During nonscripted days, the child would only receive the verbal prompt prior to beginning the activity. Researchers or paraprofessionals were the adults providing the prompts. As treatment sessions progressed adult prompting was faded out and replaced with peer prompting (e.g., pointing to the visual cue) or reminders using a vibrating timer (set to vibrate once per minute) given to the focus child.

Maintenance. Five months following the end of the treatment phase, the focus children and peers participated in three maintenance sessions. The sessions were structured in the same way baseline and treatment sessions were structured, with two peers interacting with the focus child during a table activity, then during a recess activity. Prior to the start of the coded session, the children were briefly reminded of the target verbal skills taught during the treatment phase and were asked to generate a few examples for each skill. However, no written text cues or prompts were provided during the 6-minute session; all behaviors observed for the children were spontaneous. Reinforcements were also not provided during the 6-minute sessions (i.e., giving the focus child happy faces each time a skill is used), as they were during treatment.

Study 2

Participants

Focus Children. (Table 2) Focus children in this study were four elementary school-aged children (3 males, 1 female) ages 5 to 11 years old (m = 7). Three children were Caucasian and one child was South Asian (who was also a participant in Study 1). With the exception of one kindergartener, the remaining three children had existing diagnoses of ASD based on evaluations by school psychologists or a psychiatrist. The other child exhibited some criteria for Asperger syndrome, and it was recommended he return for a formal re-evaluation after two years. Social impairments were confirmed through parent reports on the Vineland (Social and Communication domains) (Sparrow et al., 1984), Childhood Autism Rating Scale (CARS; Schopler et al., 1988), and parent and teacher reports on the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). All four children were considered to be higher functioning and were fully integrated in regular education classrooms. Two children had paraprofessionals working with them in the classroom. The other two children received pull out services from a speech-language pathologist and an occupational therapist at the school.

Peer Buddies. The peer selection criteria and process in this study was identical to that of Study 1. Each child had 6 peers (a total of 24) who participated in the study. Again, peers were selected from the focus child's classroom.

Teachers/Support Staff. As in Study 1, each child's regular education teacher provided support by nominating peer buddies, completing pre- and post-treatment

questionnaires, and assisting in the scheduling of sessions and activities. Paraprofessionals and special educators were again encouraged to be involved in treatment implementations. Prior to the start of the project, all 4 teachers, 2 special educators, and 2 paraprofessionals attended a 90-minute in-service provided by the primary investigator. There was more involvement of special educators (i.e., the speech-language pathologist and the resource room teacher) during this study. This included scheduling social opportunities, assisting during teaching sessions, prompting skill use during treatment sessions, and providing prompts and additional supports beyond the intervention setting. The speech-language pathologist, paraprofessional, and the resource room teacher all participated in providing instruction and prompting during the treatment sessions for two children in this study.

Settings and Sessions

Similar to Study 1, table games and recess comprised two of the three possible settings for interaction. For one child, in addition to the table game setting, speech and language therapy with the school's SLP was the second setting. Lunch bunch was an additional setting provided, in lieu of recess, for one of the four focus children. During lunch bunch, the children were given a choice between two activities designed to promote conversation (e.g., topic cards or silly pictures to stimulate discussion), with each person taking turns selecting cards or pictures from a pile followed by a board game. The format and duration of settings and sessions were

identical to that of Study 1. Buddy groups gathered three days each week, with two 6-minute sessions (one in each of the two interaction settings) per day.

Measurements

Dependent measures. Dependent measures in this study were identical to those measured in Study 1 (see Table 3). One primary difference was that the researchers measured sequential communicative interactions between the focus child and his/her peers. This consisted of coding who initiated first (e.g., focus child or peer), rate of focus child responses, rate of peer responses to focus child initiations, and the length of the I-R-R sequences (defined as a conversational episode). A change in topic or 3-sec pause signaled the end of an episode; and a 1-sec pause between utterances was necessary to code each separate initiation by the focus child or a peer.

Peer comparison. Identical to Study 1 procedures, peer comparison data was collected to assess rates of communication between peers in the absence of the focus child.

Peer acceptance. Peer acceptance ratings were also obtained as in Study 1.

Reliability. Reliability criteria were identical to those in Study 1.

Procedures

Prior to the start of the intervention, parents of the focus children and peers were provided detailed information about the nature of the project. Written consent

was obtained from parents of the focus children and peers. Verbal assent of the focus children and their peers were also obtained prior to their participation in the project.

Baseline. Sessions during baseline followed the same procedures as in Study 1.

Text-Based Communication Intervention. In Study 2, three different communication skills were successively taught to each group over the course of the treatment phase. These skills were selected based on a pre-treatment teacher survey, parent report, and baseline observations of limited skill use. The first communication skill was directly taught during three teaching sessions lasting approximately 20 minutes. The focus child attended each of these sessions, with one peer dyad. Thus, the focus child received the same information three times and each peer heard the information once. During the teaching portion, the primary investigator modeled the intervention steps for the school staff participating. First, she discussed the target skill for the day, then elicited responses from the children regarding the importance of that skill (e.g., "Why is it important to make suggestions or talk about our ideas?"), and then asked the group to generate simple sentences of what they could say for that communication skill during the activity they were about to play (e.g., "What are some ideas you can talk about while you play Trouble?"). Two to three examples generated by the group were written onto laminated 'topic bubbles' or written on a stimulus card that labeled the target skill. This card was placed into a 5x7 plastic photo frame that stood upright. The frame was placed in front of the focus child. Peers were encouraged to point to the text cues to remind the focus children to use

those communication skills at appropriate times during the interactions. Once the primary author demonstrated the teaching sequence twice, the school staff person was encouraged to implement the treatment during the third session and for the remainder of the school year.

Focus children were positively reinforced for using the target communication skills. The focus child was given a card with the current skill indicated at the top and 10 empty boxes directly beneath the skill. The focus child had 10 opportunities to earn happy faces (which adhered to the empty boxes with Velcro). The goal for the 6-minute session was for the focus child to earn all 10 happy faces, filling up his/her entire card. Before beginning the teaching session, the adult asked the child to predict how many happy faces he or she would aim to get for that session. Following the completion of the 6-minute activity, the adult reviewed how many faces the child earned, provided verbal praise if the child did well during that activity, reviewed examples of how the child could use the skill, and encouraged the child to use it more frequently during the next activity if they did not reach their goal.

After the focus child demonstrated improvements in the first communication skill compared to baseline performance, and maintained those gains over 4-6 sessions, a second communication skill was introduced in the same manner as the first (during 3 consecutive teaching sessions). This skill was again selected based on baseline performance, and school staff report of continued difficulties in nontreatment school activities. The first communication skill remained in view in the first photo holder, and the second skill was placed in a second frame. When the focus child

maintained gains in the second skill, the final or third social skill was introduced. Similarly, a third photo frame was Velcroed to the other two, providing consistent access to all three text prompts and skills targeted. Throughout the intervention, the adult prompted each targeted skill once per minute if the child did not use the skill spontaneously. Occasional prompts for previously taught skills were provided if data indicated a decline in these social skills. Therefore, each new skill was added to the previous, so that by the time the third skill was taught, the focus child was encouraged to use all three skills as appropriate within the social activity.

Maintenance. Maintenance sessions ranged from two to four sessions per focus child and followed the same procedures as in Study 1.

The Current Study

Coding and definitions

Because this study aimed to look at the nonverbal communication behaviors of participants in an intervention that targeted verbal communication skills, all of the coded data were obtained through watching previously videotaped sessions of the same children's interactions in triads. In general, the nonverbal behaviors coded were: (1) gestures, (2) joint attention, (3) eye gazes, (4) facial expressions, (5) nonverbal niceties, and (6) negative or repetitive behaviors. Only the table activities were coded for analysis in the present study, due to the structure and improved quality of the videotaped interactions.

Gestures. A code for gestures (GES) was coded if the focus child: (a) pointed at a referent object or to a peer in attempts to elicit joint attention with a peer toward that object or person, (b) reached for an out-of-reach object (e.g., a game piece, a card) in attempts to elicit help from a peer in obtaining that object, (c) showed peer an object to get the peer to turn his or her attention to that object, (d) tapped a peer (e.g., on the shoulder) to get his or her attention, and (e) shook or nodded his/her head in a contextually appropriate way (e.g., in response to a peer's question). Gestures were coded each isolated time they occurred. Behaviors coded as gestures were appropriate to the interaction. Inappropriate (e.g., rude or hostile) gestures were specified as inappropriate and were not included in the sum of gestures. Out of context, stereotypic, or repetitive movements were not coded as gestures. Rather, those behaviors were coded as STIM for stereotypic or self-stimulating behaviors, classified as a negative behavior for the purposes of this study.

Joint Attention. A code for joint attention (JA) was coded when the focus child (a) engaged in a 3-point gaze (e.g., child looks at referent object, then looks at peer, then looks back at referent object; or looks to peer-referent object-peer), or (b) responded to a peer's attempt at joint attention by looking to where the peer is pointing.

Eye gaze. A code for eye gaze (EG) was coded if the focus child: (a) made eye contact with a peer, or (b) looked at a peer's face. Each new attempt at an eye gaze initiated by the focus child was coded. New attempts were considered when there was a marked break in the eye gaze (focus child looks at peer, looks away, then

looks back at peer), or the focus child switched eye gaze from one peer to another. GES and EG were both coded if the child was using both skills to engage a peer (e.g., looking at peer while tapping his shoulder).

Nonverbal Niceties. Nonverbal niceties (NNic) were coded when the focus child engaged in (a) sharing (e.g., responds to peer's request to borrow or use something they are using), (b) giving (e.g., passes the dice to a peer, draws a card for a peer when the deck is out of the peer's reach), and (c) used any nonverbal gestures while cheering for a peer (e.g., clapping; giving the peer a high five while cheering "good job!"; giving the peer a pat on the back and saying "way to go").

Positive Affect. A positive affect expression, happy (H), was coded when the focus child was observed to be smiling or laughing in a contextually appropriate way (e.g., smiling when he/she wins the game, laughing with peers in response to a funny comment). A new affect code was recorded for each time of occurrence.

Negative Affect. Negative affect included sad (S), when behaviors such as frowning or pouting was observed, and mad (M), when the focus child was seen as angry or frustrated. Inappropriate affect (InAf) expressions were also coded if the affect was inconsistent with the context of the group activity or interfered with the quality of the group interaction (i.e., the focus child is angry when the activity overlapped with the start of lunch time, the child is frustrated that he/she does not get to go first and does not want to compromise). Inappropriate affect was also coded when the child exhibited positive affect that was inconsistent with the context of the

group activity (e.g., when he/she smiled or laughed while engaging in self-stimulating behaviors). A new affect code was recorded for each time of occurrence.

Negative behaviors. Stereotypic and self-stimulating behaviors (STIM) were recorded for any repetitive, out of context or unusual mannerisms. This included any repetitive hand and body movements. Stereotypic and repetitive behaviors were coded for each time of occurrence. Off-task behaviors (OT) were coded when the focus child: (a) left or wandered away from the group, (b) was disengaged or uninterested in the activity (e.g., seemed to be daydreaming), (c) was unresponsive to peer's attempts to engage the child, (d) was playing with parts of the activity (e.g., cards, game pieces) by him or herself and not interacting with peers, or (e) was doing something unrelated to the group's activity. STIM and OT were considered mutually exclusive so the two could not be coded simultaneously.

The same coding system and definitions were used for coding pre-baseline peer comparison data as well as focus child data during baseline, treatment, and maintenance phases of the intervention. As previously discussed in the procedural descriptions for Study 1 and Study 2, peer-comparison sessions involved 3 typical peers engaging in a 6-minute table activity without the focus child present. Peer sessions occurred prior to the start of baseline sessions involving the focus child. Baseline, treatment, and maintenance sessions involved the focus child and 2 peer buddies engaging in a 6-minute table activity.

Reliability

Research assistants were trained to be primary coders. A total of 4 research assistants participated in the primary coding of nonverbal communication behaviors. Two of the research assistants were psychology undergraduate students recruited from the University of Kansas. These RAs were involved in the initial stages of the coding process (i.e., piloting and revision of the coding system). Once the coding system was established, they completed a portion of the coding for Study 1. The remaining two research assistants were Masters-level graduate students in psychology recruited from Boston College in Boston, Massachusetts. They were the primary coders for a portion of Study 1 sessions and all of Study 2 sessions. All RAs were unfamiliar with the original project and were not exposed to any details of the baseline, treatment, or maintenance phases. They were solely trained on observing and coding nonverbal communication behaviors and were aware of who the focus children were. All sessions were provided to the RAs in a randomized order.

Prior to coding the data used in this study, all research assistants were required to demonstrate a level of at least 85% reliability with the primary investigator on three consecutive sessions, practicing with videotaped sessions from a similar study. Once the 85% criterion was established, research assistants were expected to maintain at least 80% inter-observer reliability with the primary investigator. The primary investigator randomly selected sessions from each phase of the intervention (i.e., baseline, treatment, and maintenance) to do reliability coding. Coding was done independently by each coder, after which both coding sheets were gathered for

analysis. Disagreements were scored if the coders did not agree on the categorization of the behavior or if one observer coded a behavior that the other observer did not notice. The inter-observer reliability percentage was calculated by dividing the number of agreements by the sum of agreements and disagreements, then multiplying the value by 100.

Reliability estimates were calculated for 30% of peer comparison, baseline, treatment, and maintenance sessions for all focus children in Study 1 and Study 2. Across both studies, inter-observer reliability was greater than 85% for all focus children. For Study 1, the average reliability for Michael was 90% (range of 86% to 95%), there was also a 90% average for Mark (range of 83% to 100%), an 86% average for Tim (range of 83% to 100%), and an 88% average for Kasey (range of 84% to 95%). For Study 2, the average reliability for Michael was 88% (range of 83% to 94%); Kristen's average reliability was 90% (range of 83% to 100%); Jay's average reliability was 89% (range of 80% to 100%), and Joseph's average reliability was 86% (range of 81% to 100%). For reliability rates for each nonverbal skill coded, refer to Table 4. Averaging across both studies, nonverbal niceties and negative behaviors had the lowest rates of interrater reliability (51% and 72% respectively). Nonverbal niceties, in a broader sense, are gestures, and coder disagreement may have resulted in one person coding the behavior as a gesture while the other person coded the same behavior as a nonverbal nicety. The low agreement in nonverbal niceties may have been due to possible overlap in interpreting the definitions of specific gestures paired with a verbal nicety (e.g., "Good job" and a pat

on the shoulder), and gestures that were not paired with verbal niceties (e.g., pat on the shoulder to say, "Your turn"). Coders were not trained to observe and code the verbal communication behaviors. The low frequency of occurrence of nonverbal niceties and negative behaviors could have also contributed to low agreement rates. For instance, if there was only one observed occurrence of a nonverbal nicety during an entire 6-minute session, the only possible agreement rates for nonverbal niceties in this particular session is either 0% or 100%. Therefore, a few instances of 0% agreement would lower the overall reliability average.

Due to circumstances that occurred during the end of the data coding phase (i.e., for personal reasons, one research assistant had to withdrawal from completing her portion of the coding), the project investigator coded the remaining sessions (17% of the total number of sessions) as the primary coder. Reliability checks were completed by the remaining research assistant, and the reliability criterion was met for 30% of these sessions.

Results

The results are organized in two primary sections—findings from the children in Study 1 and findings from the children in Study 2. Within both studies examined, each of the four research questions was addressed. First, the nonverbal communication behaviors observed during baseline for the focus children and pre-baseline for the peers was compared to assess for relative differences between their rates of nonverbal communication. Second, to identify any changes in their

communication patterns, the nonverbal communication behaviors for each focus child was assessed across the three phases of the study: at baseline, during the treatment phase, and during the follow up (i.e., maintenance) phase. Third, the focus children's negative (i.e., stereotypic, repetitive, or off-task) behaviors and negative affect (i.e., sad, mad, and inappropriate affect) was assessed for any changes across baseline, treatment, and maintenance phases. Finally, each focus child's use of nonverbal skills was compared to their use of the targeted verbal communication skills (i.e., saying a peer's name, talking about taking turns, making suggestions, asking questions, and using verbal niceties) to assess for a potential relation between the acquisition of these verbal skills and the acquisition of nonverbal skills. Specifically, the average combined use of all targeted verbal skills was compared to the combined use of all nonverbal skills for each focus child.

Study 1

Question 1. Five to seven baseline sessions (6-minutes per session) were coded for each of the four focus children. This yielded 30 to 42 minutes of baseline data per focus child (150 minutes total). To obtain peer comparison data, four 6-minute peer (only) sessions were coded for each focus child, with a different peer selected as the 'target child' out of the three peers, for each session. This yielded 24 minutes of nonverbal peer communication data per focus child (96 minutes total).

As illustrated in Figure 1, generally, all four focus children demonstrated less frequent use of nonverbal skills during baseline when compared to their typical peers

pre-baseline, with the exception of their average use of joint attention. The focus children and their peers were equal in their average use of joint attention behaviors (M = 2). The average baseline frequency of gestures across the four focus children (M = 3) was markedly less than that of their peers (M = 9). The focus children engaged in less frequent eye gaze (M = 13) than their peers (M = 17), and were also less likely to use nonverbal niceties (M = 0) than their peers (M = 2). Overall, they expressed one-half as many positive facial expressions (i.e., affect coded as "happy") (M = 4) compared to their peers (M = 8).

Regarding negative affect, which includes sad facial expressions, mad facial expressions, and inappropriate expressions of affect, the focus children and their peers were equal in their expression of negative affect during baseline (focus child M = 0) and pre-baseline peer comparison sessions (peer comparison M = 0), respectively. They also did not differ greatly on their average observed negative behaviors (focus child M = 1; peer comparison M = 0), which include stereotypic/repetitive behaviors (STIM) and off-task behaviors (OT).

Question 2. To determine whether the focus children increased their use of nonverbal behaviors after the written-text treatment, frequencies and means comparisons between baseline and treatment sessions were calculated. Child performance during similar peer groupings 5 months later was also examined to determine if the focus children maintained improvements in nonverbal behaviors. Each child's observed behaviors across baseline, treatment, and maintenance sessions

are first addressed individually. Changes in each child's frequency of observed appropriate positive affect are also examined.

Michael. Michael's data consisted of 7 baseline sessions, 19 treatment sessions, and 3 maintenance sessions, totaling 29 6-minute sessions (174 minutes of data). In general, Michael exhibited a minimal increase in his average use of nonverbal skills (gestures, joint attention, and eye gaze) following the written-text treatment, and during maintenance, while other skills (nonverbal niceties) were consistently absent (refer to Figure 2a). When comparing performance in baseline and treatment, Michael showed minimal improvement in his average use of gestures (baseline M = 6; treatment M = 7), as well as his average joint attention behaviors (baseline M = 1; treatment M = 2). Michael's average use of eye gaze increased slightly during the treatment phase (baseline M = 23; treatment M = 26). There were no changes in Michael's average use of nonverbal niceties from baseline to treatment (baseline M = 0; treatment M = 0). In terms of contextually appropriate positive affect observed, Michael's display of happy facial expressions was consistent in baseline and following the start of treatment (baseline M = 3; treatment M = 3).

Michael's average use of gestures at the 5-month follow up was again a minimal improvement from gestures used during treatment (treatment M = 7; maintenance M = 8). There was no improvement in his joint attention behaviors at maintenance (treatment M = 2; maintenance M = 2). Michael's average use of eye gaze increased (treatment M = 26; maintenance M = 32). His average use of nonverbal niceties again remained unchanged during maintenance (treatment M = 0;

maintenance M = 0). However, Michael exhibited a marked increase in rate of appropriate positive affect during follow up (treatment M = 3; maintenance M = 13). The frequency of Michael's observed nonverbal communication behaviors across all sessions can be seen in Figures 3a and 3b.

Mark. Mark's data consisted of 5 baseline sessions, 22 treatment sessions, and 3 maintenance sessions, totaling 30 sessions (180 minutes of data). In general, there were no significant changes in Mark's use of nonverbal communication skills between baseline and treatment phases. Following the start of treatment, Mark's gestures remained rather consistent (baseline M = 2; treatment M = 3), as did his eye gaze (baseline M = 11; treatment M = 10), joint attention (baseline M = 1; treatment M = 1), and nonverbal niceties (baseline M = 0; treatment M = 1). Regarding appropriate positive affect, Mark showed a small decline in observed happy facial expressions between baseline and treatment phases (baseline M = 6; treatment M = 3).

Mark's nonverbal communication skills showed the greatest change at the 5-month follow up, specifically in his average use of gestures (treatment M = 3; maintenance M = 18) and eye gaze (treatment M = 10; maintenance M = 18). Mark's joint attention average at follow up was a marginal improvement compared to treatment (treatment M = 1; maintenance M = 3), while his use of nonverbal niceties slightly decreased between treatment and maintenance (treatment M = 1; maintenance M = 0). Mark demonstrated a marginal gain in his expressed positive affect during follow up compared to treatment (treatment M = 3; maintenance M = 6), though the

average observed happy facial expressions at maintenance was equal to that observed during baseline. The frequency of Mark's observed nonverbal communication behaviors across all sessions can be seen in Figures 4a and 4b.

Tim. Tim's data consisted of 7 baseline sessions, 19 treatment sessions, and 3 maintenance sessions, totaling 29 sessions (174 minutes of data). Overall, Tim exhibited variable changes in his nonverbal communication behaviors (refer to Figure 2c). From baseline to treatment, there were no changes in his use of nonverbal niceties (baseline M = 0; treatment M = 0) and a slight decrease in his joint attention behaviors (baseline M = 5; treatment M = 3). However, there were positive changes in Tim's average use of gestures (baseline M = 1; treatment M = 7) and eye gaze (baseline M = 8; treatment M = 21). As can be seen in Figure 5a, these two behaviors were more frequently used within the later treatment sessions. Regarding happy affect expressions, Tim showed a marginal change after the start of the written-text treatment (baseline M = 1; treatment M = 3).

During the 5-month follow up, Tim demonstrated marginal improvement in nonverbal niceties (treatment M = 0; maintenance M = 2). There was also a return to baseline levels of joint attention during maintenance (baseline and maintenance M = 5). Tim's average use of gestures continued to show improvement during maintenance (treatment M = 7; maintenance M = 11), as did his eye gaze (treatment M = 21; maintenance M = 35). There was also a notable improvement in his positive affect during follow up (treatment M = 3; maintenance M = 7). The frequency of

Tim's nonverbal communication behaviors across all sessions can be seen in Figures 5a and 5b.

Kasey. Kasey's data consisted of 6 baseline sessions, 19 treatment sessions, and 3 maintenance sessions, totaling 28 sessions (168 minutes of data). Overall, the only noticeable change in Kasey's nonverbal communication skills was his average use of eye gaze following the start of treatment (baseline M = 9; treatment M = 15). In addition, he maintained his use of eye gaze during the 5-month follow up sessions (maintenance M = 14). Kasey's use of gestures remained consistent throughout all three phases (baseline M = 1; treatment M = 2; maintenance M = 1), as did his joint attention behaviors (baseline M = 1; treatment M = 1; maintenance M = 0), and nonverbal niceties (baseline M = 0; treatment M = 0; maintenance M = 0). Though Kasey's only improved nonverbal communication behavior was his use of eye gaze, also of note was the level of his positive affect observed during maintenance. That is, his positive affect greatly improved at the 5-month follow up compared to treatment (treatment M = 3; maintenance M = 12). The frequency of Kasey's observed nonverbal communication behaviors across all sessions can be seen in Figures 6a and 6b.

As previously mentioned, each focus child in Study 1 had a total of 5 to 7 baseline sessions. Treatment sessions ranged from 19 to 22 sessions per focus child, and each focus child had a total of 3 maintenance sessions 5 months following the completion of the treatment phase. Looking at frequency changes across nonverbal behaviors following the start of treatment, one child (Tim) demonstrated a small

increase in his use of gestures, whereas the other three focus children remained consistent in their average frequency of gestures. Two of the four focus children (Tim and Kasey) used more frequent eye gaze during treatment compared baseline. Joint attention behaviors as well as nonverbal niceties were either low or absent and remained virtually unchanged after the start of treatment for all four focus children. One child (Mark) showed a small decrease in happy facial expressions between baseline and treatment. There were little to no change in happy facial expression for the remaining three children.

Between the treatment phase and the 5-month follow up, one focus child (Mark) demonstrated noticeable improvement in his use of gestures, and one child (Tim) demonstrated a slight increase in gestures. Regarding eye gaze, three of the four focus children (Michael, Mark, and Tim) engaged in greater eye gaze with peers at follow up compared to treatment. Again, as was observed across all four focus children following the start of treatment, joint attention and nonverbal niceties remained consistently low or absent at the 5-month follow up. All four children showed at least a small increase in happy facial expression at follow up, with two of the four (Michael and Kasey) showing a substantial increase in their positive affect.

Question 3. To assess whether the negative behaviors (i.e., stereotypic, repetitive, or off-task behaviors) and negative affect (i.e., sad, mad, and inappropriate affect) changed across baseline, treatment, and maintenance phases, the frequency and means were examined for each focus child. Due to the relative consistency across sessions and the low frequency of negative behaviors and negative affect

observed across the phases for all four focus children, the average use of these behaviors were combined and labeled *interfering behaviors* in Table 5.

Michael. Between baseline and treatment phases, Michael's average negative behaviors and negative affect remained consistent. In general, his stereotypic (STIM) behaviors (baseline M = 5; treatment M = 5) and off-task (OT) behaviors (baseline M = 2; treatment M = 2) remained unchanged following the start of treatment. Regarding the negative affect expressions observed, Michael's average combined negative affect increased minimally from baseline to treatment (baseline M = 1; treatment M =2). As shown in Table 5, his overall interfering behaviors increased minimally (baseline M = 8; treatment M =9).

Between treatment and the 5-month follow up, Michael's average stereotypic behaviors (treatment M = 5; maintenance M = 2) decreased slightly, while his average off-task behaviors (treatment M = 2; maintenance M = 3) showed a minimal increase. There was again an increase in Michael's negative affect between treatment and maintenance (treatment M = 2; maintenance M = 4). However altogether, Michael's interfering behaviors remained consistent (treatment M = 9; maintenance M = 9).

Mark. The only changes in Mark's negative behaviors was a minimal increase in average stereotypic behaviors between baseline and treatment (baseline M = 0; treatment M = 1) and a minimal increase between treatment and follow up (treatment M = 1; maintenance M = 2). His average off-task behaviors remained unchanged across all phases of the study (baseline M = 0; treatment M = 0;

maintenance M = 0) as did his negative affect expressions (baseline M = 0; treatment M = 0; maintenance M = 0). As shown in Table 5, Mark's overall interfering behaviors changed minimally across study phases (baseline M = 0; treatment M = 1; maintenance M = 2).

Tim. There was a minimal increase in Tim's average negative affect expressions between baseline and treatment (baseline M = 0; treatment M = 1) as well as average stereotypic behaviors (baseline M = 0; treatment M = 1), while the average of his off-task behaviors were unchanged (baseline M = 0; treatment M = 0). In contrast, between treatment and maintenance, Tim's observed stereotypic behaviors decreased minimally (treatment M = 1; maintenance M = 0), while his off-task behaviors increased minimally (treatment M = 0; maintenance M = 1). Tim's average combined negative affect expressions were unchanged between treatment and follow up (treatment M = 1; maintenance M = 1). Overall, Tim's interfering behaviors (as shown in Table 5) increased minimally after baseline, but remained consistent thereafter (baseline M = 0; treatment M = 2; maintenance M = 2).

Kasey. Kasey's average stereotypic behaviors between baseline and treatment increased minimally (baseline M = 0; treatment M = 1) as did his average negative affect expressions (baseline M = 0; treatment M = 1), while his off-task behaviors decreased minimally (baseline M = 1; treatment M = 0). However, between treatment and maintenance, his average stereotypic behaviors decreased minimally (treatment M = 1; maintenance M = 0) as did his average negative affect expressions (treatment M = 1; maintenance M = 0), while his off-task behaviors increased minimally

(treatment M = 0; maintenance M = 1). Overall, Kasey's interfering behaviors (as shown in Table 5) changed minimally across study phases, with his rates during baseline and follow-up being equal (baseline M = 1; treatment M = 2; maintenance M = 1).

Question 4. To assess whether collateral changes in nonverbal communication skills were related to changes in improved verbal communication skills following written-text treatment, the frequencies and averages of nonverbal communication skills and targeted verbal communication skills were examined for each focus child. Target verbal communication skills varied across the four focus children. In Study 1, two (for one child, Michael) or three target verbal communication skills were selected for each focus child, based on the child's identified areas of need by the classroom teacher, and as indicated by low and stable rates in baseline. Targeted verbal skills may have included two or three of the following skills: Secures for Attention, Suggestions, Turn-Taking, Social Niceties, and Requests. The nonverbal skills included in the following analyses are: Gestures, Joint Attention, Eye Gaze, Nonverbal Niceties, and Positive Affect. The total frequency of target behaviors per session and the total frequency of the 5 nonverbal skills were compared (see Figures 14b-17b) per session. In addition, mean rates of behaviors across baseline, treatment, and maintenance phases were calculated for both nonverbal and target verbal skills.

Michael. Michael's targeted verbal communication skills were Social Niceties (e.g., offering to help, letting a peer go first in a game, complimenting

others) and Suggestions (e.g., talking about how to play the game, offering ideas for how to do an activity) (refer to Table 3 for full definitions of verbal communication skills). The first 9 sessions of treatment targeted Niceties and the final 9 sessions of treatment targeted Suggestions. For Michael only, a multiple baseline design across two communication behaviors was used to measure the effectiveness of the written-text intervention. For the other three focus children, a multiple baseline design replicated across the triads was used.

As illustrated in Figure 7a, between baseline and treatment phases, there was a small increase in Michael's average use of nonverbal skills (baseline M = 33; treatment M = 38), and a moderate change in his average targeted verbal skills (baseline M = 0; treatment M = 9). Between treatment and follow up, there were notable changes in Michael's nonverbal skills (treatment M = 38; maintenance M = 56) while his targeted verbal skills improved slightly (treatment M = 9; maintenance M = 12). There was a wide range in the observed rates of Michael's nonverbal communication skills across baseline (range of 14 to 67 skills per 6-minute session), treatment (range of 10 to 66), and maintenance (range of 43 to 64), as shown in Figure 7b. In contrast, there was less variability in the range of total targeted verbal skills used in baseline (range of 0 to 2), treatment (range of 1 to 22), and maintenance (range of 9 to 13).

Mark. Mark's targeted verbal communication skills in treatment were Suggestions (e.g., talking about how to set up or play an activity), Turn-Taking (e.g., talking about who goes first, second, third), and Secures for Attention (e.g., using

someone's name in combination with a verbal utterance). As shown in Figure 8a, Marks' targeted verbal skills showed marked improvement (baseline M = 1; treatment M = 24), however, there was no increase in his nonverbal communication skills between baseline and treatment phases (baseline M = 20; treatment M = 19). Between treatment and follow up, there was a small increase in Marks' targeted verbal skills (treatment M = 24; maintenance M = 27), and also a noticeable increase in his nonverbal skills (treatment M = 19; maintenance M = 44). Figure 8b indicates that following the start of the treatment phase, Mark's targeted verbal skills immediately improved, while his nonverbal skills remained variable (baseline range = 4 to 40, treatment range = 6 to 46). Further, his use of the targeted verbal skills continued to improve as the treatment phase progressed, while this same pattern of improvement was not observed for his nonverbal skills. It was only during the 5-month follow up that Mark's nonverbal skills (range = 25 to 65) showed some improvement while his verbal communication skills (range = 21 to 35) remained consistent when compared to treatment.

Tim. Tim's targeted verbal communication skills were Suggestions, Niceties, and Secures for Attention. As shown in Figure 9a, between baseline and treatment, there were positive changes in Tim's average use of targeted verbal skills (baseline M = 4; treatment M = 11) as well as nonverbal skills (baseline M = 15; treatment M = 33). Between treatment and maintenance, there was a moderate increase in his targeted verbal skills (treatment M = 11; maintenance M = 17) and a noticeable increase in his nonverbal skills (treatment M = 33; maintenance M = 59). Figure 9b

indicates that as the treatment phase progressed, Tim's use of nonverbal skills (treatment range = 2 to 70) increased at a slightly greater rate than his use of targeted verbal skills (treatment range = 2 to 27). The increases in his nonverbal skills primarily occurred toward the end of the treatment phase and at the 5-month follow up (maintenance range = 40 to 97).

Kasey. Kasey's targeted verbal communication skills were Suggestions, Niceties, and Requests (e.g., requesting an action, requesting clarification from peers, asking general questions). As illustrated in Figure 10a, there was a noticeable change in Kasey's average use of targeted verbal skills (all three skills combined) between baseline and treatment (baseline range = 3 to 9, M = 6; treatment range = 14 to 63, M = 31), and similarly a positive change in his nonverbal behaviors (baseline range = 3 to 27, M = 16; treatment range = 5 to 42, M = 22). From treatment to maintenance, there was a noticeable decrease in Kasey's verbal skills (treatment M = 31; maintenance range = 9 to 19, M = 13), while his nonverbal skills increased slightly (treatment M = 22; maintenance range = 20 to 40, M = 27). During baseline (refer to Figure 10b), it appeared as though the more Kasey used his nonverbal skills, the fewer verbal skills he used. Furthermore, when his use of targeted verbal skills increased, his use of nonverbal skills decreased. The same general pattern is seen again during the initial sessions of the treatment phase (sessions 1, 3, and 4) as well as during the final sessions of the treatment phase (sessions 15, 17, and 19). However, during the middle of the treatment phase, Kasey's use of nonverbal and verbal skills seemed to increase and decrease in unison (sessions 5 to 14). In general, there was

great variability in Kasey's use of targeted verbal skills (treatment range = 14 to 63) as well as his use of nonverbal skills (treatment range = 5 to 42) throughout the entire treatment phase. The maintenance range of target verbal skills was 9 to 19 occurrences during a 6-minute activity, while the maintenance range of nonverbal skills was 20 to 40.

Study 2

Question 1. To investigate whether levels of nonverbal communication differed between four focus children with ASD and peers at baseline, frequencies and means of nonverbal behaviors were calculated for the focus children during baseline, and were compared to the means obtained for peer nonverbal behaviors during the peer comparison sessions (when a triad of peers interacted without the presence of the focus child). Peer comparison sessions occurred prior to baseline.

Six to nine baseline sessions (6-minutes per session) were coded for each focus child. This yielded 36 to 54 minutes of baseline data per focus child (186 minutes total). To obtain peer comparison data, four 6-minute peer (only) sessions were coded for each focus child, with a different peer selected as the 'target child' out of the three peers, for each session. This yielded 24 minutes of peer comparison data per focus child (96 minutes total).

As illustrated in Figure 11, on average, all four focus children demonstrated less frequent use of nonverbal communication skills when compared to their typical peers. The average baseline frequency of gestures across the four focus children (M

= 3) was markedly less than that of their peers (M = 8). The focus children also used eye gaze less frequently (M = 8) than their peers (M = 18), as well as markedly less positive affect (i.e., affect coded as "happy") (M = 3) when compared to their peers (M = 16). However, the focus children and their peer comparison group did not differ greatly in their use of joint attention (focus child M = 1; peer M = 2) or nonverbal niceties (focus child M = 0; peer M = 1).

Regarding negative affect, which includes sad facial expressions, mad facial expressions, and inappropriate expressions of affect, the focus children and their peers were equal in their average expression of negative affect during baseline (focus child M = 0) and pre-baseline peer comparison sessions (peer comparison M = 0), respectively. They also did not differ greatly on their average observed negative behaviors (focus child M = 1; peer comparison M = 0), which include stereotypic/repetitive behaviors (STIM) and off-task behaviors (OT).

Question 2. To determine whether the focus children increased their use of nonverbal behaviors after the written-text treatment, frequencies and means comparisons between baseline and treatment sessions were calculated. Child performance during similar peer groupings 5 months later was also examined to determine if the children maintained improvements in nonverbal behaviors. Each child's observed behaviors across baseline, treatment, and maintenance sessions are first addressed individually. Changes in each child's frequency of observed appropriate positive affect are also examined.

Michael. Michael's data consisted of 6 baseline sessions, 24 treatment sessions, and 4 maintenance sessions, totaling 34 sessions (204 minutes of data). In Study 2, Michael exhibited increases in his average use of gestures and eye gaze during treatment, and minimal to no change in his use of joint attention, nonverbal niceties, and expression of positive affect (refer to Figure 12a). When comparing averages across baseline and treatment sessions, there was an increase in his use of gestures (baseline M = 4; treatment M = 7) and a more marked increase in eye gaze (baseline M = 16; treatment M = 23). There was no change in his use of joint attention (baseline M = 1; treatment M = 1) and only minimal changes in nonverbal niceties (baseline M = 0; treatment M = 1) and his expression of positive affect (baseline M = 3; treatment M = 5).

At the 5-month follow up, his use of gestures continued to improve (treatment M = 7; maintenance M = 12), as did his eye gaze (treatment M = 23; maintenance M = 26). Joint attention behaviors increased during maintenance (treatment M = 1; maintenance M = 4), as did his average positive affect expression (treatment M = 5; maintenance M = 7). No changes were observed in his average use of nonverbal niceties during follow up (treatment M = 1; maintenance M = 1). The frequency of Michael's observed nonverbal communication behaviors across all sessions can be seen in Figures 13a and 13b.

Kristen. Kristen's data consisted of 9 baseline sessions, 22 treatment sessions, and 2 maintenance sessions, totaling 33 sessions (198 minutes of data). Kristen's average use of eye gaze and happy facial expressions showed greatest improvement

during the treatment phase, while her use of gestures, joint attention, and nonverbal niceties remained consistent across baseline and treatment phases (refer to Figure 12b). During treatment, Kristen's average use of eye gaze increased markedly (baseline M = 4; treatment M = 9), as did her average frequency of positive affect (baseline M = 0; treatment M = 4). There was a minimal change in her use of nonverbal niceties (baseline M = 0; treatment M = 1). However, there was no change in her average use of gestures (baseline M = 2; treatment M = 2) and joint attention (baseline M = 1; treatment M = 1).

During the 5-month follow up, there was a small increase in Kristen's average use of joint attention (treatment M = 1; maintenance M = 3). However, there was a minimal decline in her use of gestures (treatment M = 2; maintenance M = 1) and nonverbal niceties (treatment M = 1; maintenance M = 0), while a slightly greater decline was observed for eye gaze (treatment M = 9; maintenance M = 4) and positive affect expression (treatment M = 4; maintenance M = 1). The frequency of Kristen's observed nonverbal communication behaviors across all sessions can be seen in Figures 14a and 14b.

Jay. Jay's data consisted of 8 baseline sessions, 22 treatment sessions, and 2 maintenance sessions, totaling 32 sessions (192 minutes of data). Jay exhibited little to no change in his nonverbal communication behaviors between baseline and treatment, but during follow-up, there was noticeable change in 3 of the 5 nonverbal skills (refer to Figure 12c). When comparing his behaviors during baseline and treatment, Jay's average use of gestures (baseline M = 4; treatment M = 2) and eye

gaze (baseline M = 7; treatment M = 5) showed a minimal decline, while there was no change observed in his average use of joint attention behaviors (baseline M = 1; treatment M = 1) or nonverbal niceties (baseline M = 0; treatment M = 0). There was also only a minimal change in his observed positive affect (baseline M = 4; treatment M = 5).

At the 5-month follow-up, Jay's average use of gestures (treatment M = 2; maintenance M = 13) and eye gaze (treatment M = 5; maintenance M = 20) were markedly improved in comparison with his treatment averages. His positive affect expressions were also more frequent (treatment M = 5; maintenance M = 15). However, as was observed during baseline and treatment, Jay demonstrated no changes in his average use of joint attention behaviors (treatment M = 1; maintenance M = 1) or his average use of nonverbal niceties (treatment M = 0; maintenance M = 0) at the 5-month follow-up. The frequency of Jay's observed nonverbal communication behaviors across all sessions can be seen in Figures 15a and 15b.

Joseph. Joseph's data consisted of 8 baseline sessions, 26 treatment sessions, and 3 maintenance sessions, totaling 37 sessions (222 minutes of data). Joseph demonstrated increases in one nonverbal behavior during treatment; that is, his average use of eye gaze increased from a mean of 6 to a mean of 9 (refer to Figure 12d). For the other four nonverbal communication skills, there were minimal changes in his average use of nonverbal niceties (baseline M = 0; treatment M = 1) and his positive affect expression (baseline M = 1; treatment M = 2). However, there were no

changes in his average use of gestures (baseline M = 1; treatment M = 1) or joint attention behaviors (baseline M = 1; treatment M = 1).

At the 5-month follow-up, there was a minimal increase in his eye gaze (treatment M = 9; maintenance M = 10) and in his positive facial expressions (treatment M = 2; maintenance M = 3). However, there was no change in his average use of gestures (treatment M = 1; maintenance M = 1), and joint attention behaviors (treatment M = 1; maintenance M = 0) and nonverbal niceties (treatment M = 1; maintenance M = 0) declined. The frequency of Joseph's observed nonverbal communication behaviors across all sessions can be seen in Figures 16a and 16b.

As previously mentioned, each focus child in Study 1 had a total of 6 to 9 baseline sessions. Treatment sessions ranged from 22 to 26 sessions per focus child, and maintenance sessions ranged from 2 to 4 sessions per focus child. Looking at frequency changes following the start of treatment, only one child (Michael) demonstrated an increase in his use of gestures, while others showed no change (Kristen and Joseph) or a small decline (Jay) in their use of this skill. All four focus children showed no change in their average use of joint attention behaviors and minimal to no change in their use of nonverbal niceties between baseline and treatment phases. Three of the four showed moderate improvement in their use of eye gaze during treatment, while one child's (Jay) use of eye gaze declined slightly. There was a small increase in observed positive facial expressions for all four focus children during treatment.

During the 5-month follow up, gestures improved for two of the four children (Michael and Jay), while it remained unchanged (Joseph) or declined (Kristen) for the other two children. Joint attention behaviors, which were unchanged following the start of treatment for all four kids, improved slightly for two of the four children (Michael and Kristen), while it remained unchanged (Jay) or declined (Joseph) for the others. There was again, minimal to no changes in the use of nonverbal niceties across all four focus children. Three of the four children exhibited some improvement in their use of eye gaze, while one child (Kristen) exhibited less eye gaze during maintenance. The same three children also exhibited more positive facial expressions during maintenance, while one (Kristen) exhibited fewer.

Question 3. To assess whether the negative behaviors (i.e., stereotypic, repetitive, or off-task behaviors) and negative affect (i.e., sad, mad, and inappropriate affect) changed across baseline, treatment, and maintenance phases, the frequency and means were examined for each focus child. Due to the relative consistency across sessions and the low frequency of negative behaviors and negative affect observed across the phases for all four focus children, the average use of these behaviors were combined and labeled *interfering behaviors* in Table 5.

Michael. Between baseline and treatment phases, Michael's average negative behaviors were generally consistent. There was no change in his stereotypic or repetitive behaviors (baseline $\underline{M} = 1$; treatment $\underline{M} = 1$) and minimal changes were observed for his off-task behaviors (baseline $\underline{M} = 1$; treatment $\underline{M} = 0$) and negative affect expressions (baseline $\underline{M} = 1$; treatment $\underline{M} = 0$). Between treatment and the 5-

month follow up, Michael's stereotypic behaviors (treatment M = 1; maintenance M = 1), off-task behaviors (treatment M = 0; maintenance M = 0), and negative affect expressions (treatment M = 0; maintenance M = 0) remained unchanged. As shown in Table 5, Michael's total interfering behaviors showed a small decrease following baseline (baseline M = 3; treatment M = 1; maintenance M = 1).

Kristen. Kristen's average negative affect (baseline M = 0; treatment M = 1) increased minimally between baseline and treatment phases. Her negative behaviors—stereotypic (baseline M = 1; treatment M = 1) and off-task (baseline M = 1; treatment M = 1)— remained unchanged following the start of treatment. At the 5-month follow-up, Kristen's stereotypic behaviors again remained unchanged (treatment M = 1; maintenance M = 1). There was a minimal increase in her off-task behaviors (treatment M = 1; maintenance M = 2). There was a slight increase in her average negative affect (treatment M = 1; maintenance M = 3) between treatment and follow up. Altogether, as shown in Table 5, Kristen showed a small increase in interfering behaviors at each study phase (baseline M = 2; treatment M = 3; maintenance M = 6).

Jay. There were minimal improvements in some of Jay's negative affect behaviors following the start of treatment. There was a slight decline in average negative affect expressions (baseline M = 2; treatment M = 0). There was also a small decline in his off-task behaviors (baseline M = 2; treatment M = 0) between baseline and treatment. Jay's average stereotypic behaviors (baseline M = 0; treatment M = 0) remained unchanged between baseline and treatment phases.

Between treatment and maintenance sessions, there was a minimal increase in stereotypic behaviors (treatment M = 0; maintenance M = 1) and an increase in the frequency of negative affect (treatment M = 0; maintenance M = 3). Altogether, Jay's interfering behaviors (as shown in Table 5) improved during treatment, but increased to baseline levels at follow-up (baseline M = 4; treatment M = 0; maintenance M = 4).

Joseph. Joseph's negative affect expressions remained unchanged between baseline and treatment phases (baseline M = 1; treatment M = 1). There were minimal declines in his stereotypic behaviors (baseline M = 4; treatment M = 3) and his off-task behaviors (baseline M = 1; treatment M = 0). Between treatment and maintenance, a minimal change was observed for negative affect (treatment M = 1; maintenance M = 0). Joseph's off-task behaviors (treatment M = 0; maintenance M = 0) were maintained, while a moderate increase in stereotypic behaviors was observed (treatment M = 3; maintenance M = 9). As seen in Table 5, Joseph's total interfering behaviors improved slightly during treatment, but increased again at follow-up (baseline M = 6; treatment M = 4; maintenance M = 9).

Question 4. To assess whether collateral changes in nonverbal communication skills were related to changes in acquired verbal communication skills during treatment, the frequencies and averages of nonverbal communication skills and targeted verbal communication skills were examined for each focus child. Target verbal communication skills varied among the four focus children. In Study 2, three target verbal communication skills were selected for each focus child, based on

teacher completion of a pre-treatment survey on their perceptions of important social communication skills, and the child's areas of need as indicated by low and stable frequencies of those skills during baseline. Targeted verbal skills may have included: Secures for Attention, Suggestions, Turn-Taking, Social Niceties, and Requests. The nonverbal skills included in the following analyses are: Gestures, Joint Attention, Eye Gaze, Nonverbal Niceties, and Positive Affect (i.e., contextually appropriate happy facial expressions). The total frequencies of the 3 targeted verbal skills and the total frequencies of the 5 nonverbal skills were calculated per session. Mean rates for baseline, treatment, and maintenance sessions were then calculated for nonverbal skills and targeted verbal skills.

Michael. Michael's targeted verbal communication skills were Turn-Taking (e.g., talking to peers about who goes first, second, third), Social Niceties (e.g., complimenting a peer, cheering when someone wins), and Requests (e.g., asking a peer a question) (refer to Table 3 for detailed definitions of all target verbal skills). For all focus children in Study 2, a multiple baseline design across communication behaviors, replicated across triads was used to measure the effectiveness of the written-text intervention. Thus, treatment began on one verbal skill and once consistent increases were observed for that skill, the next skill was added in treatment. Similarly, when improvements were observed for the second target skill, the third verbal skill was added while coding of the previous two skills continued. For Michael, the sequence of his targeted verbal skills was Turn-Taking, then Niceties, followed by Requests.

As shown in Figure 17a, there was a marked increase in Michael's average use of targeted verbal skills (baseline M = 3; treatment M = 9) and a slight increase in his average use of nonverbal skills (baseline M = 5; treatment M = 8). Between treatment and maintenance, there were increases for both verbal skills (treatment M = 9; maintenance M = 12) and nonverbal skills (treatment M = 8; maintenance M = 11). Figure 17b illustrates that despite the variability in frequencies across sessions, there appears to be a trend of gradual improvement in Michael's targeted verbal skills across baseline (range = 4 to 17 skills per 6-minute session), treatment (range = 10 to 49), and maintenance phases (range = 27 to 44). This gradual trend was also observed for collateral nonverbal skills across baseline (range = 11 to 31), treatment (range = 15 to 49), and maintenance (range = 34 to 52).

Kristen. Kristen's targeted verbal communication skills, in order of treatment target, were Suggestions (e.g., talking about how to set up or play an activity), Niceties, and Secures for Attention (e.g., using someone's name in combination with an additional verbal utterance). As shown in figure 18a, there was a noticeable change in her average use of targeted verbal skills between baseline and treatment (baseline M = 1; treatment M = 6). At the same time, there was only a minimal change in her use of nonverbal skills (baseline M = 2; treatment M = 3). During maintenance, there was continued improvement in her use of verbal skills (treatment M = 6; maintenance M = 9) and a minimal decline in her use of nonverbal skills (treatment M = 3; maintenance M = 2). Figure 18b suggests that Kristen showed steady improvement in her use of targeted verbal skills from baseline (range = 0 to 7)

to the end of the treatment phase (range = 3 to 37), and that she maintained these behaviors during follow-up (range = 14 to 38). While the intervention had a positive effect on her targeted verbal skills, Kristen's nonverbal skills also showed some gradual improvement between baseline (range = 1 to 11) and treatment (range = 6 to 25). However, when the third verbal skill was introduced into the intervention during the last few treatment sessions, Kristen's use of nonverbal skills declined to near-baseline rates. Her average use of nonverbal skills during follow up (range = 5 to 8) was equal to her average use during baseline.

Jay. Jay's targeted verbal communication skills were Niceties, Requests, and Secures for attention (targeted during treatment in that order). As shown in Figure 19a, between baseline and treatment, there was a marked increase in the average frequency of Jay's targeted verbal skills (baseline M = 3; treatment M = 10). In contrast, there was a minimal decline in his observed nonverbal skills (baseline M = 3; treatment M = 2). At the 5-month follow-up, Jay maintained his treatment gains in verbal skills (treatment M = 10; maintenance M = 11) and exhibited a moderate increase in his nonverbal skills (treatment M = 2; maintenance M = 8). Figure 19b indicates that while Jay's targeted verbal communication skills showed continued improvement across baseline (range = 3 to 13), treatment (range = 9 to 53), and maintenance (range = 12 to 76), his nonverbal skills remained consistent across baseline (range = 5 to 20) and treatment (range = 1 to 17), and increased only during follow-up (range = 32 to 35).

Joseph. Joseph's targeted verbal communication skills were Secures for Attention, Suggestions, and Niceties (targeted during treatment in that order). As seen in Figure 20a, there were clear improvements in Joseph's targeted verbal skills during treatment (baseline M = 1; treatment M = 7) and minimal change in his nonverbal skills (baseline M = 2; treatment M = 3). At follow-up, he maintained improvements in his verbal skills (treatment M = 7; maintenance M = 8), while his nonverbal skills remained consistent from treatment to follow-up (treatment M = 3; maintenance M = 3). Figure 20b suggests that while there was a gradual change in Joseph's use of targeted verbal skills from baseline (range = 0 to 8), to treatment (range = 6 to 39), to follow-up (range = 18 to 30), his use of nonverbal skills remained variable and did not improve across all phases of the study (baseline range = 1 to 20; treatment range = 3 to 23; maintenance range = 9 to 13).

Discussion

The current project examined the collateral changes in nonverbal communication behaviors of school-age children with ASD following participation in peer-mediated text based verbal communication interventions. Participants were 7 school-aged children with ASD. Four focus children participated in Study 1 and 2, with one child participating in both years. Specifically, the current project aimed to: 1) identify whether there were pre-treatment differences in rates of nonverbal communication behaviors between the focus children and their peers without disabilities, 2) identify the focus children's collateral changes in nonverbal

communication skills throughout their participation in the peer-mediated communication interventions, 3) identify any collateral changes in negative affect and behaviors that may have interfered with positive group interactions, and 4) determine whether there was a relation between gains in verbal communication skills and collateral changes in nonverbal communication behaviors following participation in the peer-mediated communication interventions.

While children with ASD continue to have significant deficits in both verbal and nonverbal communication skills well into and beyond their school-aged years, the majority of past and present research endeavors for school-age children have only targeted verbal communication skills (Kamps et al., 1992; 2002a; 2002b; 2002c; Thiemann & Goldstein, 2001; 2004). In comparison to this growing body of research, there is a lack of research focusing on the nonverbal communication behaviors of school-age children with ASD. The majority of intervention research focusing on nonverbal communication skills (e.g., joint attention) has involved preschool aged children (Martins & Harris, 2006; Whalen et al., 2006). The current study sought to contribute to our understanding of how school-age children with ASD communicate nonverbally during peer interactions, without direct teaching of these nonverbal behaviors.

Findings from this study demonstrated that there were pre-treatment differences in the use of nonverbal communication behaviors by children with ASD and their same-aged typical peers. In general, the children with ASD used fewer eye gaze, gestures, and expressions of positive affect than their typical peers. Results also

indicated positive collateral effects on nonverbal behaviors for some focus children in both studies following treatment, namely in their increased use of eye gaze, gestures, and expression of positive affect. Though small improvements were observed for the aforementioned behaviors, other nonverbal skills such as joint attention and nonverbal niceties did not improve. Despite high variability in the use of nonverbal communication skills for the focus children in both studies, comments can be made regarding some general patterns that emerged.

Eye Gaze. All focus children on average exhibited less frequent use of eye gaze than their typical peers prior to treatment. This finding is consistent with diagnostic criteria of an Autism Spectrum Disorder (APA, 2000), which includes difficulty engaging in eye contact and the lack of sensitivity to another person's eye gaze. This finding is also in line with the literature which supports that children with ASD have difficulty differentiating between direct gaze and averted gaze (Senju et al., 2003) and engaging in direct eye contact (Phillips et al., 1992). During baseline and treatment, eye gaze occurred more frequently than all other nonverbal behaviors. More importantly, the majority of the focus children showed a modest increase in their average use of eye gaze following treatment; and their rates of eye gaze continued to improve 5-months later. Some environmental and setting variables may have elicited the observed collateral improvements in eye gaze. For example, throughout the project, when the focus child attempted to bring the adult into the interaction (e.g., to ask how to play the game), the adult would redirect the focus child to ask his/her peers (e.g., stating "ask your friends" while pointing to the peers).

At times, this helped the focus child to look in the direction of his/her peers while talking to them. Also, for several of the focus children, one targeted verbal skill was to say a friend's name before talking to them (Secures for Attention). When prompting this verbal skill, the adult would sometimes ask, "Who are you talking to?" which also encouraged the child to look in the peer's direction. Finally, one secondary outcome of the peer-mediated intervention studies from which this study was derived, was an increase in peer verbal initiations and responses to the focus children; this likely encouraged greater participation in group discussions and games, which could lead to more frequent eye gaze.

Gestures. All children with ASD exhibited fewer gestures than their peers prior to treatment. During treatment, although more than half of the focus children showed some increase in their use of gestures, the overall average rate across all focus children remained rather low. This is consistent with the research literature, which suggests that children with ASD have difficulty communicating using gestures (e.g., pointing) (Baron-Cohen et al., 1992). However, the treatment did produce collateral improvements for two children. One child from Study 1 (Tim) had a notable increase in gestures following the start of treatment. A possible explanation for this improvement may have been related to the alteration of his treatment settings. Rather than having the 6-minute table activity and 6-minute recess activity, Tim's treatment setting was modified to include one 12-minute table activity. This change was made due to behavior difficulties that arose during recess, which lacked adequate structure for Tim. Although only 6 of the 12 minutes of each session were coded (to

stay consistent with the coding done for the other children), perhaps having 12-minute sessions provided more opportunities for Tim to observe and practice nonverbal skills such as gestures; opportunities that may not have been available in an unstructured recess environment. From Study 2, Michael was the only one who showed an improvement in gestures during treatment. This may have been due to his prior participation in Study 1, which provided him with an entire year of experience with the treatment settings and peer interactions that the other three children did not have.

For the four focus children whose gestures improved between baseline and treatment, their gestures continued to improve at follow-up; five months later, these four children showed substantially more gestures than in baseline. One possible explanation for the improvements in gestures is the nature of the targeted verbal skills selected for these children. Some children had Secures for Attention as one of their target skills; thus, they would have the opportunity to use gestures (e.g., tapping a peer on the shoulder or pointing to a peer) to gain a peer's attention. Other targeted verbal skills selected included Turn-Taking and Making Suggestions, which also offer opportunities to use gestures, such as pointing to a peer to tell him/her to take a turn, pointing to the game board to explain an idea about how to play the game, and nodding or shaking one's head in agreement or disagreement to someone else's suggestion. Niceties, another target skill, offered additional opportunities to use gestures such as clapping to cheer for a peer who won the game. The results revealed that second to eye gaze, the use of gestures was another collateral nonverbal

communication skill that increased following participation in a peer-mediated communication intervention, specifically for two children with ASD. The literature indicates that in typical development, gestures are often used in conjunction with eye contact as well as verbalizations to communicate (Iverson & Thal, 1998). Findings from this project were consistent with this, in that the increases in rates of gestures across the study phases generally mirrored improvements in eye gaze following participation in a communication intervention. Perhaps there is a response class of nonverbal behaviors, that is, perhaps an increase in verbal communication skills led to (for example) new gestures and eye gaze behaviors in treatment compared to baseline. Further, it is possible that with the focus children looking at their peers more often during the structured social interactions, they were more likely to notice nonverbal communication skills used by their peers and consequently imitated those modeled behaviors.

Joint Attention. In both studies, there were virtually no pre-treatment differences between focus children and peers in their use of joint attention, which was relatively infrequent. In Study 2, peers used more joint attention behaviors than the focus children, but this difference was minimal. Furthermore, the focus children did not exhibit any marked changes in joint attention throughout treatment or at follow up.

The literature supports that children with ASD have significant impairments in their ability to engage in joint attention when compared to typical peers or to children with other developmental disabilities such as Down Syndrome (Dawson et al., 1998;

Lewy & Dawson, 1992; Martins & Harris, 2006; Warreyn, Roeyers, Oelbrandt, & DeGroote, 2005). Specific impairments include initiating one's gaze between a peer and an object using a three-point gaze or following another person's joint attention initiation. However, it is interesting that low rates of joint attention behaviors were also observed for the typical peers in this study, given that triadic interactions, or the ability to bring attention to a referent object into a dyadic interaction with someone, emerges by approximately 18-months of age in typical development (Bakeman & Adamson, 1984). Lord and Magill-Evans (1995) found similar rates of joint attention in school-age children and adolescents with and without ASD. Although the children with ASD and their typical peers did not differ in their rates of joint attention, the findings suggested that children with ASD were less likely than their typical peers to combine behaviors to communicate and share attention during interactions.

It may be that the nature of some of the treatment activities created less of a demand to explicitly elicit the joint attention of a peer (e.g., the children focused their attention on one central object while working on one craft project together). Further, the activities chosen for the study were selected because they served to maximize the opportunities for verbal communication and interaction; the children often directed their attention toward a single game object (e.g., game board, deck of cards) and were often encouraged to share materials (e.g., passing around one fishing pole rather than each child having his/her own).

It is also possible that, although joint attention is one of the early prelinguistic skills to emerge during early childhood, it is not as essential to successful

communication once language is more developed, as demonstrated by the children in these studies. For instance, it is easier to direct someone's attention toward something by stating, "Hey, look at that!" rather than attempting to elicit eye contact with someone and engaging in a 3-point gaze. Perhaps with higher verbal skills children are less reliant on nonverbal skills to communicate efficiently. At this time, research is sparse in terms of exploring joint attention during school-age years through adolescence, both in typical development and in relation to ASD. One recent study by Sigman and McGovern (2005) followed the developmental progression of 48 children with autism at preschool age (mean of 3 years), at mid-school age (mean of 12 years), and at young adulthood (mean of 19 years), and found that the children made gains in nonverbal joint attention initiations and responses between preschool and mid-school ages. However, between mid-school and young adulthood, participants' rates of response to joint attention did not change, whereas their joint attention initiations declined. Comparisons to typical peers cannot be made at this point as the research on joint attention in typical adolescent development is currently lacking. More research is needed to better understand how joint attention is utilized by typical children and by children with ASD as they get older and their communication skills progress.

Another possible explanation for the low rates of joint attention observed across all participants has to do with the coding definition of joint attention. For this project, joint attention was defined as (a) engagement in a 3-point gaze (peer-referent object-peer, or object-peer-object), or (b) sharing attention with a peer by looking to

where a peer is pointing. Throughout the coding process, observing the 3-point gaze was extremely rare. Thus, the majority of the joint attention behaviors coded in this project represented the child's *response* to a peer's attempt at joint attention. Perhaps if the definition of joint attention was expanded to include the combination of eye gaze plus pointing toward an object or eye gaze plus showing the object to a peer, the rate of joint attention may be slightly higher. Instead, following the definitions used in this project, that combination would have been coded as one eye gaze and one gesture—pointing and showing were coded as gestures in the current study. Refinement of the coding definitions for joint attention behaviors may be conducive to a more accurate representation of this particular communication behavior for this age group.

Nonverbal Niceties. The focus children in both studies also used fewer nonverbal niceties than their peers, however observed nonverbal niceties were relatively infrequent for the focus children as well as for their peers, and the difference between the focus child and peer means was minimal. Furthermore, the focus children did not show any marked changes in their use of nonverbal niceties throughout the study. The data obtained from this study does not directly lend itself to explanations of why the frequencies of nonverbal niceties were low for all participants (focus children and peers). The categorization of nonverbal niceties has not yet been delineated within the research literature, since in a broader sense these behaviors may be considered gestures.

Due to the lack of research on this specific social behavior, only speculations can be made at this time. It is possible that the children were not accustomed to participating in structured games with peers, as none of the children with ASD had previously participated in peer-mediated social interventions in a school setting. They may also be interacting with other children with whom they have had minimal contact in a social setting prior to the start of the project. These factors may have detracted the children from interacting in a more natural manner (e.g., among familiar peers and in a familiar setting).

It is also possible that nonverbal niceties are linked to concepts such as intersubjectivity (Gipps, 2004; Mundy & Hogan, 1994) and theory of mind (Baron-Cohen, 1995; Gnanathusharan & Mitchell, 2007), a certain self-other awareness and an understanding of others' mental states which are essential to social communication. Using nonverbal niceties or doing something nice for someone else requires a sense of perspective-taking (e.g., an awareness of what others would feel in response to a nice gesture), and perhaps this awareness has yet to fully develop in school-aged children in general. The literature suggests that joint attention is a predictor of several areas of social functioning including perspective-taking and theory of mind (Charman et al., 2000) and that intersubjectivity and theory of mind are considered higher level social behaviors (Whalen et al., 2006). Therefore, it makes sense that the focus children and peers in the current study demonstrated a low rate of nonverbal niceties, given their low rates of joint attention behaviors.

Positive Affect. Regarding positive affect expression, the focus children exhibited fewer happy expressions than their peers. With the exception of one child (Kristen), there was little to no change in their expression of positive affect during treatment. This finding is consistent with the research literature, which suggests that children with ASD display significantly less positive affect than their typical peers (Kasari et al., 1990; McGee et al., 1991). In addition, when children with ASD engage in joint attention, they do not exhibit affective behaviors such as positive affect, as would be seen in typically developing children (Kasari et al., 1990). And with the difficulties that children with ASD have relating to others and to others' perspectives, frequent rates of positive affect—an ability that Stern (1985) described as "clinically germane" to one's capacity to relate to others—would not be an expected collateral outcome.

However, Kristen did show a notable improvement in her positive affect expressions after the start of treatment. This could be partially explained by the quality of the interactions between Kristen and her peers. During baseline, there were frequent disagreements between Kristen and her peers during the 6-minute activity, usually regarding the order of turns, which person should go first, and how the games should be played. These disagreements often left Kristen upset, making it difficult for her to continue participating in the activity. Following the start of treatment, the communication skills taught included appropriate ways to make suggestions and talk about ideas, as well as talking nice, helping and sharing. This greatly improved the

quality of the interactions between Kristen and her peers, which was evidenced by the observed increase in positive affect.

At follow-up, the majority of the focus children showed at least a small increase in their use of positive facial expressions. Perhaps the late improvement in positive affect was due to secondary outcomes of the peer-mediated social intervention, as observed in previous studies (Thiemann & Goldstein, 2004). That is, the focus children and peers had more time to continue their interactions outside of treatment across various social settings, and develop stronger friendships. One important aspect of the verbal skills intervention was including a *network* of trained peers. This peer network consistently participated in the project throughout the school year. The trained peers may have included the focus children in recess activities or classroom group activities, where they may have not done so prior to treatment. The focus children may have grown more comfortable within interactions with trained peers as well as other peers not directly involved in the project. With an increased rate of positive interactions with their peers, the focus children may have felt more included and accepted in social situations, which would then put them more at ease and make the interactions more enjoyable for them. The observed improvements in affect may also be explained by the careful selection of verbal skills that were functional, age-appropriate, and tailored for each child's needs. The children were taught to use these functional communication skills across different social activities; improved social communication competence may have resulted in

improved quality of interactions between the focus children and their peers, which consequently resulted in more positive affect.

Negative Affect and Negative Behaviors. There were no pre-treatment differences between focus children and peers in their expression of negative affect, which was generally absent. In addition, there was little to no change across all three phases of the intervention. The focus children in both studies exhibited negative behaviors (i.e., stereotypic or off-task behaviors) more often than their peers, though these behaviors were relatively infrequent. For most of the focus children, there was little to no change in negative behaviors across the three intervention phases. Low rates of stereotypic or off-task behavior may be expected for the focus children in the present study because they were higher functioning, and demonstrated low rates of negative behaviors prior to treatment. It is also likely that the degree of structure associated with the sessions (i.e., adult presence and redirection as needed, structured activities with clear and familiar rules, clearly defined activity area) provided supports that helped the children to focus on the activity rather than engaging in off-task or stereotypic behaviors. Having selected positive peer role models for the focus children may have also helped the focus children to imitate appropriate social behaviors as well.

The Link Between Verbal and Nonverbal Communication. Findings indicated a general relation between the acquisition of target verbal communication skills and the acquisition of collateral nonverbal communication skills for most of the focus children. This finding is a definite contribution toward building an optimal

intervention for school-age children with ASD. The positive link between direct learning of verbal skills and indirect learning of nonverbal skills suggests that children with ASD are able to improve their nonverbal communication skills, even when not directly taught to do so. Direct teaching of nonverbal skills, in addition to teaching specific social communication skills, may further enhance the social and communication abilities of children with ASD and close the gap between their social abilities and those of their typical peers. Across both studies, changes in nonverbal behaviors were more modest compared to the changes in target verbal skills. This is likely a direct result of the verbal behaviors being specifically targeted in treatment.

The finding that this verbal communication intervention produced collateral changes in nonverbal communication behaviors could be interpreted in a few ways. First, this finding may indicate that direct instruction of multiple verbal communication skills leads to collateral learning of accompanying nonverbal skills once children become more skilled communicators. The supportive social settings and structured activities provided a context to learn and effectively use targeted communication skills; perhaps this increased repertoire of social communication skills was a necessary precursor for the children to begin using more nonverbal communication behaviors. Teaching multiple verbal communication skills may have enabled the focus child to become a more competent communicator, which may have led to subsequent acquisition of certain collateral nonverbal behaviors. Second, once the children began to use targeted skills more frequently during the small group interactions, they received greater peer reinforcement. Peers were often monitoring

and reinforcing the focus child's use of target skills by placing a happy face on the Velcro sheet each time a target skill is used. In addition to this visual reinforcement, peers also spontaneously offered encouragement in other ways (e.g., verbal praise, clapping, smiling) in response to the focus child using a target skill. This reinforcement and engagement in positive interactions may have led to the focus child observing and imitating more nonverbal behaviors demonstrated by their peers.

One unique finding in this study suggests that the relation between direct learning of verbal skills and collateral learning of nonverbal skills is more complex than the notion that improved verbal skills absolutely leads to improved nonverbal skills. Individual differences certainly have an effect on how one communicates. For example, although Kristen's nonverbal skills increased for the majority of the treatment phase, they appeared to decrease during the last few treatment sessions. This could be explained by the possibility that teaching certain verbal skills may render some nonverbal skills less crucial for successful communication. For Kristen, her final target verbal skill was secures for attention (SA). Once she learned how to use this skill, her eye gaze decreased; perhaps indicating that once Kristen learned to gain her peer's attention by calling a name, she did not need to then look at that peer. In essence, calling someone's name to gain their attention was more effective and efficient than solely using eye gaze. So, while increased use of verbal skills generally led to increased use of nonverbal skills for some of the focus children in Studies 1 and 2, there is evidence to suggest a more complex relationship between verbal and

nonverbal skills—one that takes into account individual child differences and their ability to efficiently use newly acquired communication skills.

To summarize, although the exact relationship between the acquisition of verbal skills and nonverbal skills are not clear at this time; the current study offers preliminary outcomes suggesting a positive link. This relationship will be better understood only following a great deal more research on specific social interventions designed to improve nonverbal behaviors of school-age children with ASD as they interact with their peers. Though the specific contributing factors are not yet clearly defined, the findings demonstrated that some collateral improvements in nonverbal behaviors did occur for the focus children as a result of their participation in a peer-mediated verbal communication intervention, and that most of the focus children maintained or improved upon their rates of nonverbal communication behaviors 5 months after the treatment ended. Further research could shed light on which intervention factors are optimal in helping school-age children with ASD learn and improve upon nonverbal communication skills. Possible aspects of the peer-mediated interventions that this study was based on that may have led to collateral improvements in some nonverbal behaviors include (1) providing structured activities that encouraged social interaction (e.g., turn-taking, talking about rules of the game, sharing materials) in a small group setting, (2) consistent contact with the same group of trained peers, who modeled specific nonverbal communication skills, and (3), the teaching of multiple, functional, and age-appropriate social communication skills.

Conclusion

If one of the goals of intervention research for children with ASD is to close the gap between their social communication skills and that of their typical peers, the current study contributes to this goal by highlighting the need to include an intervention component that targets nonverbal communication skills in addition to functional verbal skills. Targeting nonverbal communication skills may be particularly important for school-age children with ASD, due to evidence that some nonverbal abilities (e.g., joint attention initiation) decline as these children progress into adolescence and young adulthood (Sigman & McGovern, 2005). Observing that some but not all nonverbal behaviors improved within the context of these studies suggests that direct instruction of nonverbal behaviors may be a necessary component of social intervention programs. Further, given that many of the focus children in the present study improved on some nonverbal communication skills only after making gains in verbal communication skills, perhaps the timing of skill introduction should be considered; for example, first teach verbal skills, then teach nonverbal skills to add to children's social communication repertoires. However, teaching communication skills does not necessarily need to follow that particular order. Whalen and colleagues (2006) found that when teaching joint attention to preschool children with ASD, they observed positive collateral changes in both verbal and nonverbal skills, specifically in social initiations, positive affect, imitation, play, and spontaneous speech. Therefore, it may also be effective to first target nonverbal skills followed by teaching verbal communication skills.

Another way to add a nonverbal component to a direct instruction intervention could be to match a nonverbal skill to each target verbal skill and teach at the same time. For instance, when securing someone's attention, the child would be instructed to say a peer's name and look at the peer's eyes/face; or if talking about turn-taking, they would point to the person whose turn it is. Another possibility is to encourage the focus children to look at a peer each time they talk; and when referring to the game or activity, show or point to the appropriate referent object.

In addition to teaching children with ASD how to combine these behaviors, instruction could also be provided to the peers. Peers could be taught to prompt the focus child if he/she forgets to combine a nonverbal skill with the verbal. For example, if the focus child made a statement and failed to look at one of the peers, the peer can ask the focus child, "Who are you talking to?" or refrain from responding until the focus child used a nonverbal skill with the verbal statement. If initiating joint attention (e.g., pointing to something on a game board), the peers could be taught to ensure that the focus child directed his/her attention to the referent object (e.g., by turning his/her head, looking in the direction of the point) prior to continuing. To ensure that the focus child responded to the peer's joint attention initiation, the peer could be taught to use verbal and nonverbal prompts (e.g., tapping the focus child on the shoulder to get his/her attention, calling the focus child by his/her name and verbally asking him/her to look at the point of reference). In general, the peers could be taught to use nonverbal behaviors when appropriate within the activity, to serve as a model for children with ASD. More research is needed to

determine the most effective way to structure an intervention (i.e., targeting verbal skills, then nonverbal skills; targeting nonverbal skills before verbal skills; or targeting both simultaneously), necessary intervention components, and generalized learning across nonverbal and verbal behaviors for this population.

Another possible way to incorporate nonverbal skills into existing social interventions is to teach nonverbal skills as repair strategies for unsuccessful verbal initiations. For instance, if the focus child attempted to secure a peer's attention by calling his/her name and failed to gain the peer's attention, the focus child could then be instructed to use a gesture (e.g., tapping the peer on the shoulder, waving at the peer) to repair or persist with that initiation attempt.

By encouraging and facilitating the use of nonverbal skills in conjunction with verbal communication skills through direct teaching, school-aged children with ASD (particularly those who are in an inclusive school setting) may learn to communicate more effectively with their peers and do so in a way that is more consistent with how the peers typically communicate with one another. Teaching appropriate eye gaze can reduce the chance that children with ASD are ignored due to the ambiguity of where their questions/comments are directed. Teaching gestures can help the children communicate their thoughts and ideas in ways that would enable others to understand them more clearly. Teaching children how to respond to joint attention bids by peers could help sustain interaction with peers. Furthermore, children with ASD could learn the important concept of sharing attention, which may then extend to understanding and experiencing affective sharing, or sharing enjoyment of something

(e.g., an activity) with a peer. Finally, learning how to use nonverbal niceties may lead to improvements in the quality and expressing enjoyment within peer interactions as well.

Limitations. Due to the challenges of reliably observing nonverbal behaviors via videotaped sessions, data was not gathered for the unstructured settings (i.e., recess activities). The only data collected was during structured table activities, which may have been optimal for some nonverbal skills and not others (e.g., gestures used while playing a board game at a table would be quite different from gestures needed while playing basketball at recess). Recording data across a variety of settings may have yielded a broader range of nonverbal communication behaviors.

Some refinements to the coding system used in the current study may result in additional conclusions. Due to the challenges of establishing reliability in coding nonverbal behaviors, it was difficult to code the simultaneous use of a combination of nonverbal behaviors. Further refinement of the current coding system may be conducive to a more efficient way of attaining more in-depth or detailed data. For example, adding a separate category code for combined communicative behaviors. Also, gathering peer communication data throughout the entire intervention, in addition to the peer pre-treatment data, may have helped to explain collateral effects on the focus children's nonverbal communication or lack thereof (e.g., peers may or may not have increased their nonverbal behaviors similar to results found for the focus children).

The participants in the present study were a small sample of school-age children with higher functioning ASD who were all students in inclusive classroom settings. The children were all verbal communicators. Therefore, results cannot be generalized to preschool or adolescent children or to children with ASD who are nonverbal or considered low functioning. More research is needed to understand the nonverbal behavior patterns of low functioning school-age children with ASD and children with ASD who are not part of an integrated or inclusive classroom setting.

Future directions. There is a lack of current research examining the rates of nonverbal communication in older children with ASD. The present study serves as a start toward outlining differences in nonverbal communication behaviors and understanding which skills children with ASD use or do not use, in relation to their peers. Measuring specific nonverbal skills in a variety of settings (i.e., structured and unstructured) may yield a more accurate representation of rates of nonverbal communication. The results also suggest the need to include intervention strategies focused on increasing children's nonverbal communication skills in addition to direct instruction of verbal communication skills. Perhaps future peer-mediated intervention studies can incorporate direct teaching of nonverbal skills as well as verbal communication behaviors to assess concurrent changes in both skills. As more research is conducted on the acquisition and use of nonverbal communication skills in children with ASD as they interact with peers, various treatment factors (e.g., when to introduce nonverbal skills into an intervention, which specific nonverbal skills to target, training peers to use nonverbal skills) can be teased apart to understand how to

package an intervention that would maximize gains in both verbal and nonverbal communication skills for this population.

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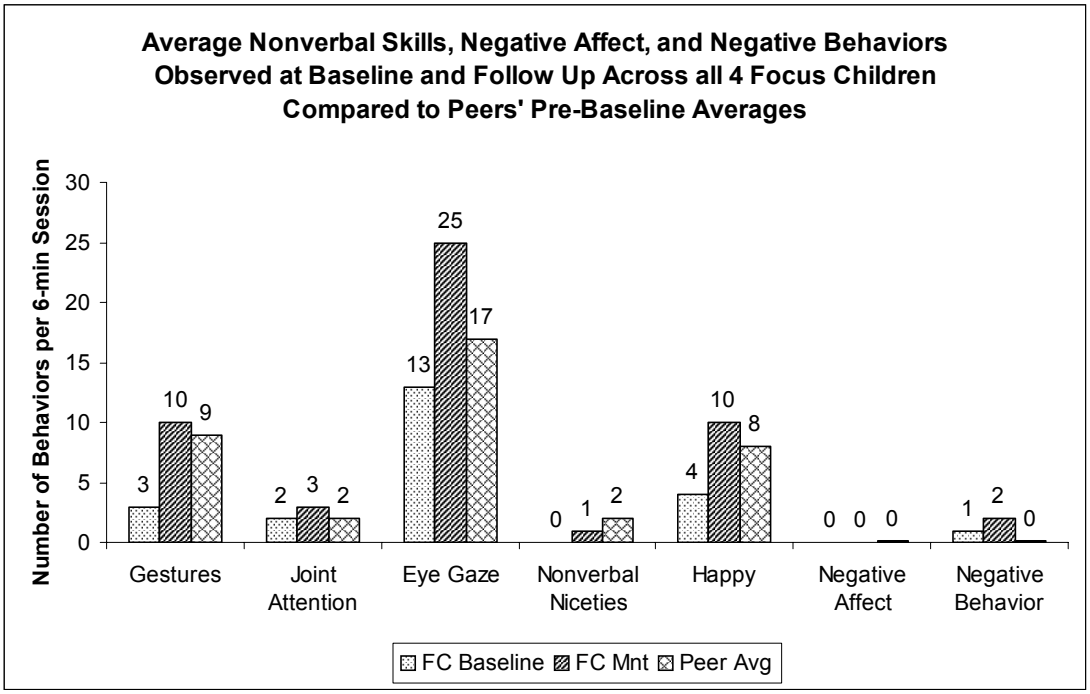
Figure 1.

Study 1 participants' (focus children and peers) average frequency of nonverbal communication skills (Gestures, Joint Attention, Eye Gaze, Nonverbal Niceties, and Positive Affect), average Negative Affect (Sad, Mad, Inappropriate Affect), and Negative Behaviors (STIM, OT) observed per 6-minute session during baseline (focus children) or during pre-baseline peer comparison session (peer buddies).



FC Baseline = Baseline average of skills across all 4 focus children in Study 1
FC Mnt = Follow-up average of skills across all 4 focus children in Study 1
Peer Avg = Peer average of skills across 16 peers (4 peers per focus child) observed during peer comparison sessions (triad of peers only) that occurred prior to baseline

Figure 2a.
Michael's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 1)

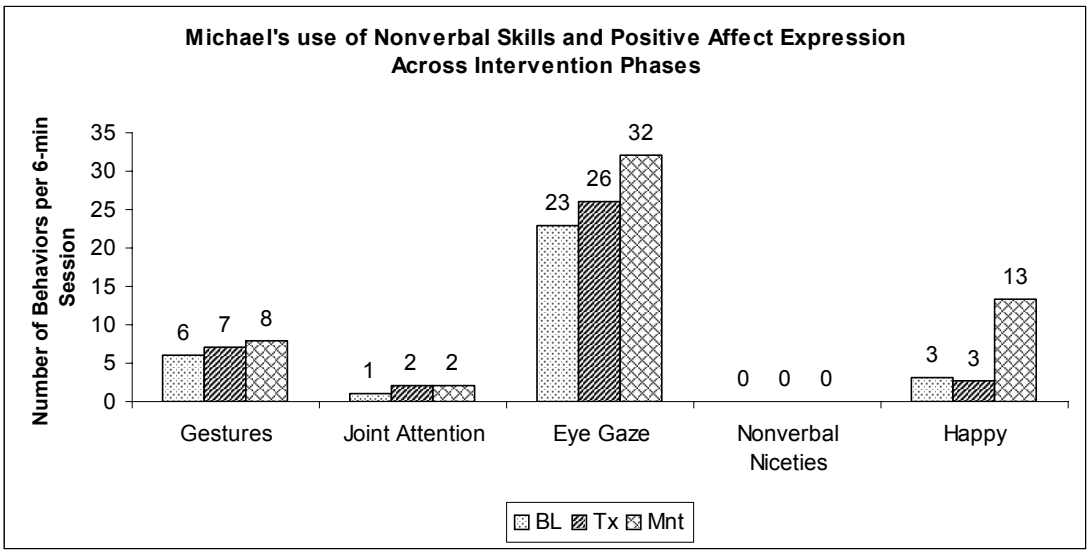


Figure 2b.
Mark's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 1)

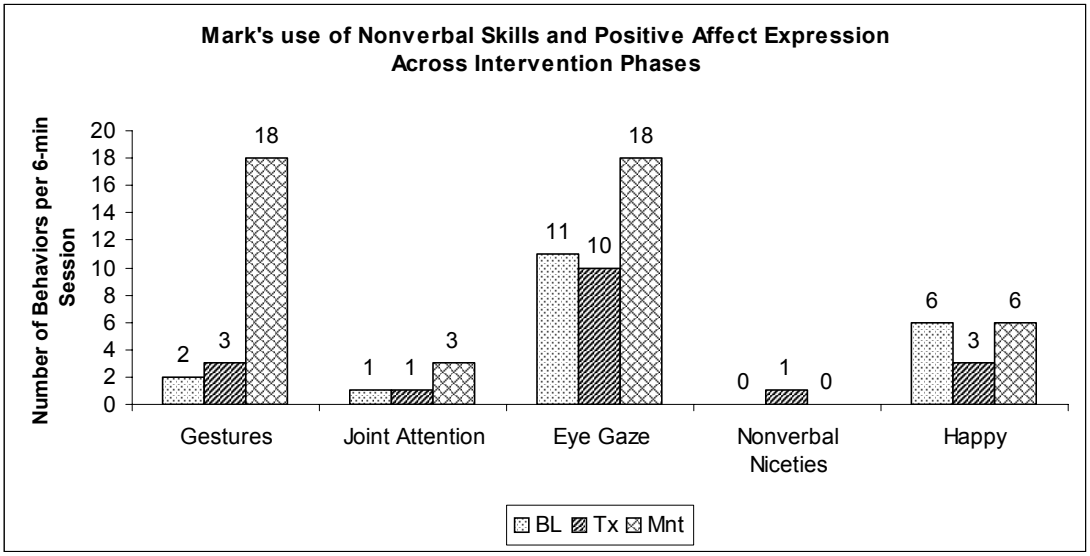


Figure 2c.
Tim's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 1)

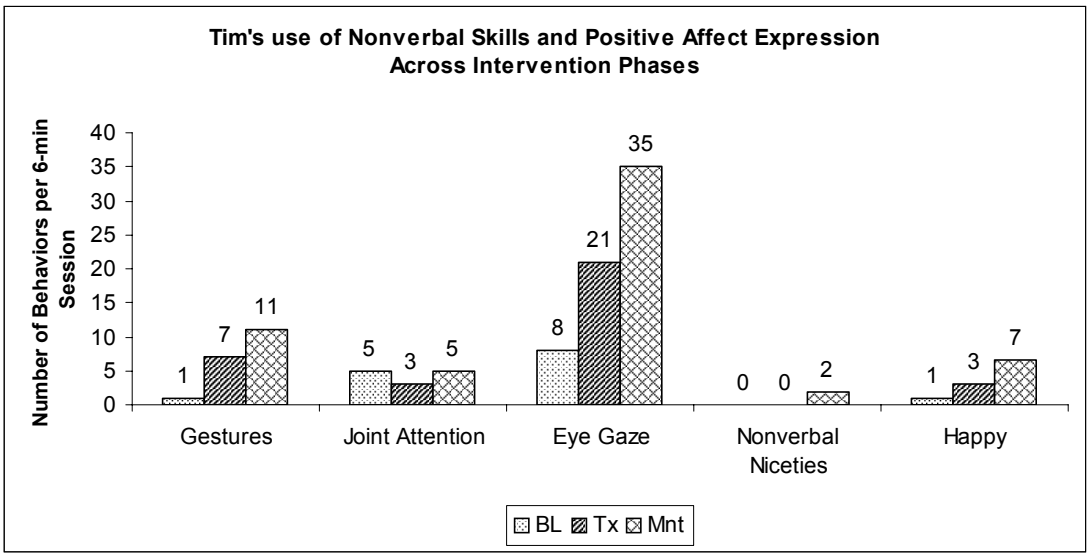


Figure 2d.
Kasey's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 1)

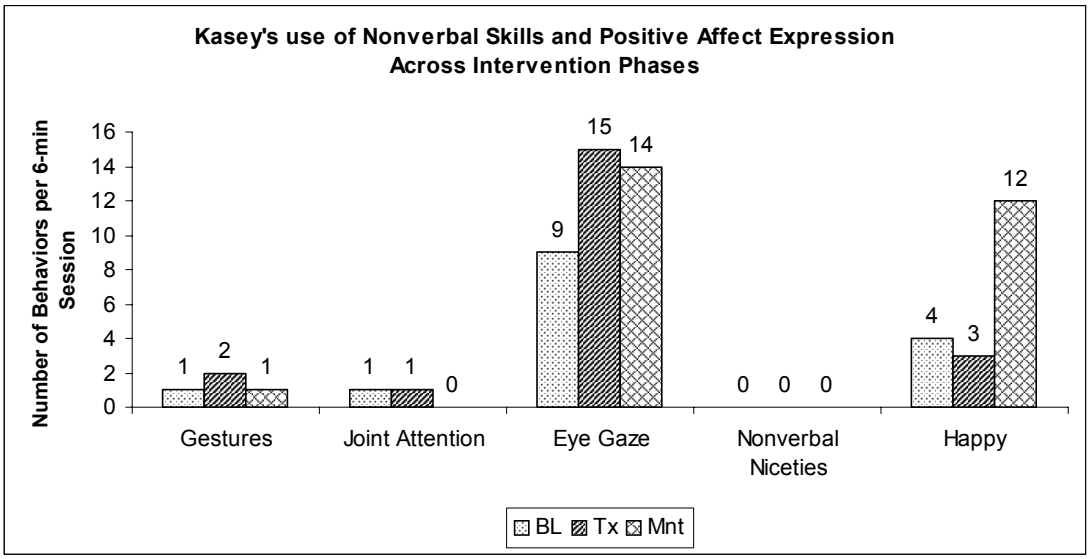


Figure 3a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Michael (Study 1)

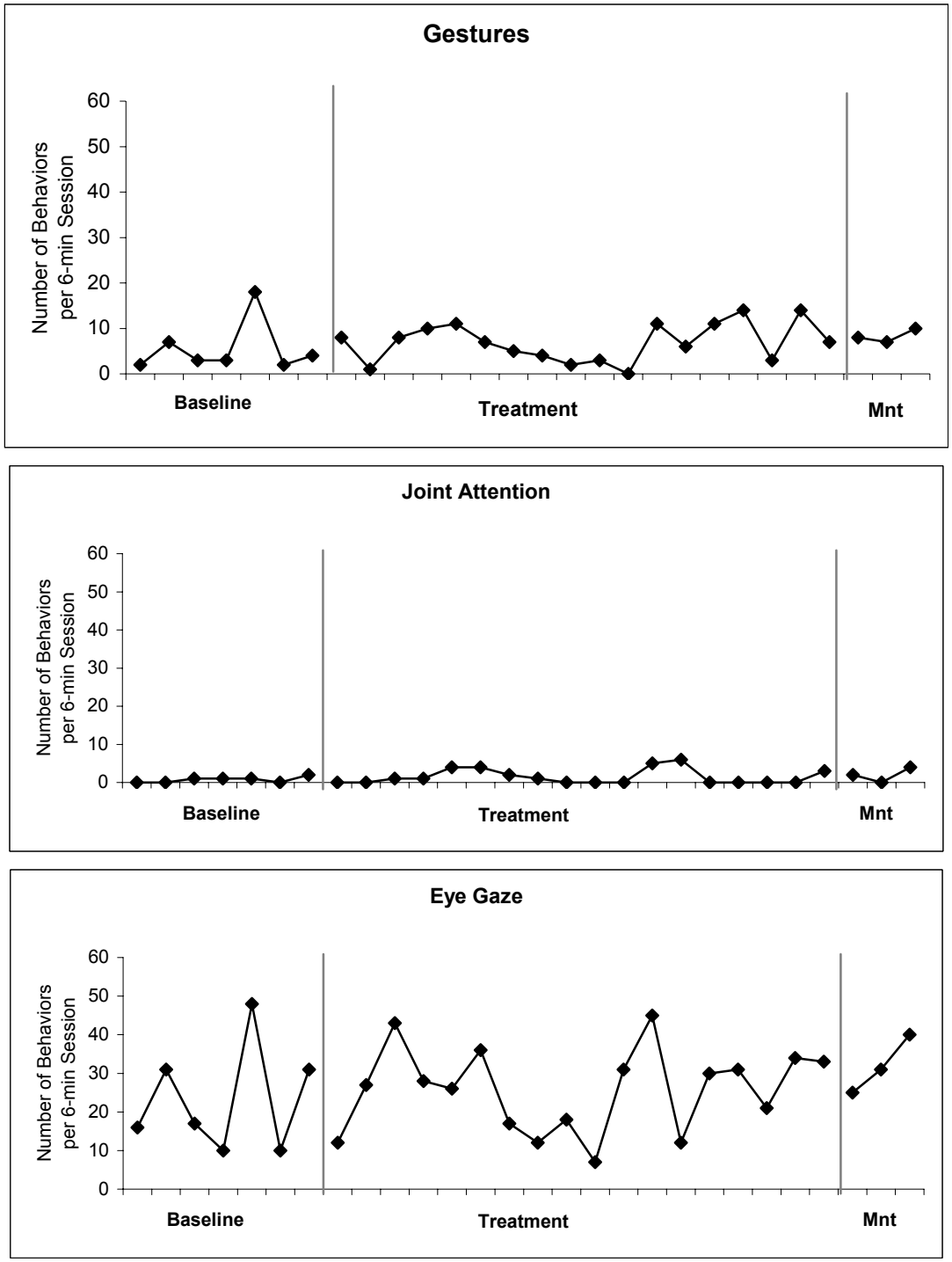
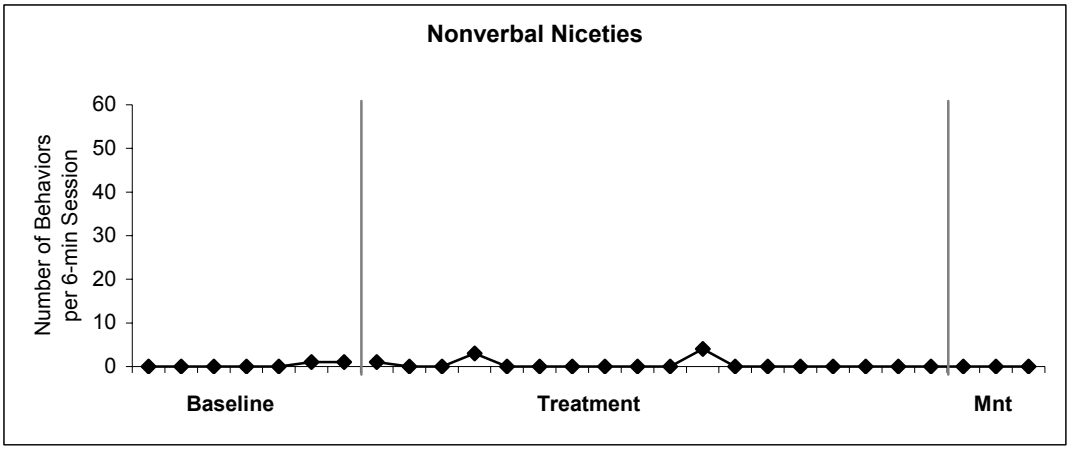


Figure 3b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Michael (Study 1)



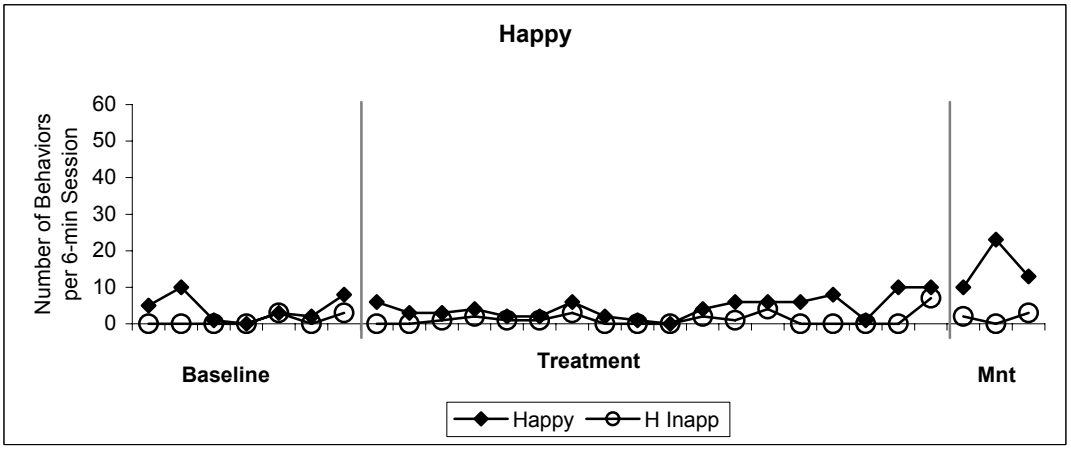
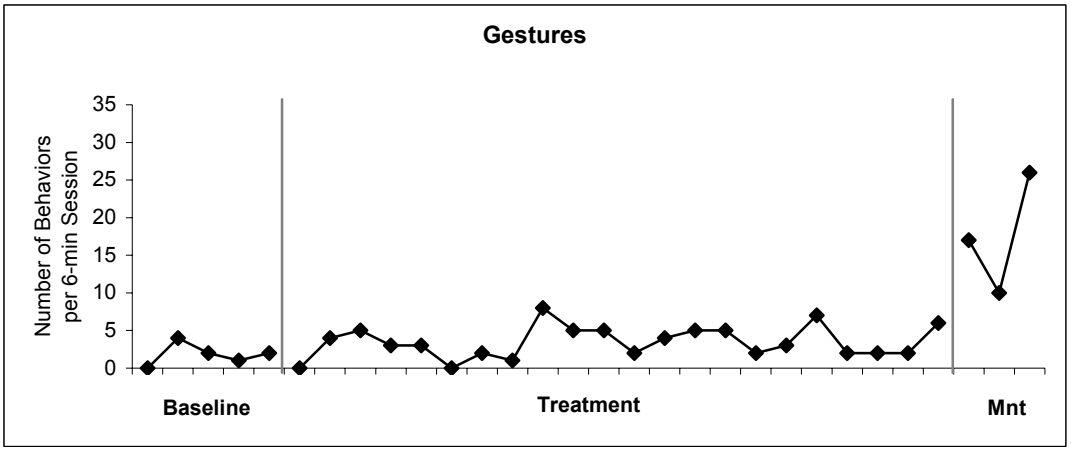
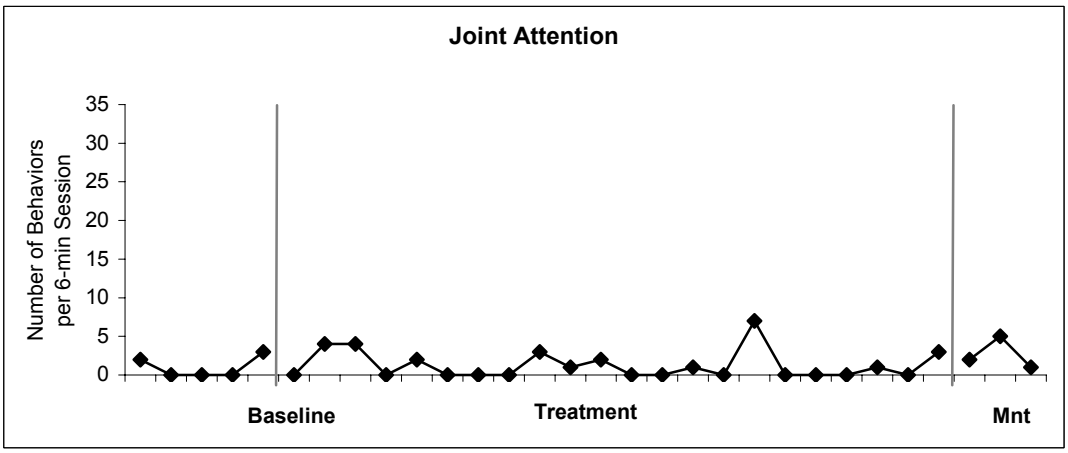


Figure 4a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Mark (Study 1)





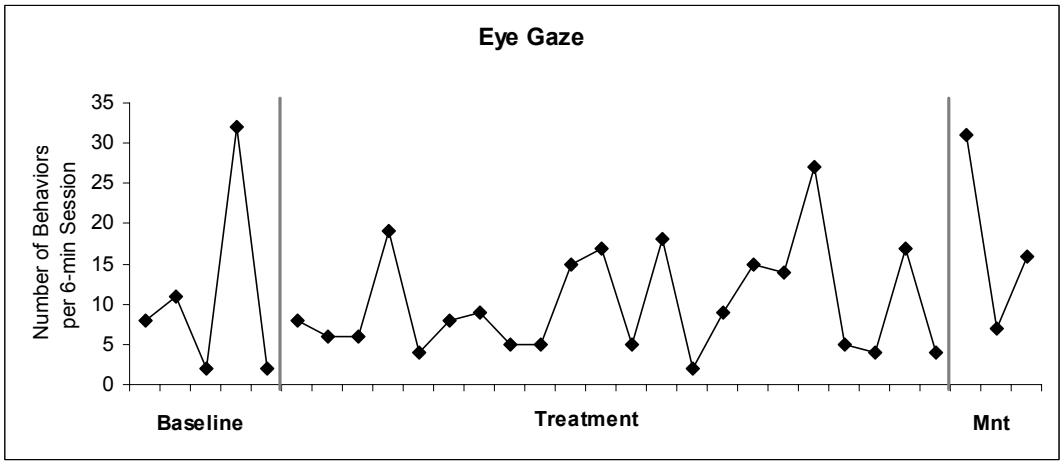


Figure 4b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Mark (Study 1)

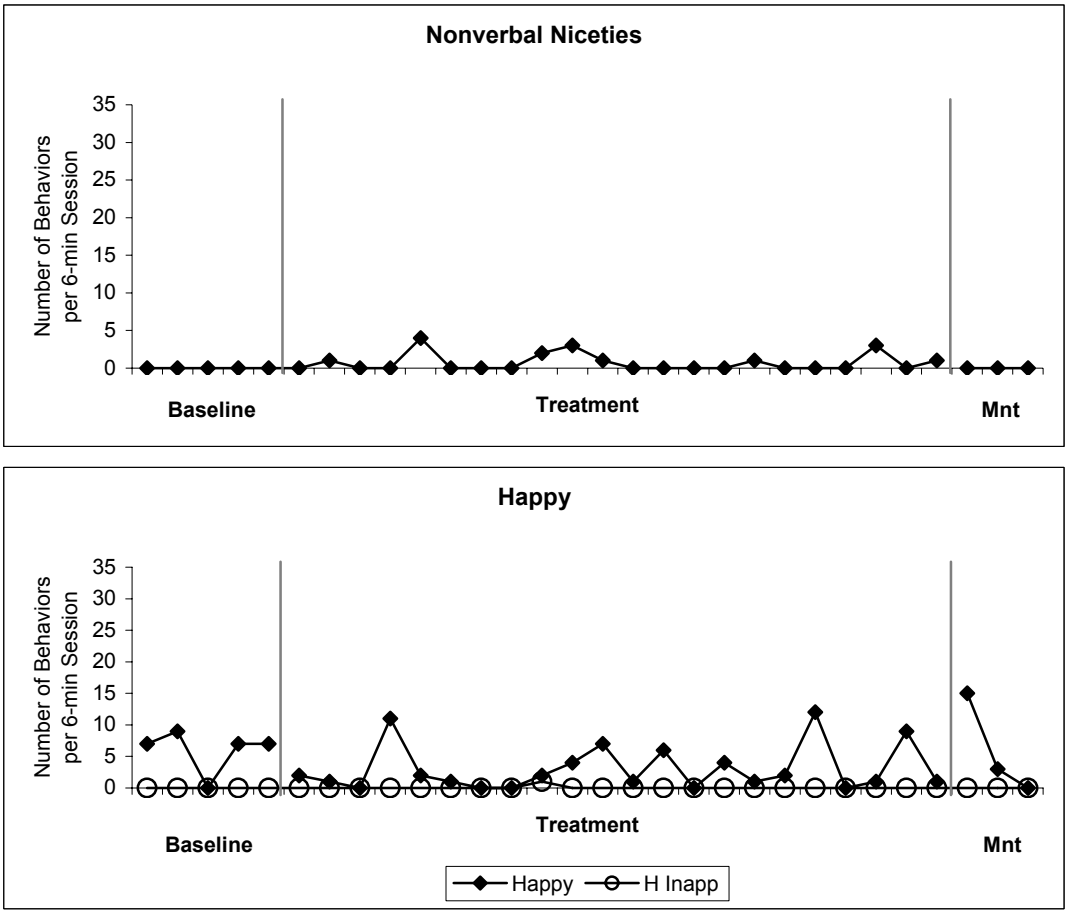


Figure 5a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Tim (Study 1)

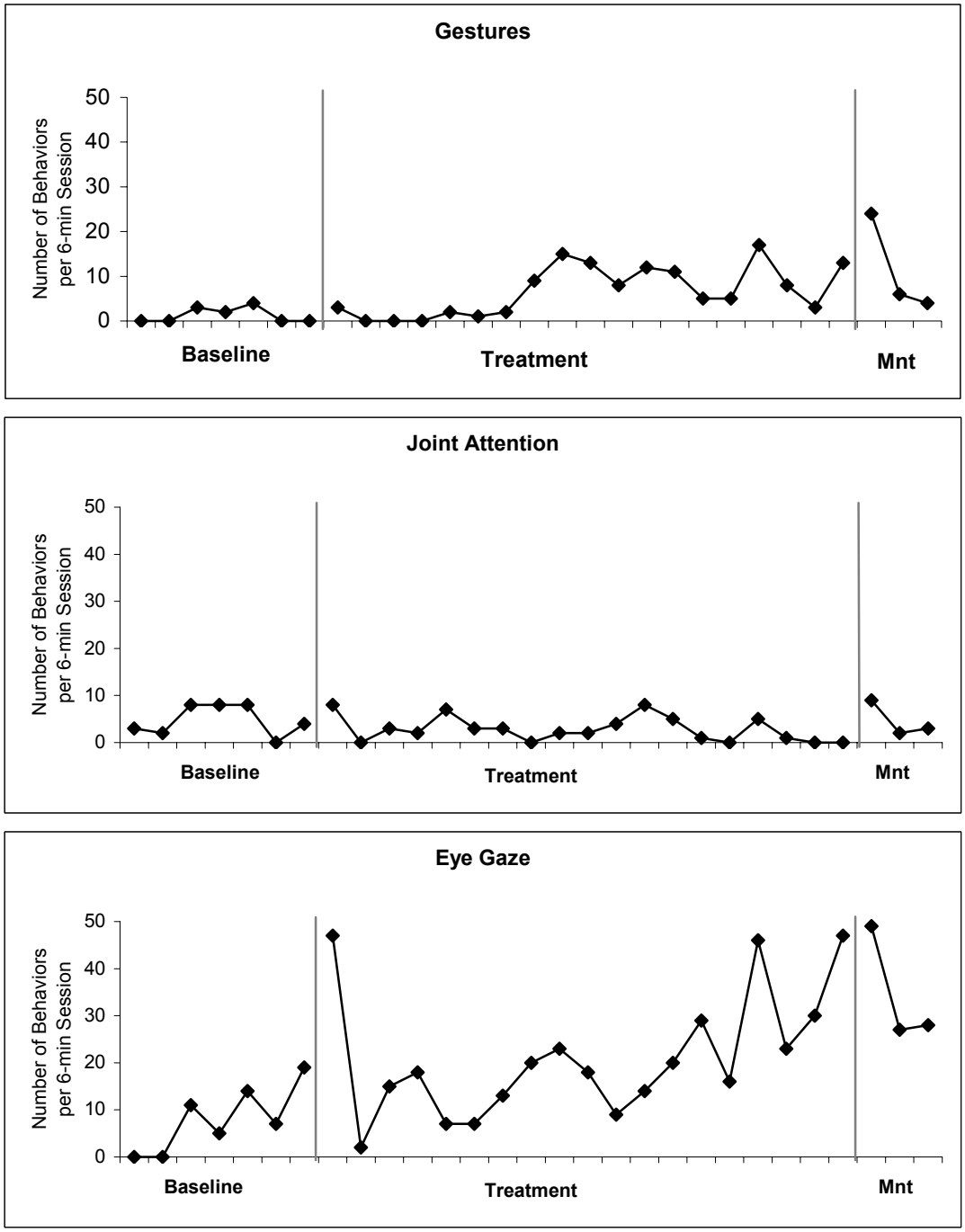


Figure 5b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Tim (Study 1)

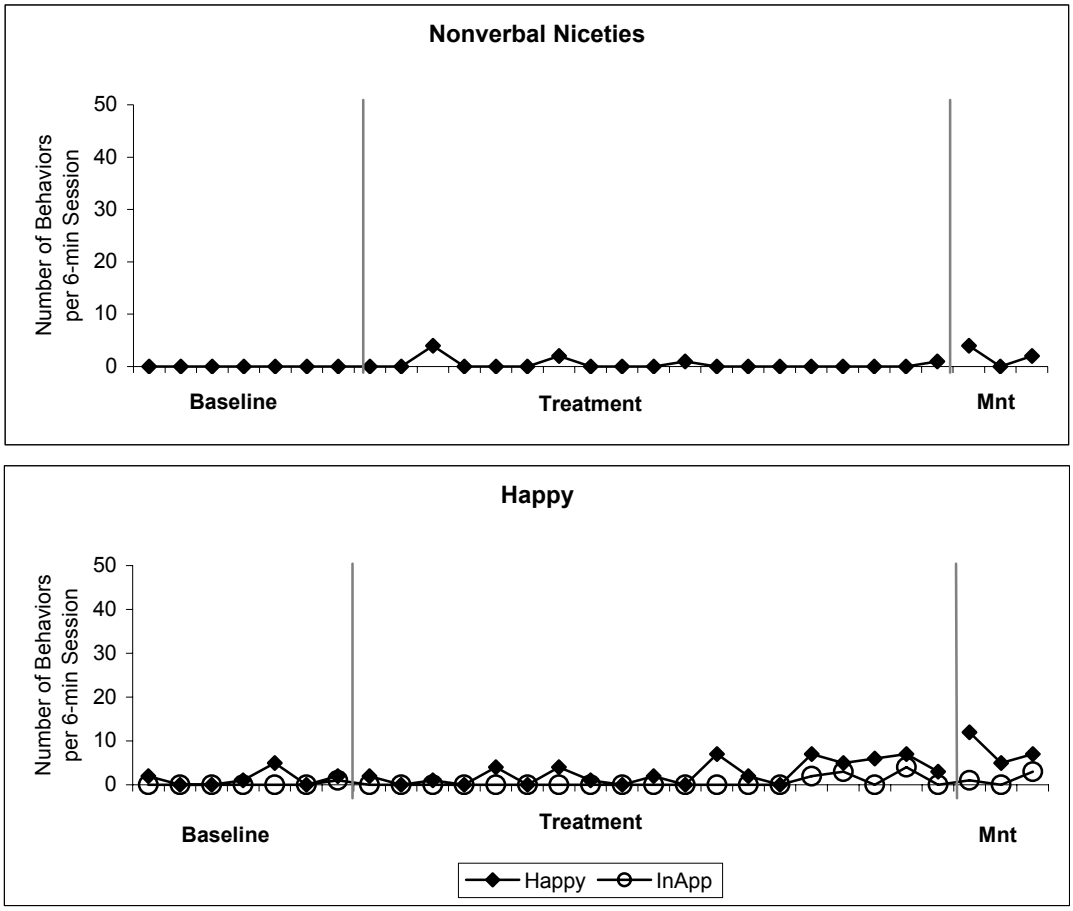


Figure 6a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Kasey (Study 1)

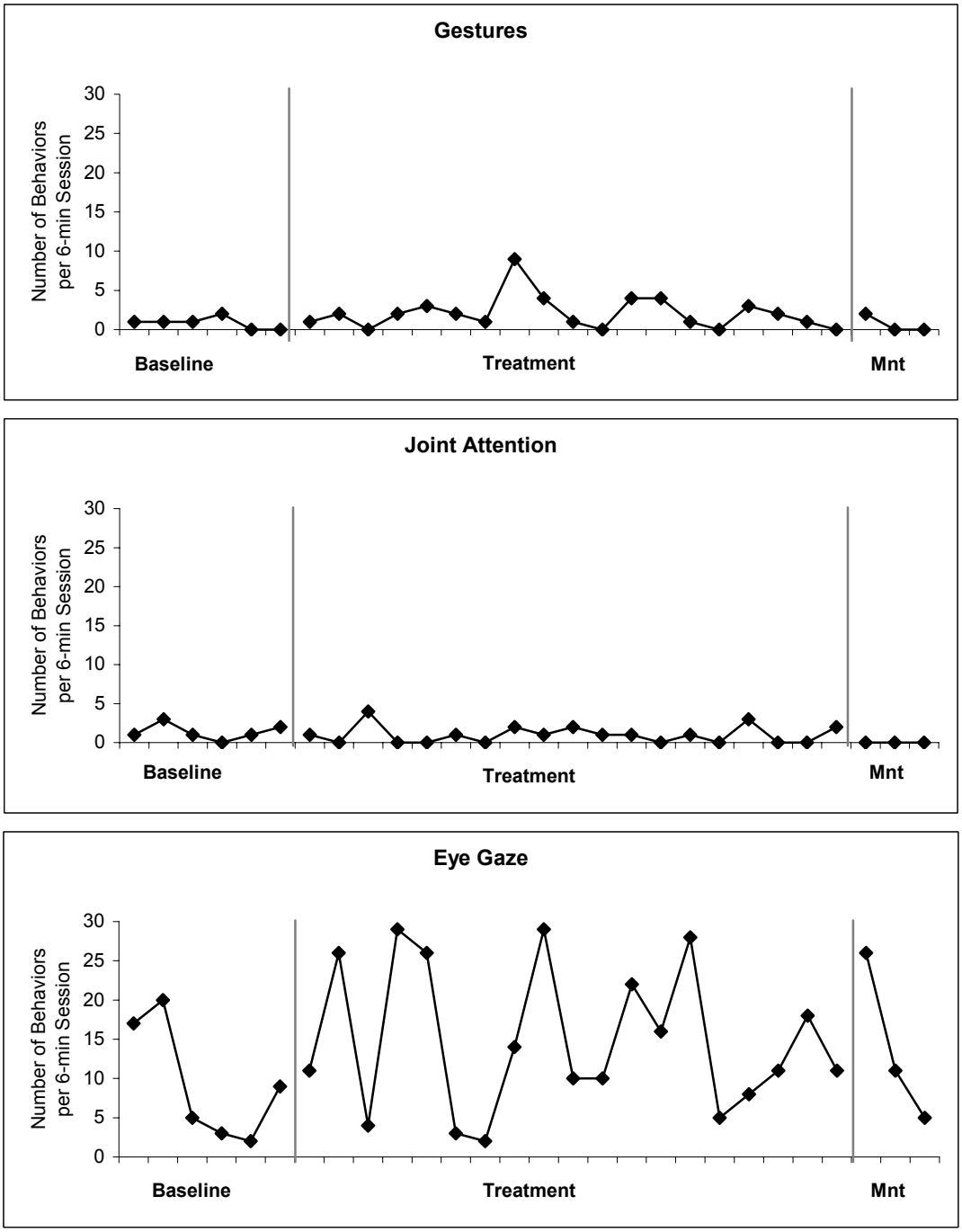
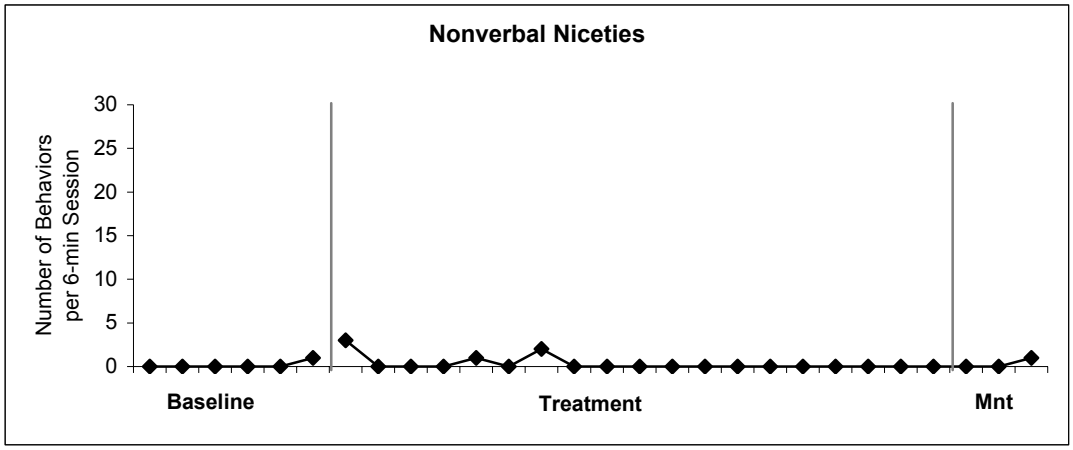


Figure 6b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Kasey (Study 1)



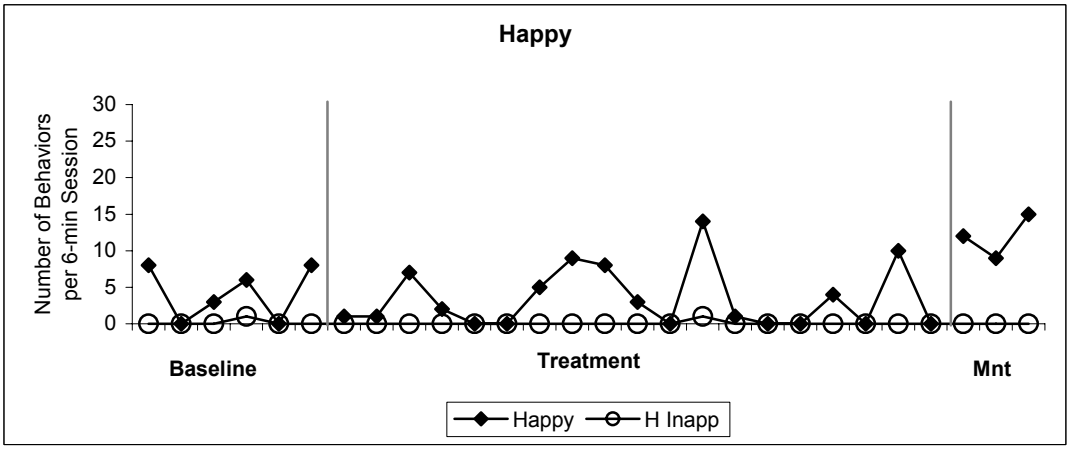


Figure 7a.
Michael's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 1)

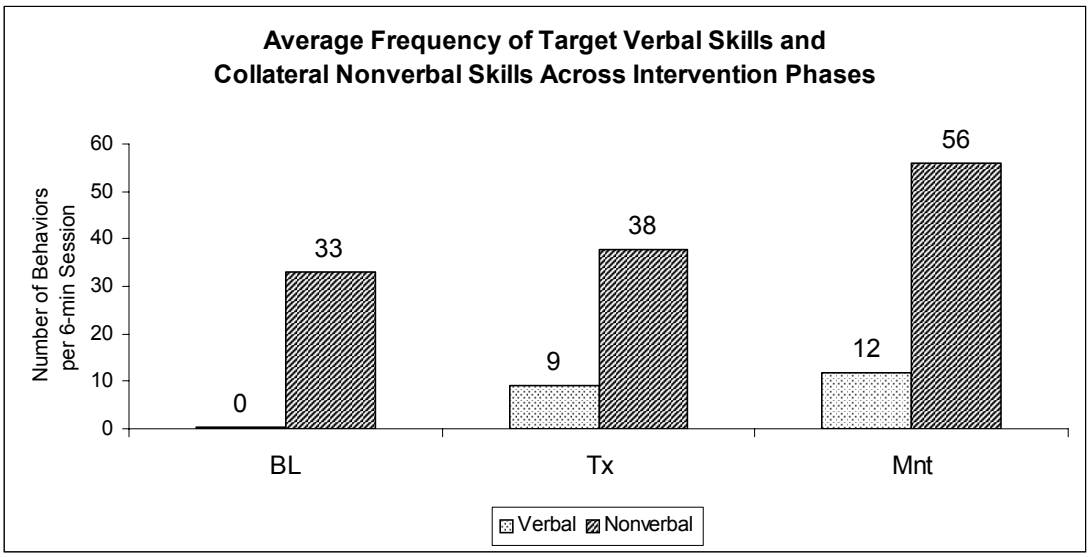
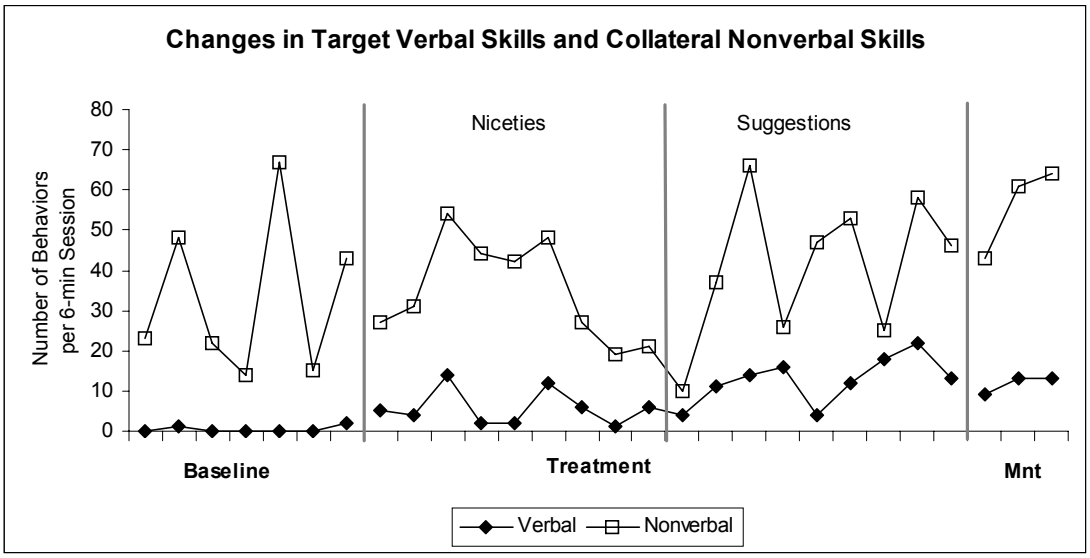


Figure 7b.
Michael's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 1)



Target verbal skills = Social Niceties and Suggestions

Figure 8a.
Mark's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 1)

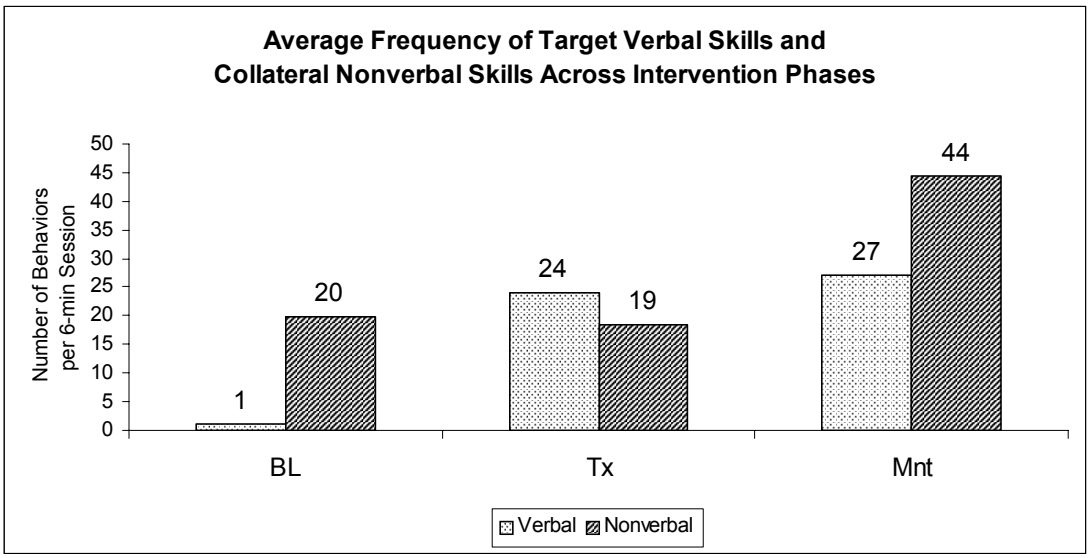
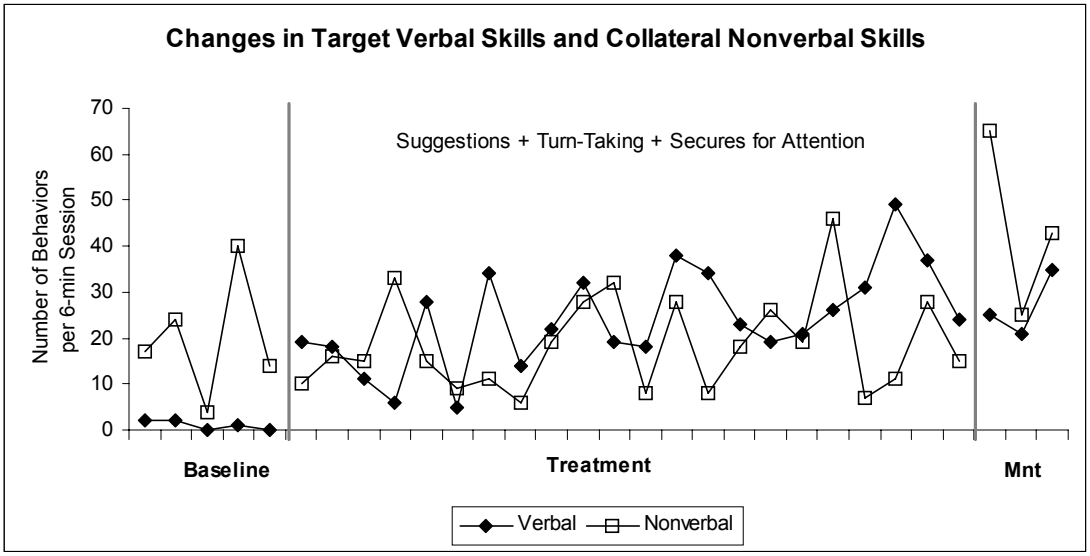


Figure 8b.
Mark's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 1)



Target verbal skills = Suggestions, Turn-Taking, and Secures for Attention

Figure 9a.
Tim's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 1)

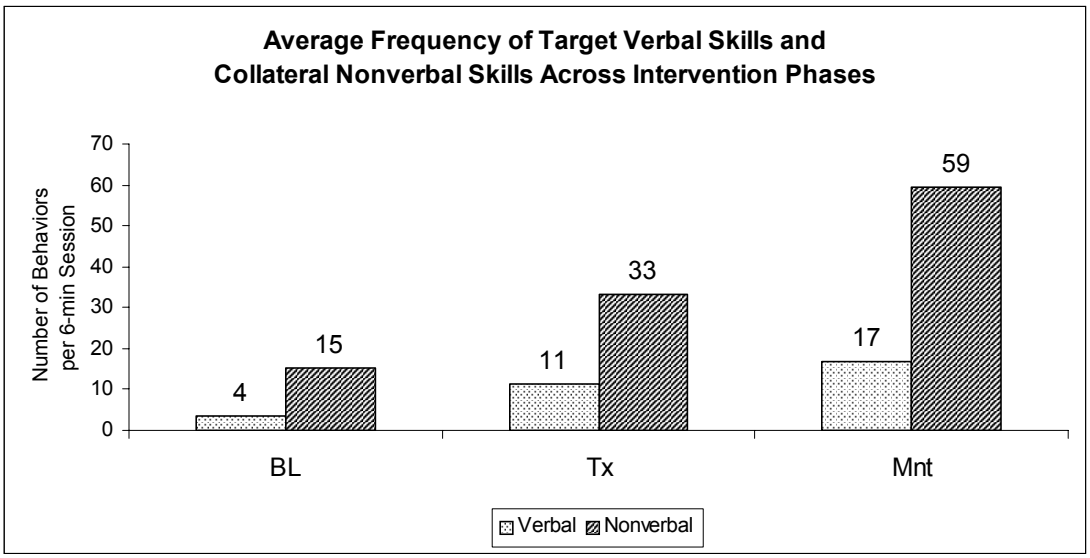
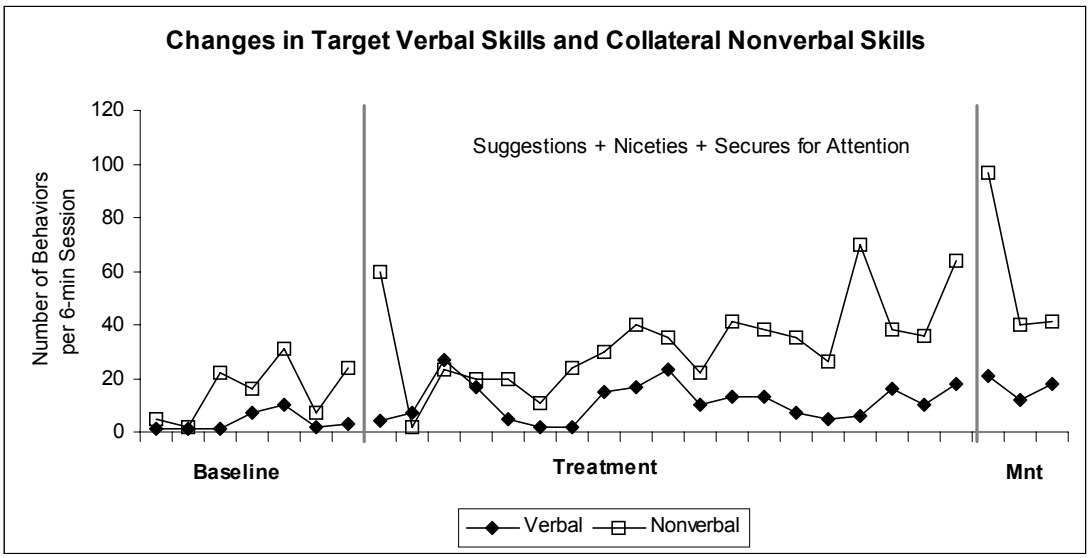


Figure 9b.
Tim's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 1)



Target verbal skills = Suggestions, Niceties, and Secures for Attention

Figure 10a.
Kasey's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 1)

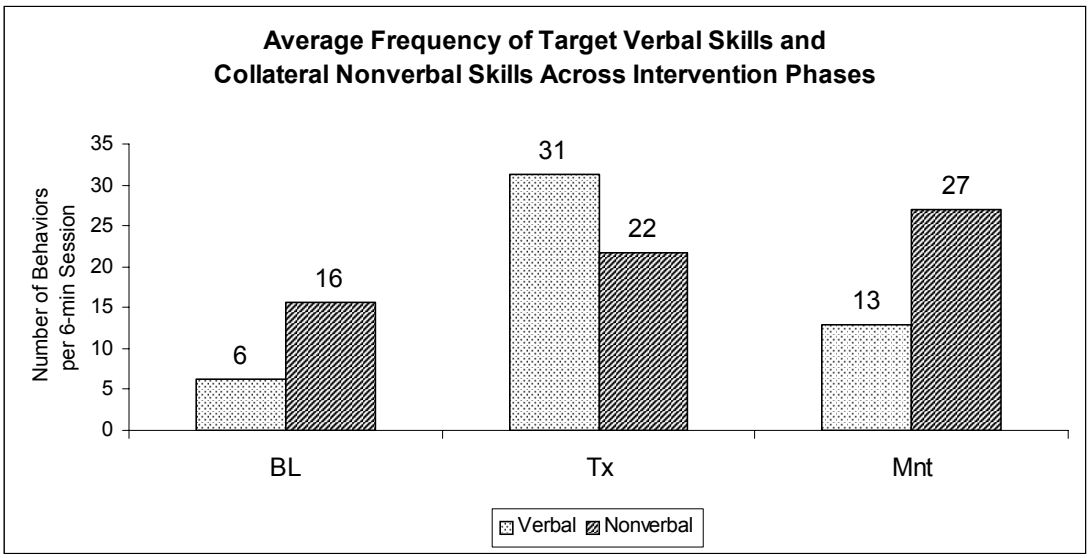
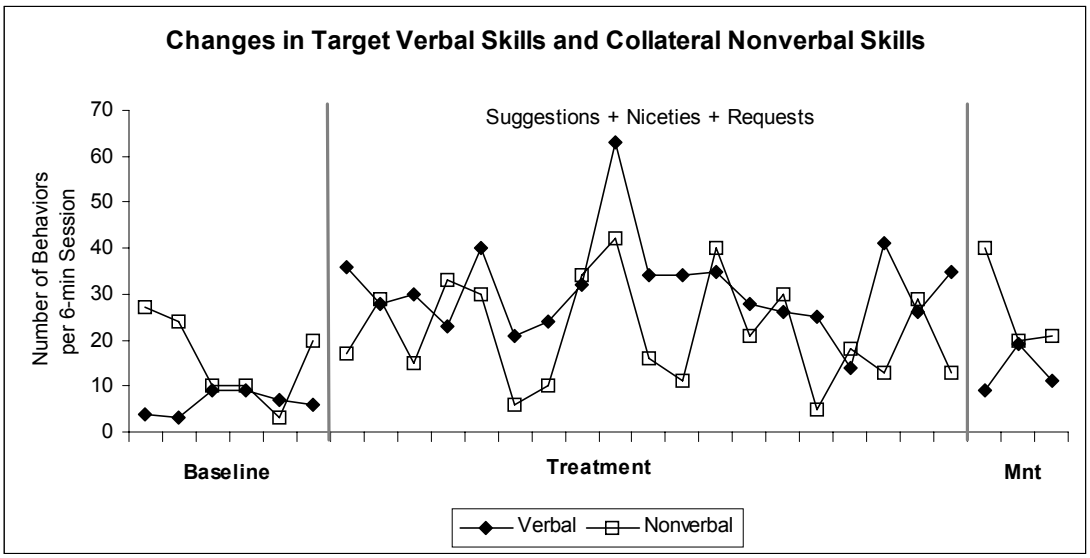


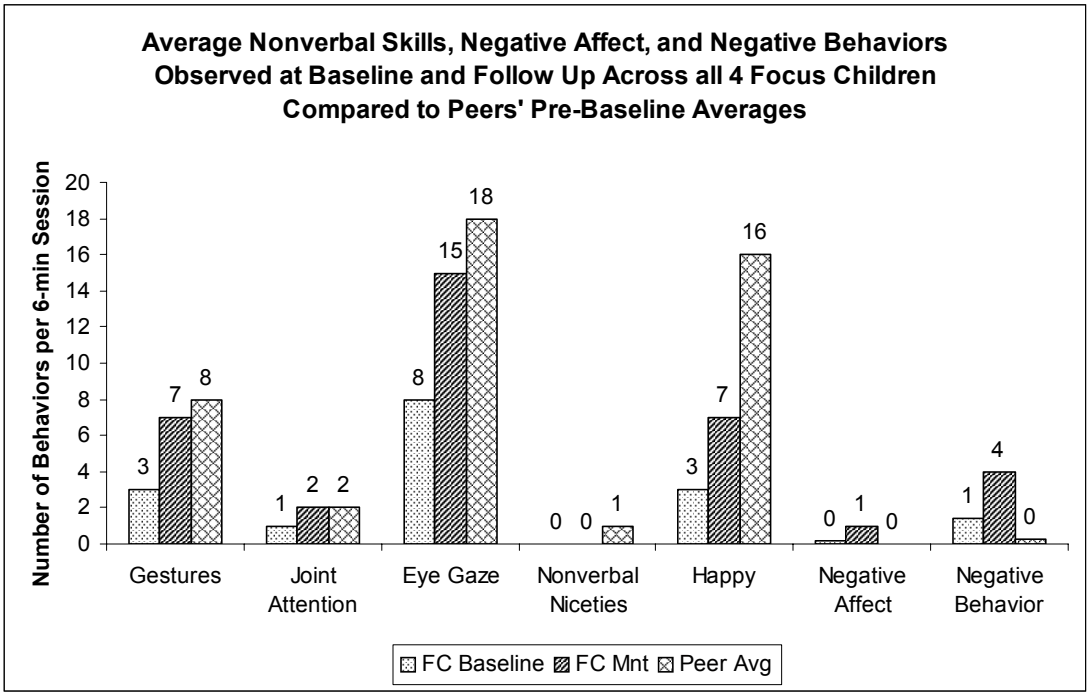
Figure 10b.
Kasey's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 1)



Target verbal skills = Suggestions, Niceties, and Requests

Figure 11.

Study 2 participants' (focus children and peers) average frequency of nonverbal communication skills (Gestures, Joint Attention, Eye Gaze, Nonverbal Niceties, and Positive Affect), average Negative Affect (Sad, Mad, Inappropriate Affect), and Negative Behaviors (STIM, OT) observed per 6-minute session during baseline (focus children) or during pre-baseline peer comparison session (peer buddies).



FC Baseline = Baseline average of skills across all 4 focus children in Study 2
FC Mnt = Follow-up average of skills across all 4 focus children in Study 2
Peer Avg = Peer average of skills across 16 peers (4 peers per focus child) observed during peer comparison sessions (triad of peers only) that occurred prior to baseline

Figure 12a.
Michael's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 2)

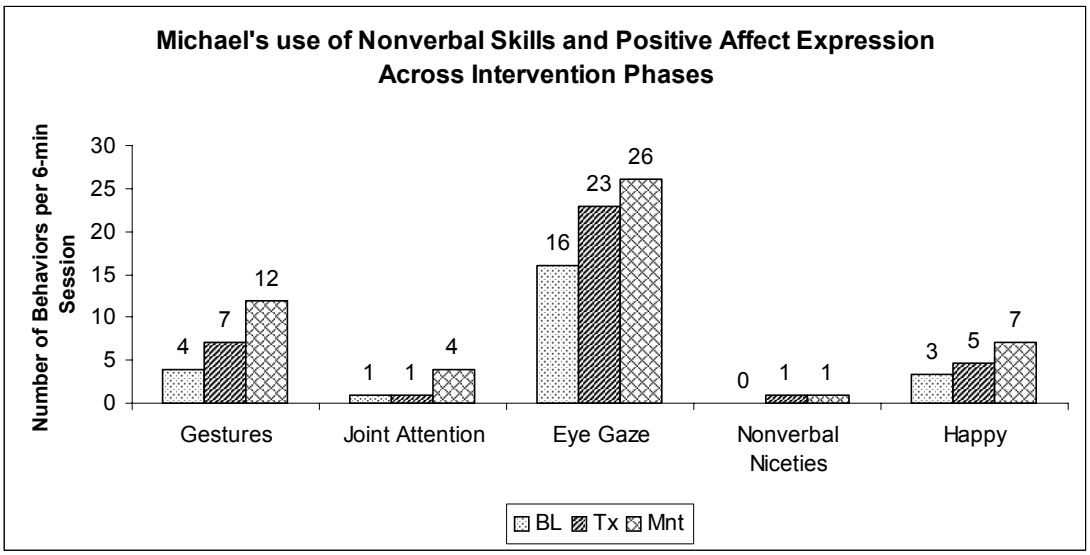


Figure 12b.
Kristen's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 2)

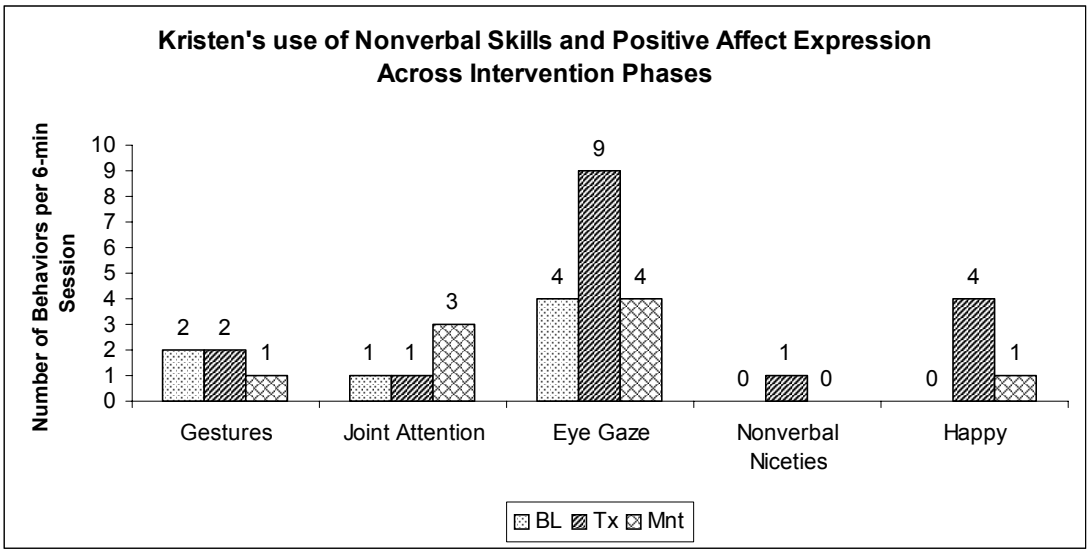


Figure 12c.
Jay's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 2)

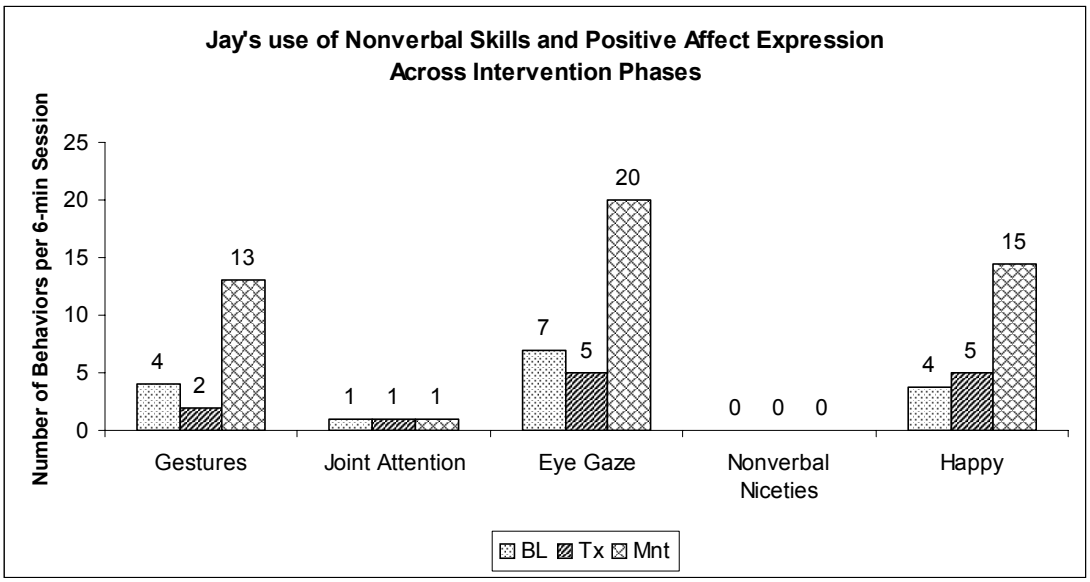


Figure 12d.
Joseph's Average use of Nonverbal Communication Skills and Positive Affect Expression during Baseline, Treatment, and Maintenance Phases (Study 2)

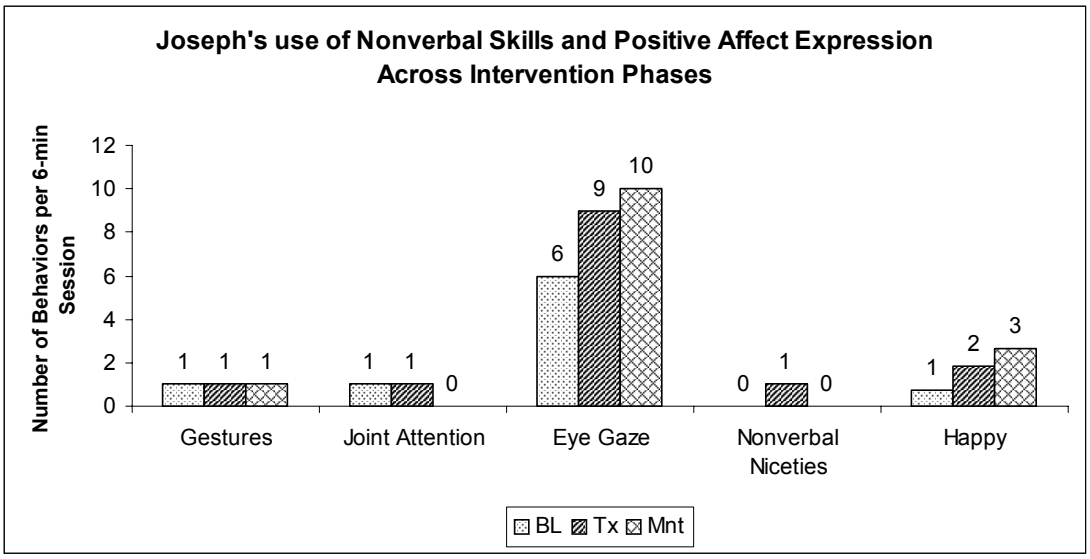
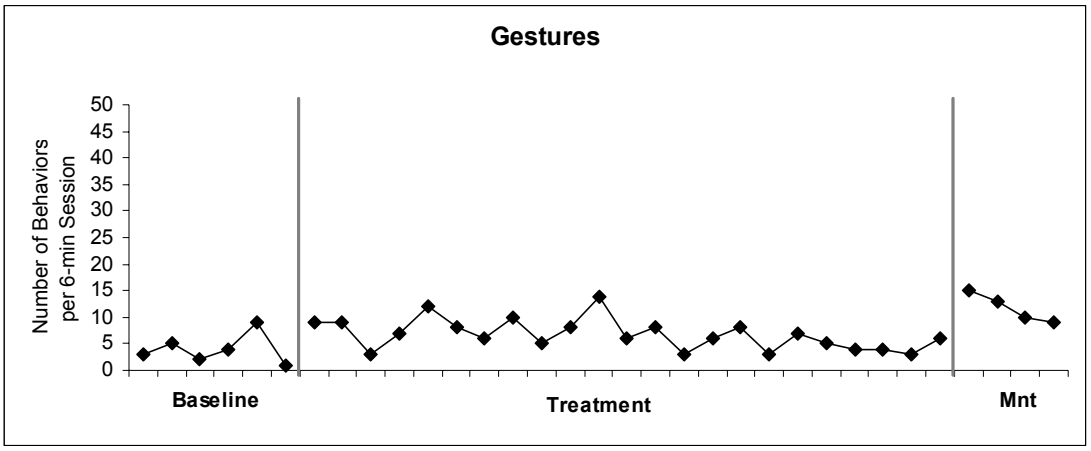
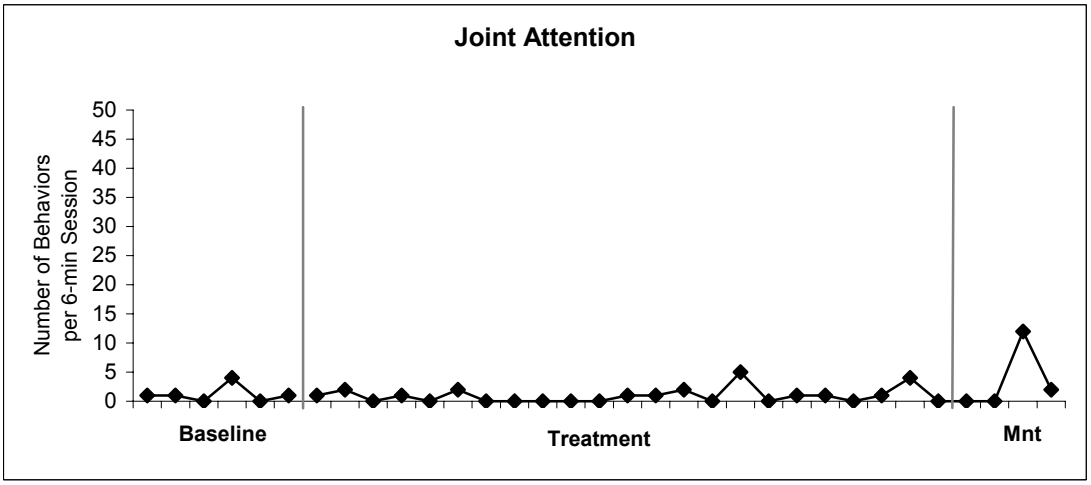


Figure 13a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Michael (Study 2)





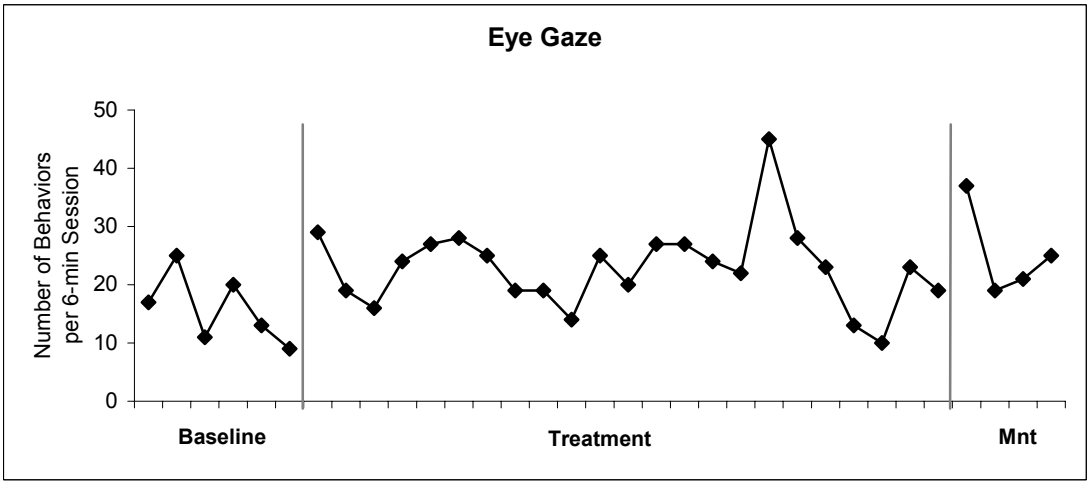
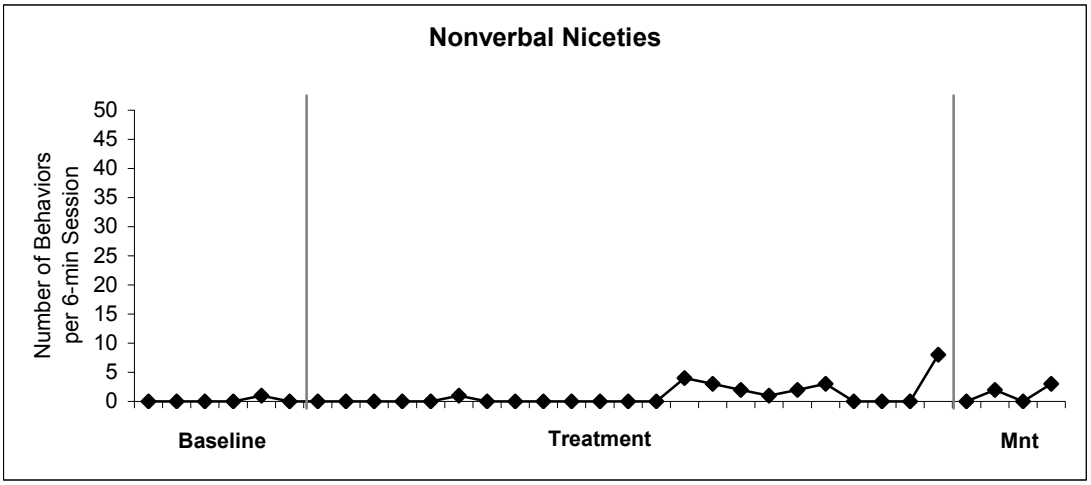


Figure 13b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Michael (Study 2)



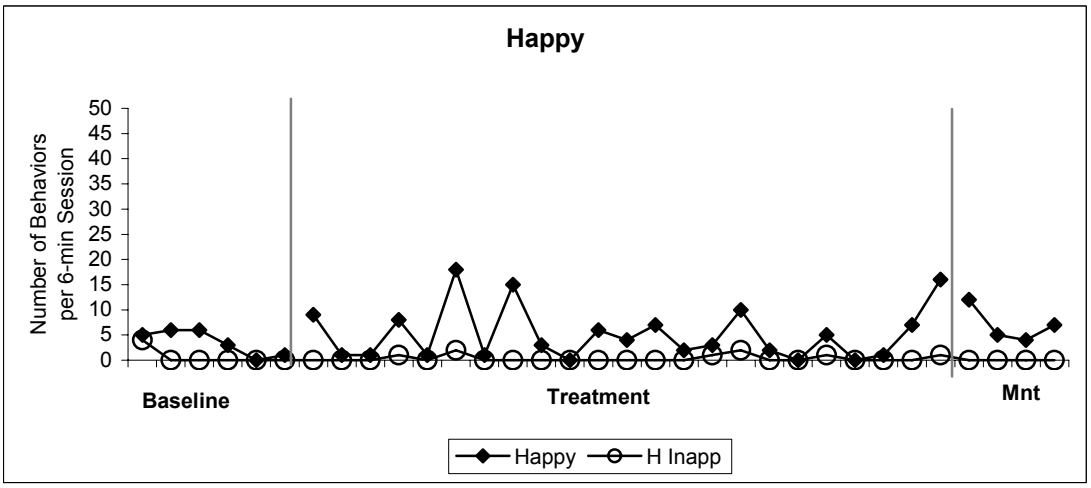
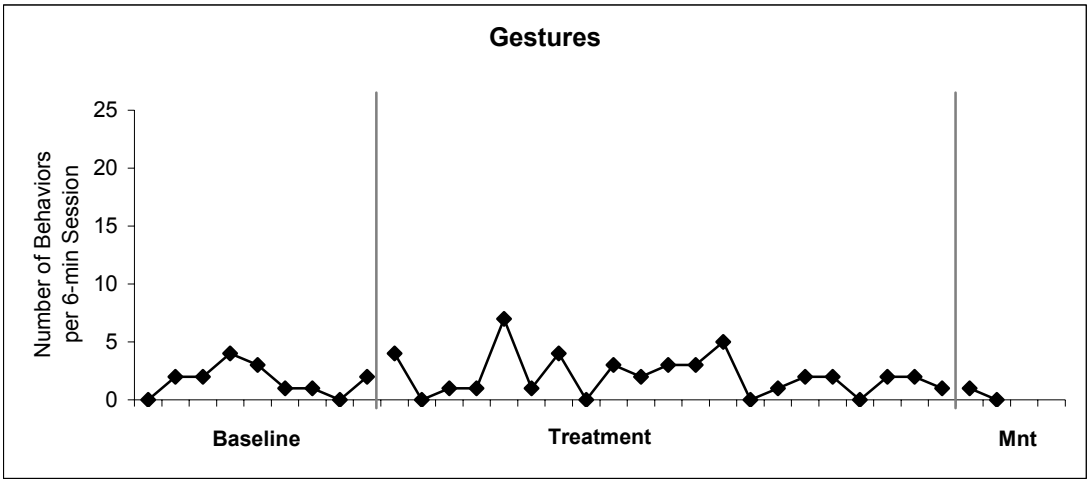
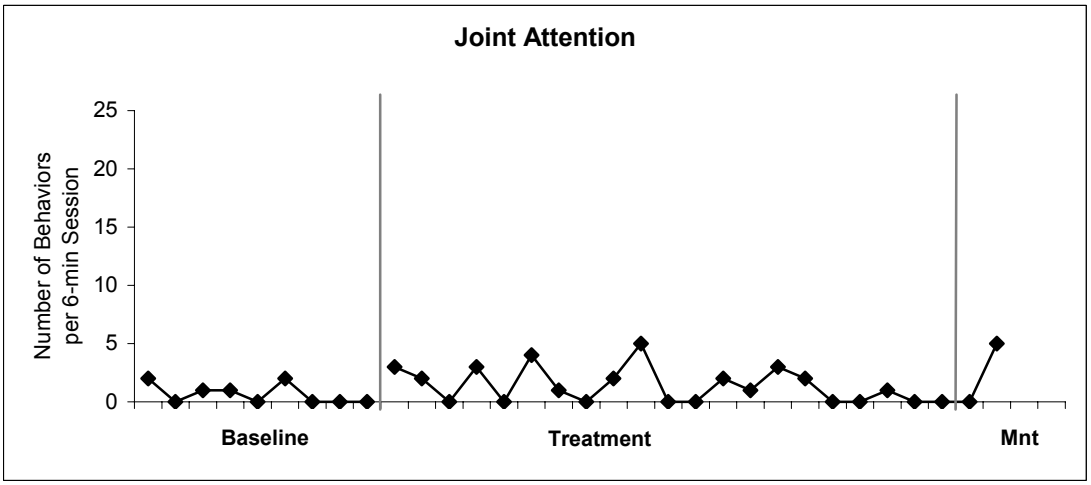


Figure 14a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Kristen (Study 2)





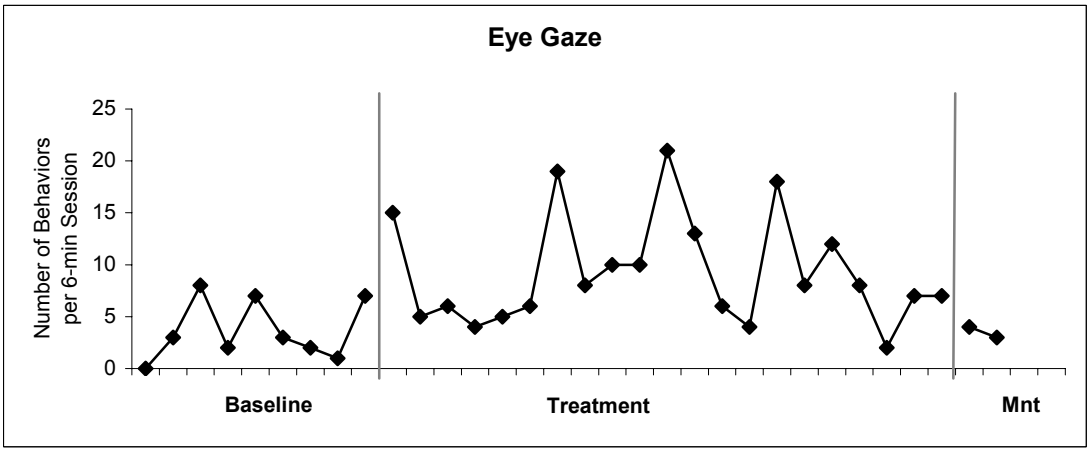
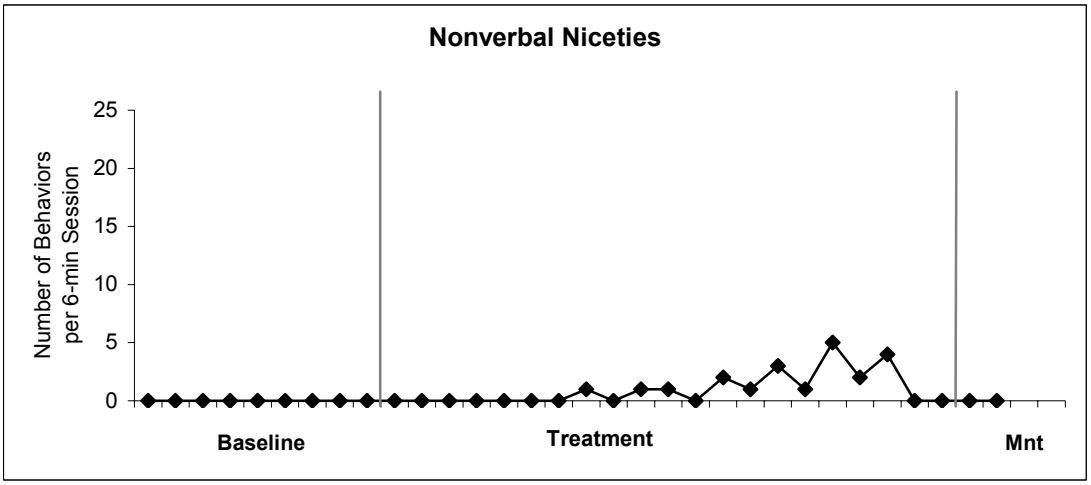


Figure 14b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Kristen (Study 2)



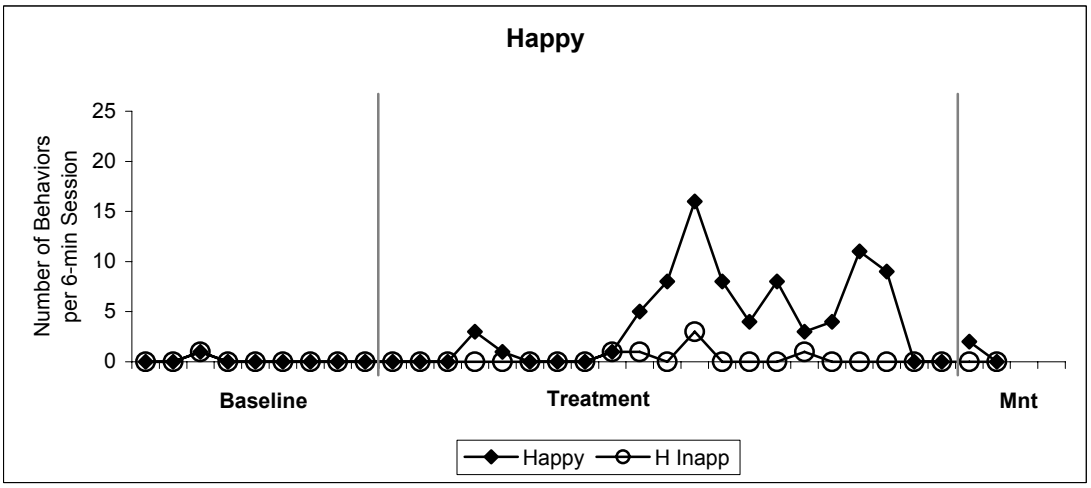


Figure 15a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Jay (Study 2)

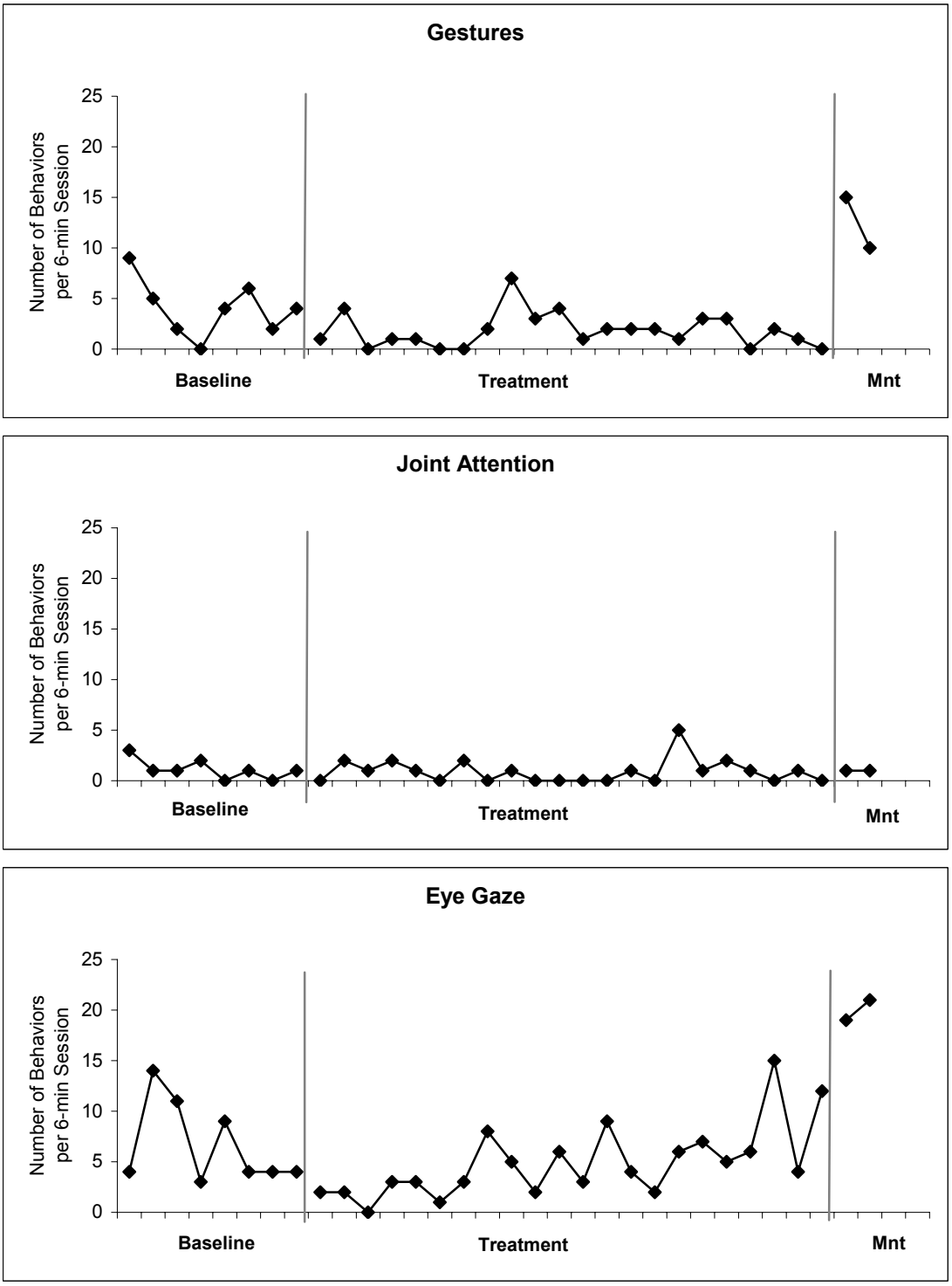


Figure 15b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Jay (Study 2)

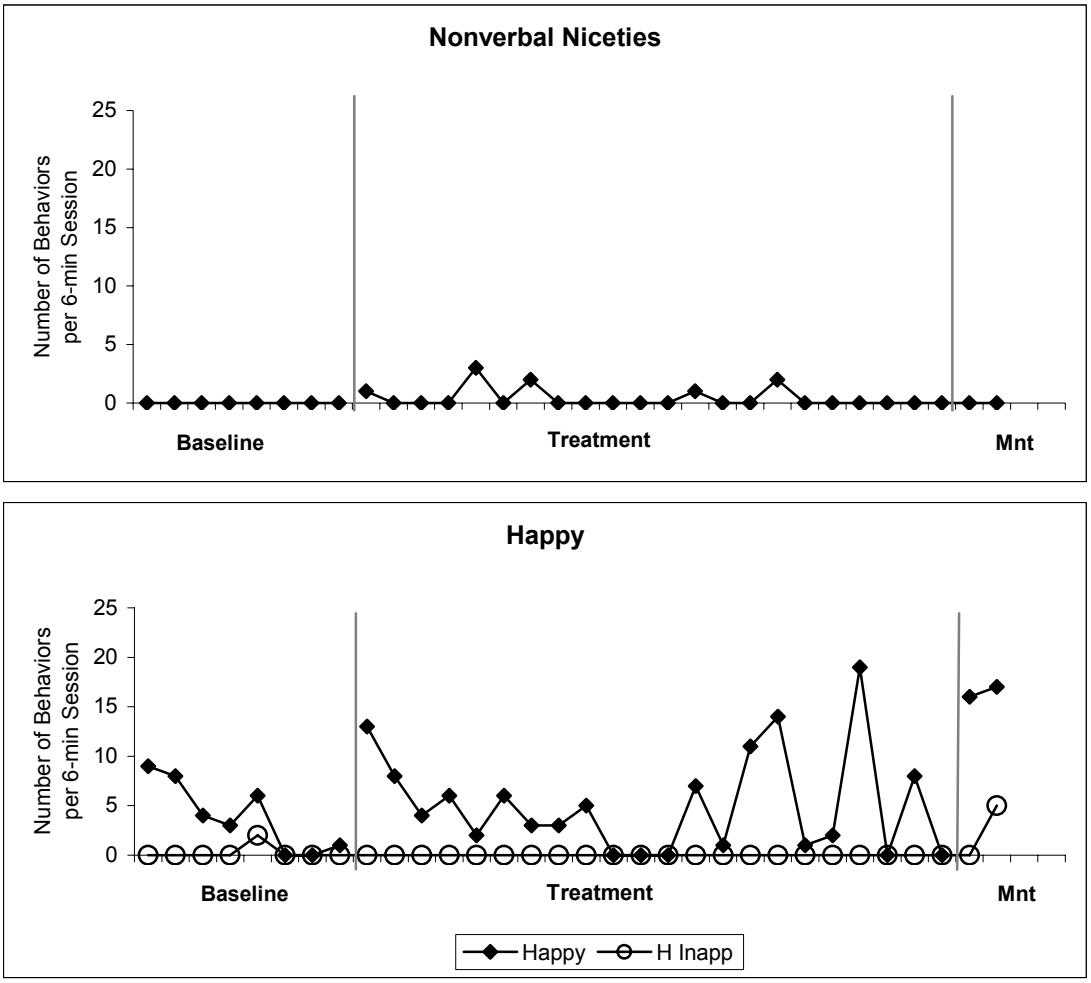


Figure 16a.
Frequency of Gestures, Joint Attention, and Eye Gaze for Joseph (Study 2)

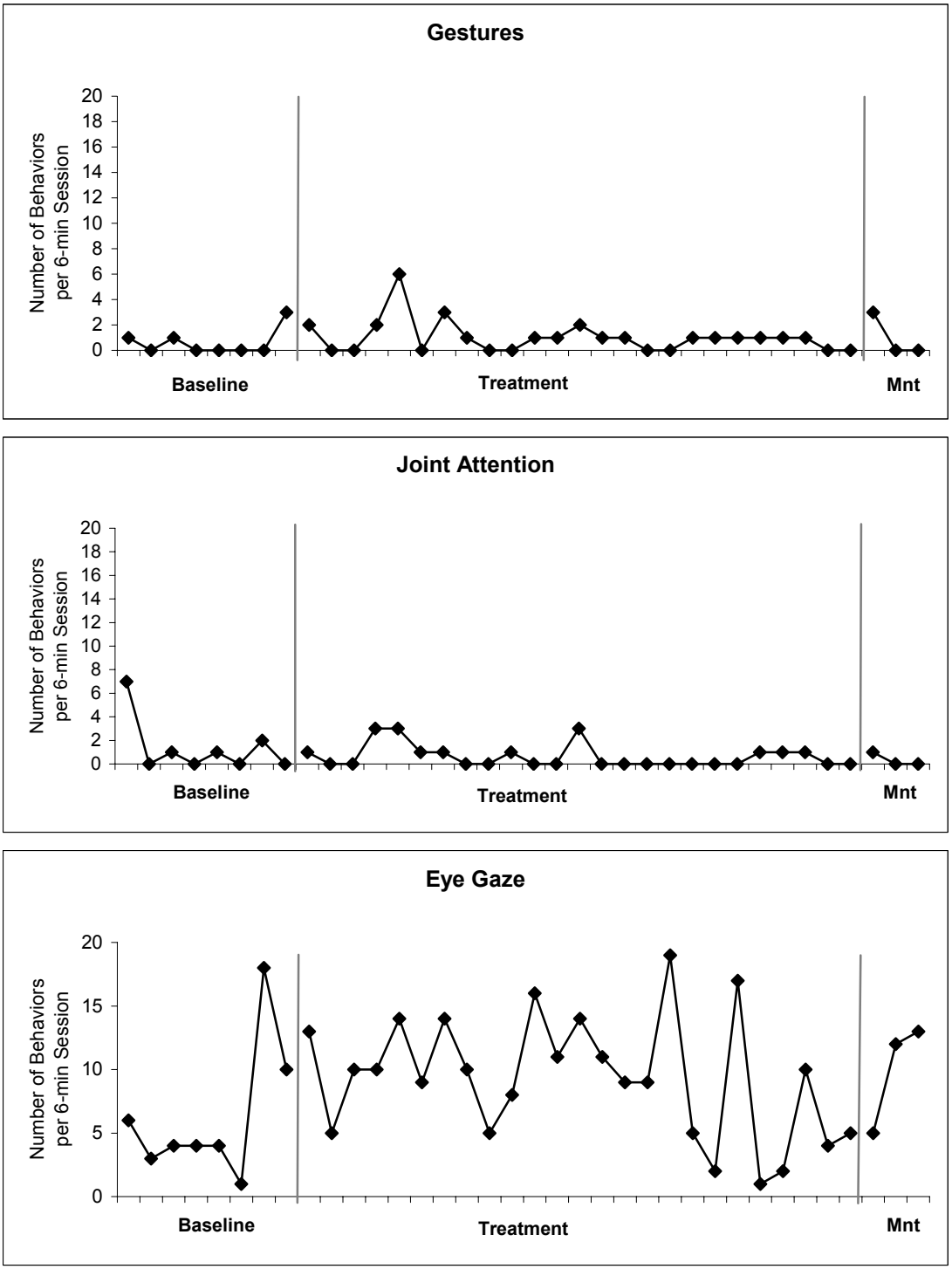
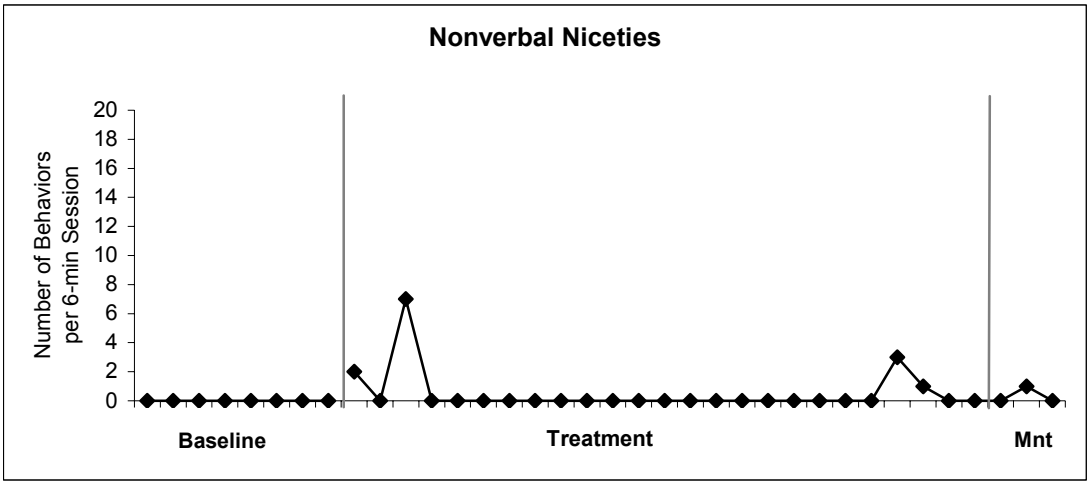


Figure 16b.
Frequency of Nonverbal Niceties and Positive Affect Expression for Joseph (Study 2)



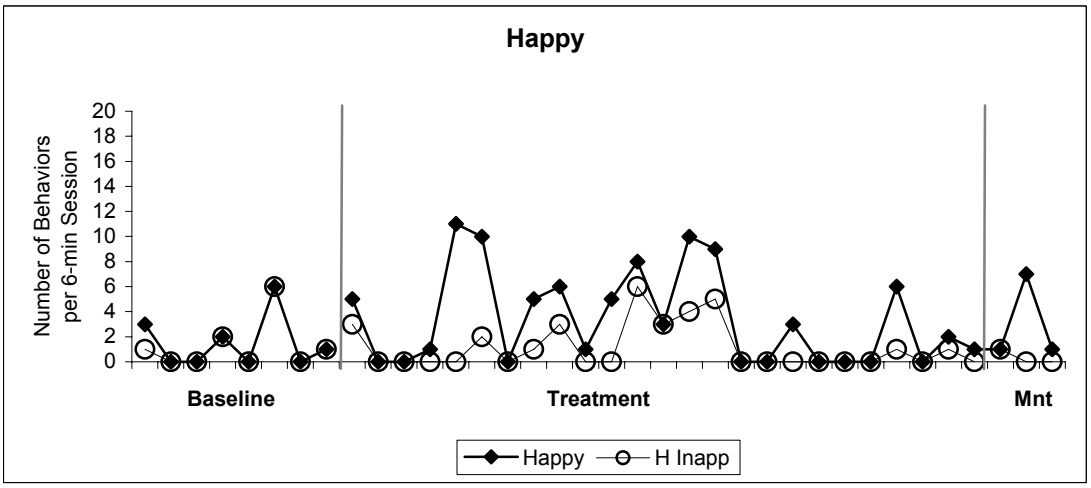


Figure 17a.
Michael's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 2)

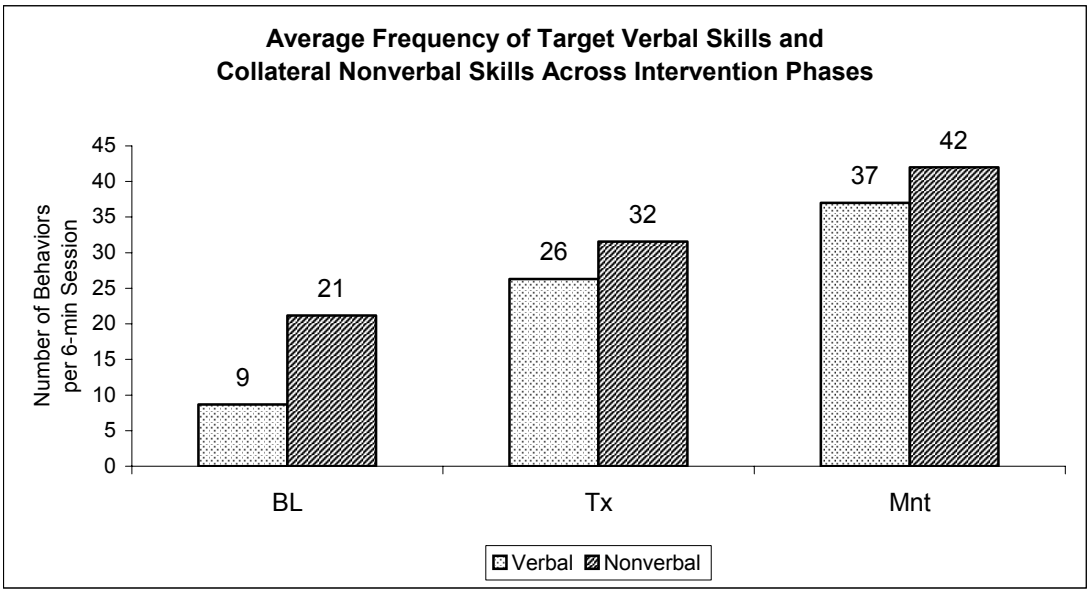
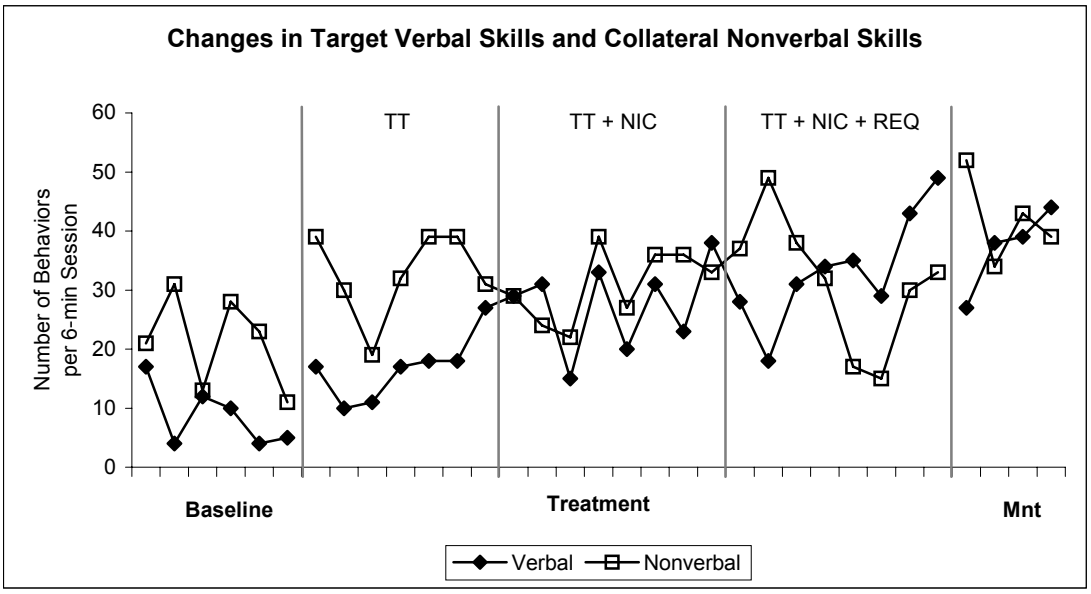


Figure 17b.
Michael's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 2)



Target verbal skills = Turn-Taking, Niceties, and Requests

Figure 18a.
Kristen's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 2)

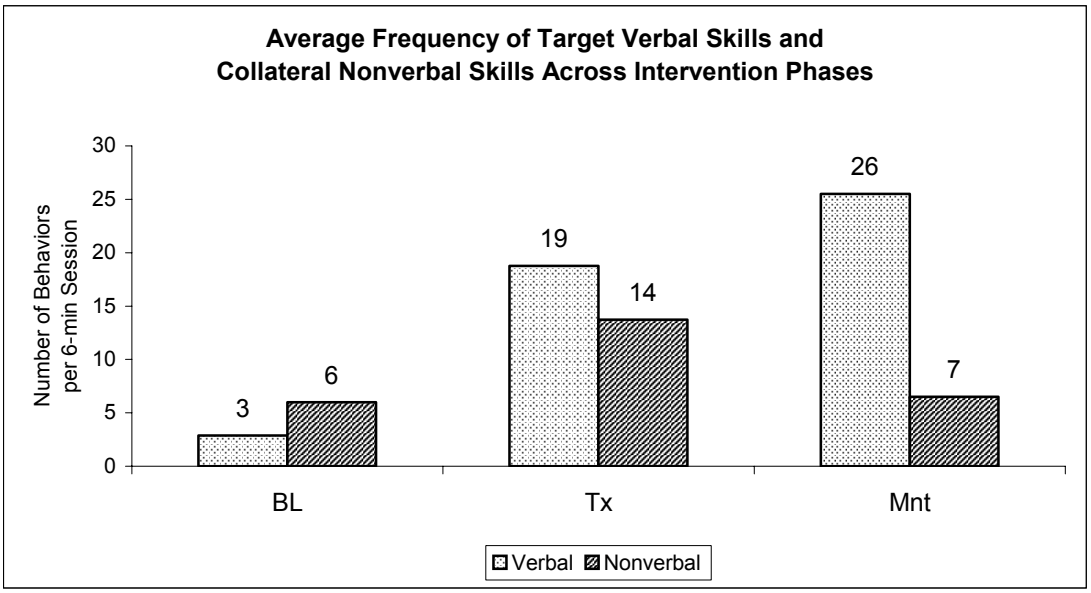
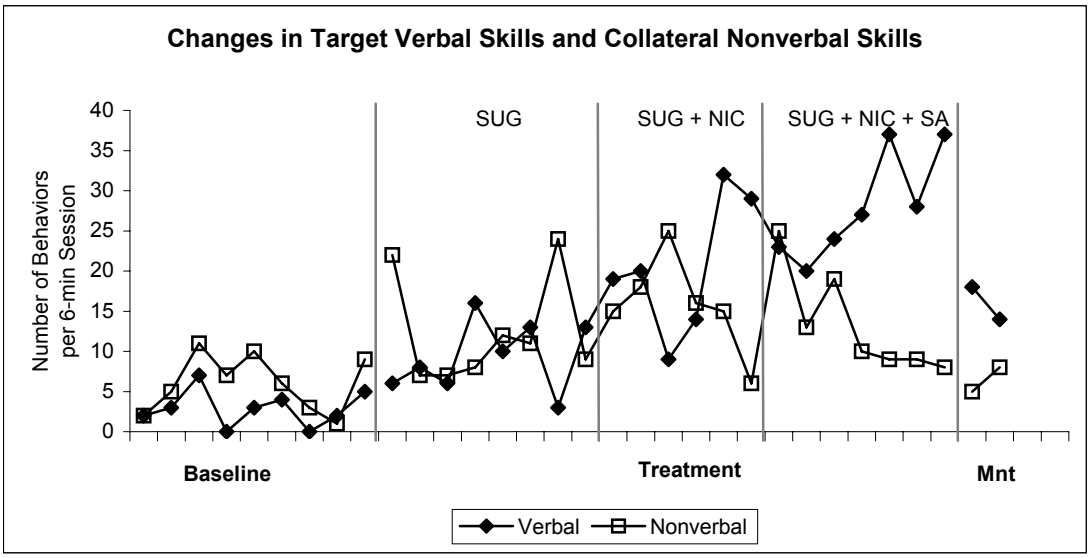


Figure 18b.
Kristen's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 2)



Target verbal skills = Suggestions, Niceties, and Secures for Attention

Figure 19a.
Jay's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 2)

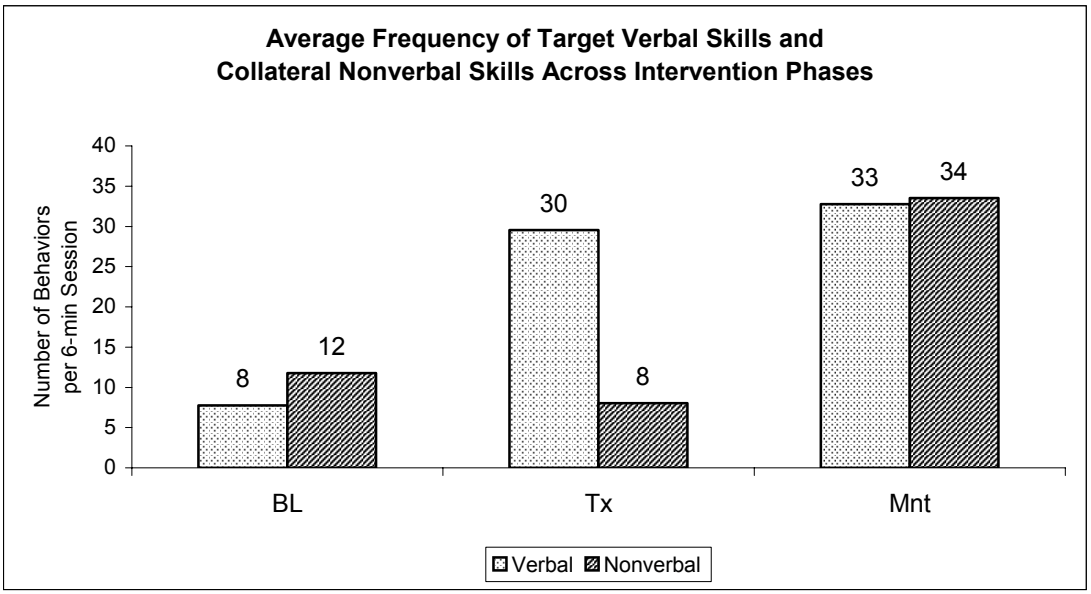
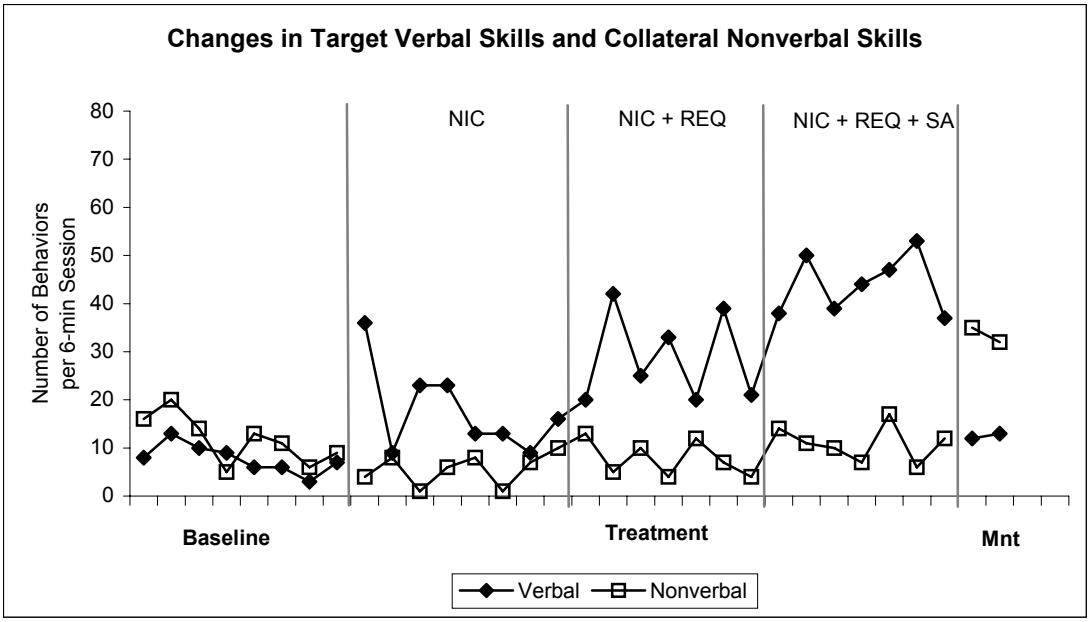


Figure 19b.
Jay's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 2)



Target verbal skills = Niceties, Requests, and Secures for Attention

Figure 20a.
Joseph's Average Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed Across Baseline, Treatment, and Maintenance Phases (Study 2)

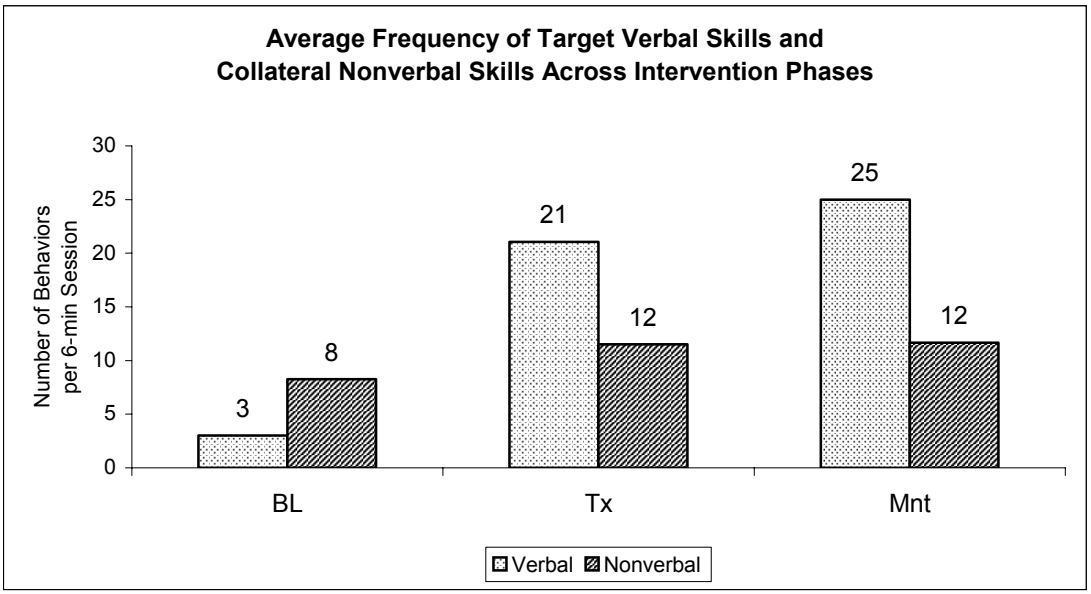
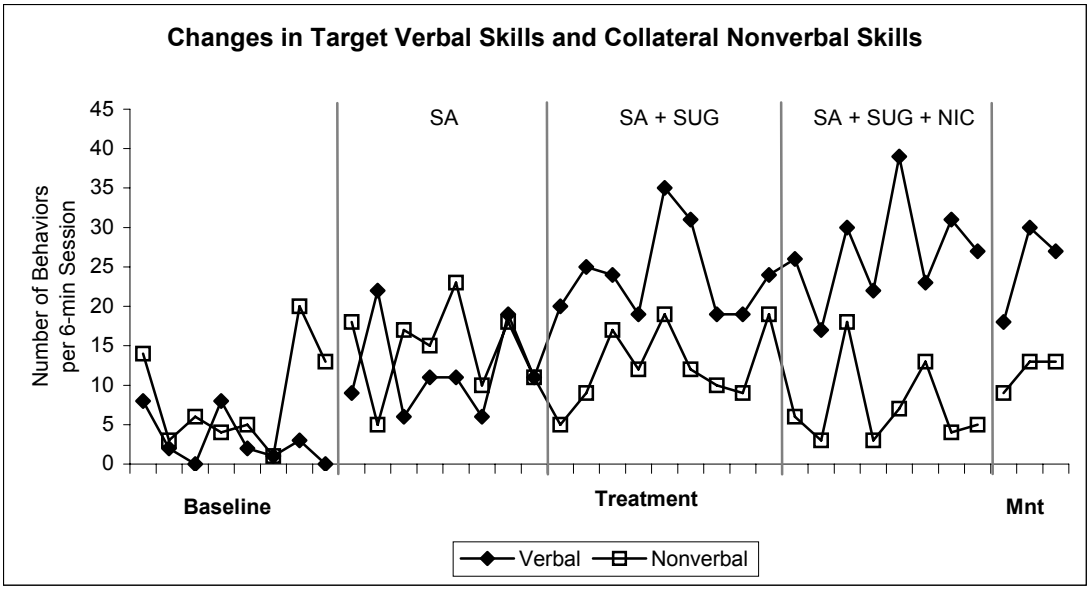


Figure 20b.
Joseph's Frequency of Target Verbal Skills and Collateral Nonverbal Skills Observed per 6-minute Session during Baseline, Treatment, and Maintenance Phases (Study 2)



Target verbal skills = Secures for Attention, Suggestions, and Niceties

Table 1

Study 1 Participants' Test Performance

	Participants							
Tests Administered	Michael		Tim		Mark		Kasey	
CARS	Mild-Mod		Mild-Mod		Mild		Non-autistic	
PPVT-R	18P	86SS	45P	98SS	21P	88SS	79P	112SS
SITIS: Teacher Rating	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Averages	2.9	3.8	3.1	2.7	2.1	3.1	2.6	3.0
Informal Reading Test	55%		100%		90%		100%	
SSRS Teacher Report	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Social Skills	14P	75P	23P	25P	<2P	10P	25P	37P
	84SS	110SS	89SS	90SS	55SS	81SS	90SS	95SS
Problem Behaviors	70P	45P	96P	79P	88P	79P	45P	66P
	108SS	98SS	127SS	112SS	118SS	112SS	98SS	106SS
SSRS Parent Report	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Social Skills	8P	88P	12P	5P	7P	14P	39P	12P
	79SS	118SS	82SS	76SS	78SS	84SS	96SS	82SS
Problem Behaviors	79P	70P	98P	98P	>98P	>98P	63P	84P
	112SS	108SS	130SS	131SS	138SS	138SS	105SS	115SS
TOLD								
Oral Vocabulary	16P	7SS	50P	10SS	<1P	2SS	64P	11SS
Grammar Understanding	16P	7SS	16P	7SS	<1P	2SS	24P	8SS
Sentence Imitation	2P	4SS	37P	9SS	5P	5SS	64P	11SS
Grammar Completion	16P	7SS	25P	8SS	5P	5SS	64P	11SS
Vineland								
Communication	37P	95SS	7P	78SS	1P	67SS	3P	71SS
Daily Living Skills	25P	90SS	39P	96SS	2P	68SS	.4P	60SS
Socialization	19P	87SS	42P	97SS	3P	71SS	2P	69SS
Adaptive Behavior	19P	87SS			1P	63SS	.5P	61SS
WRMT-R Subtests								
Word Identification	84P	115SS	57P	103SS	4P	73SS	74P	110SS
Word Attack	85P	115SS	56P	102SS	1P	62SS	74P	110SS
Passage Comprehension	19P	87SS	63P	105SS	1P	65SS	44P	98SS
K-ABC								
Hand Movements	37P	9SS	25P	8SS	2P	4SS	5P	5SS
Triangles	9P	6SS	75P	12SS	84P	13SS	75P	12SS
Matrix Analogies	84P	13SS	63P	11SS	50P	10SS	25P	8SS
Spatial Memory	1P	3SS	75P	12SS	25P	8SS	16P	7SS
Photo Series	5P	5SS	37P	9SS	9P	6SS	16P	7SS
Nonverbal Composite	10P	81SS	55P	102SS	19P	87SS	16P	85SS

P = Percentile
SS = Standard Score

Table 2

Study 2 Participants' Test Performance

	Participants							
Tests Administered	Kristen		Jay		Michael		Joseph	
CARS	Non-autistic		Non-autistic		Mild		Severe	
PPVT-R	68P	107SS	75P	110SS	8P	79SS	.2P	56SS
SITIS: Teacher Rating	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Averages	2.9	3.4	3.7	3.9	2.6	4.6	1.9	2.6
Informal Reading Test	100%		5%		85%		100%	
SSRS Teacher Report	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Social Skills	10P	37P	4P	53P	75P	79P	2P	4P
	81SS	95SS	74SS	101SS	110SS	112SS	68SS	73SS
Problem Behaviors	92P	84P	98P	66P	45P	45P	50P	70P
	121SS	115SS	131SS	106SS	98SS	98SS	100SS	108SS
SSRS Parent Report	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*	*Pre-*	*Post-*
Social Skills	18P	70P	<2P	18P	25P	66P	5P	2P
	86SS	108SS	63SS	86SS	90SS	106SS	76SS	69SS
Problem Behaviors	90P	68P	63P	18P	75P	75P	84P	63P
	119SS	107SS	105SS	86SS	110SS	110SS	115SS	105SS
TOLD								
Oral Vocabulary	75P	12SS	50P	10SS	9P	6SS	2P	4SS
Grammar Understanding	37P	9SS	50P	10SS	16P	7SS	9P	6SS
Sentence Imitation	25P	8SS	50P	10SS	9P	6SS	5P	5SS
Grammar Completion	84P	13SS	50P	10SS	5P	5SS	<1P	2SS
Vineland								
Communication	68P	107SS	2P	69SS	27P	91SS	<.1P	38SS
Daily Living Skills	.4P	60SS	1P	67SS	10P	81SS	<.1P	40SS
Socialization	2P	68SS	.5P	61SS	6P	77SS	<.1P	44SS
Adaptive Behavior	<.1P	48SS	<.1P	46SS				
WRMT-R Subtests								
Word Identification	100P	154SS	10P	81SS	55P	102SS	9P	80SS
Word Attack	98P	131SS	33P	94SS	60P	104SS	37P	95SS
Passage Comprehension	99P	137SS	56P	102SS	20P	87SS	4P	73SS
K-ABC								
Hand Movements	50P	10SS	37P	9SS	75P	12SS	1P	3SS
Triangles	50P	10SS	16P	7SS	16P	7SS	25P	8SS
Matrix Analogies	91P	14SS	84P	13SS	9P	6SS	5P	5SS
Spatial Memory	63P	11SS	16P	7SS	25P	8SS	5P	5SS
Photo Series	50P	10SS	63P	11SS	5P	5SS	9P	6SS
Nonverbal Composite	96P	127SS	37P	95SS	14P	84SS	2P	70SS

P = Percentile
SS = Standard Score

Table 3

Coding Definitions of Verbal Communication

Communication Behavior	Definition
Secures for attention (SA+)	(1) Focus child calls peer's name or uses words like "hey" or "look" to get someone's attention (2) Coded **ONLY** if used in combination with another utterance (e.g., "John, can I see that?" or "See? This is how you do it")
Turn-taking utterances (TT)	Initiations or responses related to "taking turns" and used to: (1) find out whose turn it is, find out who goes first, second, last, or to get the game going (2) tell a peer to take their turn or wait (3) request a turn (e.g., Is it my turn?; Can I go now?) (4) respond to a peer's request or question about taking a turn
Suggestions (SUG)	Initiations or responses used to: (1) set-up the game or activity (2) talk about current rules or create new rules for game play (3) giving suggestions for modifying materials/activities game (4) give directions to others to **follow game rules** (5) ask questions to determine if others understand the rules
Comments (COM)	Initiations or responses used to: (1) describe events related to the topic/activity (2) describe properties of objects (3) describe personal progress, feelings, or ideas (4) acknowledge, answer questions, or respond to requests
Requests (REQ)	Initiations or responses used to: (1) request an action (2) request or clarify information (3) ask a question to clarify a peer's prior utterance (4) give or read a direction as they play a game card (5) find out the sequence or timing of activities
Social Niceties (NIC)	**Sincere** initiations or responses that are used to: (1) compliment others for doing nice work or their looks (2) cheer on a peer for winning or doing well (3) be polite or apologize (4) offer help to another child (5) let others go first in a game
Unrelated utterances (UNR)	Utterances that are intelligible and unrelated to the immediate topic of conversation
Inappropriate utterances (OT)	Rude or inappropriate utterances directed to peers, inappropriate paralanguage or vocalizations, intentional interruptions, echolalia or stereotyped utterances, and unintelligible utterances
Peer Initiation (PI)	Peer initiates to the focus child or to the group as a whole
Peer Response (PR)	Peer responds to the focus child

Table 4

Average Reliability Rates Per Dependent Variable

	GES	JA	EG	NNIC	Happy	Neg Aff	Neg Bx
Study 1	77%	81%	91%	48%	81%	74%	76%
Study 2	81%	69%	90%	54%	75%	83%	70%
Across both studies	79%	75%	91%	51%	78%	80%	72%

Table 5

Participants' Average Frequencies of Interfering Behaviors Observed per 6-minute session during Baseline, Treatment, and Maintenance Phases*

		Study Phases		
		Baseline	Treatment	Maintenance
Study 1				
	Michael	8	9	9
	Mark	0	1	2
	Tim	0	2	2
	Kasey	1	2	1
Study 2				
	Michael	3	1	1
	Kristen	2	3	6
	Jay	4	0	4
	Joseph	6	4	9

* Due to low observed occurrences in baseline and relatively little change throughout the intervention for all focus children in Study 1 and Study 2, negative affect (sad, mad, inappropriate) and negative behaviors (stereotypic, off-task) were combined into one category labeled "Interfering Behaviors"