

The Impact of Child-Directed Treatment for Young Children with Motor Impairments
on Their Caregivers' Facilitative Behaviors

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Abstract

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Children's development of early signals of communication (e.g., triadic eye gaze) is powerfully shaped by their caregivers' facilitative behaviors which provide support for learning during caregiver-child interactions. When a child has severe motor impairments, these interactions are disrupted and communicative development is negatively impacted. Speech-language pathologists may treat either the child or the caregiver to facilitate development of early signals of communication in children with severe motor impairments. The purpose of this study was to investigate the benefits that caregivers may receive when their children receive direct treatment for triadic eye gaze. This study examined the changes in facilitative behaviors for 7 caregivers whose infants with severe motor impairments received treatment for triadic eye gaze versus 7 caregivers whose infants did not receive this treatment. Overall, there were no statistically significant differences between the changes in facilitative behaviors in the two groups. However, the treatment group did significantly decrease their facilitative behaviors from baseline to follow up. Implications for treatment are discussed as well as qualitative analysis of the caregivers' facilitative behaviors.

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DEDICATION

To my wonderful family, especially my grandparents, Anthony and Colleen Sinsky, who have always instilled in me the value of and love for education.

Introduction

The importance of a social, mutually reciprocal caregiver-child interaction in the first months of life is paramount to facilitating prelinguistic intentional communication. Early behaviors of eye gaze, gestures and vocalizations gradually become clearer and more consistent as children produce them to convey a variety of communicative functions in the context of social interactions with caregivers. These behaviors become the building blocks for later language development. Communication is inherently a social endeavor and is therefore powerfully shaped by the give-and-take between caregiver and child (Sameroff & Fiese, 2000; Vygotsky, 1978). Caregivers serve as mediators for their children, structuring the environment, filtering and introducing stimuli, and adapting their own behavior to facilitate through guidance their children's experience. In turn, the caregivers' facilitative behaviors are rewarded by the child's attention and engagement, with more sophisticated signals emerging as more learning takes place (Bates, Camaioni, & Volterra, 1979; Tomasello, 1999). Research has shown that caregiver facilitative behaviors are tied to positive child outcomes in the communication domain.

For children with severe motor impairments, the reciprocity of this early interaction is frequently disrupted. The children's ability to independently develop intentional communicative signals may be jeopardized by the severity of their impairments, which in turn impacts responses and initiations of the caregivers. The caregivers may struggle to adapt their interaction styles to child signals that are variable, idiosyncratic and unclear. Further, the child may experience difficulty with sustained engagement and physical interaction with toys and in social games.

Both child and caregiver are at a disadvantage, which results in significant disruption of the natural rhythms of interaction and learning.

Many interventions teach caregivers more responsive and interactive ways to engage with their children. The caregivers receive treatment with the expectation that their children's communication will change as an indirect result. Similarly, when a child with severe impairments needs the specialized skills of a speech-language pathologist (SLP) to teach new behaviors, the child receives direct treatment, with the hope that the caregiver will receive indirect benefit. Clearly, caregiver-directed treatment and child-directed treatment represent two different and valuable approaches. Considerable research has shown that children receive indirect benefit in terms of language growth in the caregiver-directed treatment approach (for a meta-analysis, see Roberts & Kaiser, 2011). However, little research has illuminated the benefit caregivers receive when their children are receiving direct treatment for early communication. Understanding the breadth of change for each approach is critical for planning the most efficacious interventions. The current study investigates whether caregivers' facilitative behaviors increase after their children receive treatment to improve prelinguistic communication skills, namely eye gaze.

Literature Reviewed

The following literature review will begin by highlighting the research detailing typical development of prelinguistic communication signals, followed by the theoretical basis for the transactional model of development and the caregiver's influence on the development of communication skills. Then, unique challenges faced by caregivers and children with moderate

to severe motor impairments will be addressed. Finally, the interventions that have been developed to support these dyads will be discussed.

Prelinguistic Communication: Typical Development

The trajectory of communication development in infancy moves through three distinct stages: perlocutionary (prelinguistic, reflexive), illocutionary (prelinguistic, intentional) and locutionary (linguistic, intentional) (Bates, et al., 1979). An infant's first interactive behaviors are reflexive in nature, produced in response to changing internal states such as hunger, discomfort or fatigue. These behaviors (e.g., smiling, crying, reaching) represent the beginning of the perlocutionary stage of communication; while these behaviors are not directly communicative or intentional in nature, they do alert the caregiver to the physical needs of the infant (Bates, et al., 1979). Therefore, these reflexive behaviors promote interaction between infants and caregivers. During this preintentional phase, infants gradually increase their general focus on objects and people in their environment, which caregivers interpret as interest and attempts to interact, thereby inferring and attributing communicative characteristics to these early behaviors. Simple intentional behaviors also emerge as the infant is more involved with his/her environment; for instance, an infant may reach for a desired item or vocalize to receive comfort from a caregiver. While these behaviors may be intentional, in that a motivation is associated with their use, they may not be intentionally communicative. The infant may use adults as tools but not necessarily acknowledge adults as interactive communication partners. The focus is on the want or need at hand. The infant has no real awareness that his/her behaviors have an effect on another actor, but is learning the power of his/her behaviors in terms of getting needs met or influencing change in his/her environment.

Consistent responses by caregivers to infants' preintentional and simple intentional behaviors appear to help infants learn the sequence of events or actions that lead to a specific outcome (Warren & Brady, 2007). For instance, a child may learn that when he/she looks at a toy, the caregiver puts it within reach. Consistent, predictable caregiver responses, along with maturing cognitive capacities and ongoing exposure to stimuli such as cause-effect toys and simple social games, result in young children gaining an awareness of means-end around 7-11 months of age. That is, children realize that their actions have effects on not only the environment but also actors in the environment. This development coincides with Piaget's stage V (Piaget, 1952) or, in Bates et al.'s (1979) own terminology, the transition to the illocutionary stage of communication development. Tomasello (1999) terms this shift the "9-month revolution," marking a shift from simple dyadic gaze (focus on either an adult *or* object) to *coordinated joint attention*. The hallmark of this shift is that the child is now able to coordinate his/her focus of attention with another person in order to interact with an object as a point of joint or shared interest. These coordinated joint attention skills develop through stages of complexity: first, the child demonstrates the ability to follow the gaze of an adult, therefore responding to an adult's initiation of joint attention by focusing on an object of mutual interest (Mundy & Newell, 2007). When the child takes a more active role, directing the adult's attention instead of just sharing attention, the child may link an adult and an object with a two-point gaze by first looking at one and then the other. The most sophisticated coordinated joint attention is triadic, or three point gaze, following one of two patterns: a shift from adult to object, then back to adult or from object-adult-object (Bakeman & Adamson, 1984). The child's shifts in gaze link the object of interest to the communication partner in a "referential triangle" (Tomasello, 1999), establishing a

mutual topic for communication. The intentional use of triadic eye gaze provides a more readable signal of the child's intent or desire than simple dyadic eye gaze or even a two-point gaze. Throughout the illocutionary phase the communicative behaviors become more recognizable and conventional (Dunst & Lowe, 1986). During this stage, eye gaze patterns are paired with other conventional gestures, such as reaching, pointing and vocalizations, making the child's intentions clearer and more recognizable. Coordinated joint attention provides an essential social platform for mutual reference and shared common ground, which allow the caregiver-child social interaction to flourish. In addition, coordinated joint attention helps increase the effectiveness of the child's learning from exposure to the environment. The increased specificity of the common ground established between child and caregiver heightens the probability that the child will relate the caregiver's language to the correct referents and attend to the caregiver's teaching efforts instead of irrelevant stimuli (Rogoff, 1993; Wertsch, 1984). In this way, typical children's interactive communicative experiences dovetail with their interactive environmental experiences that enable them to learn by physically doing (e.g., interacting with toys) and through caregiver mediation (e.g., caregivers helping the child understand his/her explorations).

A second revolutionary shift in cognition and communication is the child's ability to use symbolic representation to communicate. The child's intentional communication skills are further refined by building on the common ground established by coordinated joint attention (e.g., Dollaghan, 1987). Vocalizations become phonetically consistent forms with consistent referents which are increasingly more recognizable as words, marking the shift into the final stage of

communication, the locutionary stage intentional communication via a commonly understood verbal system of language.

Explaining Development: Social Context for Communication

The developmental continuum described above is facilitated in large part by ongoing social interactions. While typical children can learn much from exposure to a rich environment, even they cannot learn complex communication simply from observation. Even at the level of recognizing the sounds that constitute their native language, social interaction is necessary for learning. For instance, exposure to audio- or video-recorded language is not sufficient to stimulate increased recognition of sound-level units (Kuhl, Tsao, & Liu, 2003). In addition, Zimmerman et al. (2009) found that the amount of caregiver-child conversation was more robustly associated with positive language outcomes than the raw number of words a child heard from any and all adults in his/her environment. Carew (1980) found that measures of development were more highly and consistently correlated with a child's social, interactive experiences than a child's independent intellectual experiences (e.g., solitary play). These interactive experiences were also more closely correlated with a child's earlier achievement of milestones. Clearly, children depend on interactive, social engagement with partners more capable than themselves when learning language (Vygotsky, 1978). The transactional and socio-cultural theories of development capture the importance of this social interaction, as both emphasize the importance of the child's interaction with the environment in a social context. Sameroff and Fiese (2000) build their argument for transactional development from an ecological perspective. They assert that an organism is inseparable from the changes in its environment because of the complex way in which each influence and depend on one another.

Rogoff (1984) views this interaction from a cultural, social and cognitive perspective. She claims that the larger culture, the immediate social experience, and the child's mental and communicative processes cannot be parsed into isolated behaviors or influences. Communication and context are symbiotically intertwined in development. While these claims are not exclusive to the caregiver-prelinguistic child interaction, the fact that caregivers are the primary social partners of their infant children creates an environment that typifies many aspects of this mutuality.

The role of caregivers in shaping the learning of the child has been defined in multiple ways. One definition favored in the speech-language pathology literature focuses on the caregiver's response to infant signals, termed *caregiver responsivity*. Another, based on a social-cultural framework, focuses on the caregiver's efforts to guide a child's learning and is termed *mediation*.

Caregiver responsivity. *Caregiver responsivity* refers to a set of caregiver behaviors that are timely, appropriate and contingent upon the child's communicative signals and overall level of development. They serve to contribute to the child learning cause-effect, as well as give feedback about the power of communication. Exact definitions for responsivity and corresponding critical behaviors vary among researchers, as do measurement systems. In the speech-language pathology literature, three research teams stand out as having most thoroughly investigated caregiver responsivity: Warren, Yoder and colleagues; Mahoney and colleagues; and Landry, Smith, Swank and colleagues.

Warren and Yoder's research focuses on measuring responsivity of caregivers whose children have developmental delays of various etiologies (Yoder, McCathren, Warren, & Watson,

2001; Yoder & Warren, 1998, 2001, 2002; Yoder, Warren, Kim, & Gazdag, 1994). They identify three levels of responsivity: the most basic is *general responsivity*, or response to the child's rudimentary biological needs such as hunger and pain. However, the research tying caregiver responsivity to positive child communication outcomes focuses on the more complex aspects of responsivity, which Warren and Yoder et al. identify as consisting of molar and molecular levels. Molar level characteristics describe the overall qualities of caregiver responsivity, such as warmth and affect. Molecular level characteristics refer to caregiver behaviors made in apparent response to a child's signals.

Mahoney and colleagues' responsivity research has focused on caregivers of children with developmental delay, primarily Down syndrome (Mahoney, 1999; Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998; Mahoney, Finger, & Powell, 1985; Mahoney, Perales, Wiggers, & Herman, 2006; Mahoney, Powell, & Finger, 1986). They have empirically identified 12 behaviors categorized into four interactive style factors: (a) responsive/child oriented behaviors; (b) affect/animation; (c) achievement orientation behaviors; (d) directive behaviors (Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998) and use 5-point Likert scales to measure each of these.

Landry and colleagues investigated responsivity with caregivers of children born at very low birth weights (Landry, Miller-Loncar, Smith, & Swank, 2002; Landry, Smith, & Swank, 2006; Landry, Smith, Swank, Assel, & Vellet, 2001; Landry, Swank, Guttentag, & Smith, 2008; Smith et al., 1996). Their definition of caregiver responsivity is reflected in the behaviors comprising their maternal rating scale, which is composed of 10 behaviors in four domains: contingent responsiveness, emotional support, caregiver's response to child's focus of attention, and the quality of verbal input provided by the caregiver (Landry, et al., 2006). Landry and

colleagues used 5-point Likert scales for behaviors judged to be molar, such as emotional support. They used frequency counts for behaviors judged to be more molecular or discrete because they occur in response to a child's signal, such as responses to a child's focus of attention.

Overall, definitions of caregiver responsivity describe behaviors that are largely dependent on child initiation and readable signals. Research suggests that highly responsive caregivers tend to have children with better outcomes in self-regulation (e.g., Jaegermann & Klein, 2010; Sameroff & Fiese, 2000), cognition (Landry, 2006), social-emotional development (e.g., Bornstein and Tamis-LeMonda, 1989; Landry, 2001), and many aspects of language such as morphosyntax, vocabulary, etc. (e.g., Landry, 2002; Yoder and Warren, 1999). Highly responsive caregivers have children who attain language milestones earlier (Landry, 2001) and have a faster rate of development (Mahoney, et al., 2006). These positive effects hold true across different cultures (e.g., Girolametto, Bonifacio, Visini, Weitzman, Zocconi, & Pearce, 2002). No critical period for responsivity has been identified; instead, consistency of optimal responsivity across childhood appears to have cumulative effects (Landry, 2001).

Mediation. *Mediation* is a related perspective addressing the role of the caregiver in child development. According to Vygotsky and Feuerstein (2010), learning takes place in a context where adults act to mediate a child's experience. Klein (1997) describes a mediated learning experience (MLE) as one in which "the environment is interpreted for the child by another person who understands the child's needs, interests, and capacities, and who takes an active role in making components of that environment, as well as past and future experiences, compatible with the child." (p 62). The caregiver provides guidance to help the child move from his/her

actual, independent performance to a higher level of function, the child's *potential* performance. Vygotsky termed the distance between actual and potential performance the *zone of proximal development* (ZPD). The ZPD is not a static zone even within one child; it is influenced by a variety of factors but is essentially "the region of sensitivity to guidance where the child is not quite able to manage the problem independently" (Rogoff, 1993, p. 126). The caregiver must negotiate to achieve a level of support that is appropriate for the child: not so much that the child fails and not so little that child is not challenged, and therefore does not learn. The child contributes by providing signals that indicate engagement, appropriate pacing and thresholds for interaction. Learning takes place in the ZPD as the child experiences a more capable adult modeling use of higher cognitive and communicative functions while simultaneously mediating their use to help the child participate in incrementally more challenging ways. As the child is able to achieve more and more independence with these skills, the caregiver reduces the amount of structure and support in the interaction, much like a master guides an apprentice (Rogoff, 1993; Vygotsky, 1978). Some call this process internalization (Vygotsky, 1978); others term it a shift from other-regulation to self-regulation (Wertsch, McNamee, McLane, & Budwig, 1980); Rogoff (1993; 1984) calls it guided participation. However, all agree that mediation is an active process for both caregiver and child. In each encounter, the dyad must first establish common ground through communication (Vygotsky's (1978) "semiotic mediation") such as mutually engaging in a task with the same goals. Then, the caregiver and child are able to negotiate the ZPD, with the caregiver facilitating the child's increased independence and mastery over time. Importantly, while the caregiver is intentionally interacting, he/she may not be aware that teaching is occurring (Rogoff, et al., 1984).

Klein et al. (1987) determined the necessary and sufficient caregiver behaviors that constitute a mediated learning experience. These mediation behaviors include the following:

1. Focusing: The caregivers' attempts to gain and maintain the children's attention and engagement.
2. Exciting/Affecting: The caregivers' use of excitement, enthusiasm, affect, and tone of voice to enrich the interaction, highlighting salient aspects of the activity.
3. Regulation of Behavior: The caregivers' attempts to help the children regulate their own behavior in order to succeed in the interaction. For example, a caregiver may provide instructions on how hard to push a button or how fast to shake a toy to activate it.
4. Expanding: The caregivers' effort to map meaning onto the children's behaviors and focus of attention by making connections between events within or beyond the activity (e.g., associating memories, describing feelings). This transcendence of the immediate context is critical as it serves to expand the child's cognitive skills and build associations, enabling the child to use past experiences to learn from future ones.
5. Encouraging: Caregivers offer feedback and encouragement when the children succeed.

These mediation behaviors reflect the caregivers' intentional efforts to select, accentuate, and organize important aspects of the interaction while maintaining reciprocity with the children. Klein and colleagues have investigated the effect of maternal interactions on children around the world with different abilities including gifted children, children with very low birth weight (Klein & Hundeide, 1996a), children from low and middle socioeconomic homes (Klein & Alony, 1993; Klein & Feldman, 2007), children with sensory issues (Jaegermann & Klein, 2010) and children with Down syndrome (Klein, Adi-Japha, & Rosenthal, 2010). All of these

populations appear to benefit cognitively as well as in language development from increased caregiver mediation. For instance, the cognitive scores of typically developing 4-year-olds were predicted more reliably by the quality of the caregivers' mediation behaviors than by their cognitive scores as infants. Of the mediation behaviors described, Expanding and Encouraging behaviors were most frequently related to positive cognitive outcomes in these children (Klein, 2006). In children with Down syndrome, pre-verbal communication was positively associated with caregivers' use of the full complement of mediation behaviors, rather than one or two isolated behaviors (Klein, et al., 2010).

Both *caregiver responsivity* and *mediation* address the adult's role in supporting a child's development. Both of these perspectives have a common core construct, which in the current study will be called *facilitating through guidance*. *Caregiver facilitative behaviors* refer to the observable indicators of this core construct. These behaviors capture the ways in which caregivers support development by recognizing and responding to children's communicative signals and interactive abilities. The presence of these behaviors indicate the power of the reciprocal, intentional caregiver-child interaction and correlate with positive communicative development, both immediately and long-term. In this way, communication and ongoing engagement between the caregiver and child is critical to the refinement of communicative signals and facilitate the child's progression from actual performance to more sophisticated potential performance. However, if either the caregiver or child has limitations that inhibit him/her from performing his/her role in this interaction, the reciprocity can be disrupted and the power of the interaction is diluted.

Challenges of Severe Impairment: Effect on Reciprocal Interactions

In dyads where the child has a moderate to severe motor impairment, the communicative interaction between the two partners is frequently disrupted. This disruption is primarily seen in two areas: first, motor impairments impact the ability of the child to independently interact with his/her environment. For the caregiver, this may result in more time and effort fulfilling basic needs of the child, such as feeding and bathing, sacrificing mediation for necessity and efficiency. Second, motor impairments impact the ability of the child to develop and use clear signals of communication with the caregiver. When the child's signals are unclear, the caregiver may be unable to recognize them and as a result not respond appropriately or may face difficulty establishing a common ground for negotiation of the ZPD. Each of these constraints will be discussed in further detail below.

Interaction constraints. Children with moderate to severe motor impairments are limited in their ability to engage with their environment, including their caregivers. For instance, these children may not be able to access and explore toys or other materials both due to fine motor limitations (e.g., unable to push buttons, reach for toys, or explore textured toys) and/or gross motor limitations (e.g., unable to sit independently, crawl, cruise or walk to interact with items in their environment). These children also have limited independence in activities of daily living, which combined with other medical complications such as dysphagia, upper respiratory infections, etc., means the caregiver takes more time to assist in meeting basic needs such as feeding, administering medication and bathing. For instance, in one study, caregivers spent an average of 11.4 hours per week on feeding alone for children with spastic quadriplegia, with a range spanning 5.5 to 24.8 hours weekly (Edebol-Tysk, 1989). Concomitant sensory constraints may prevent children from gaining information from visual, auditory or tactile modalities.

Cognitive impairments may mean slower processing time, reduced short term memory, and difficulty generalizing learning (Siegel & Cress, 2002). Furthermore, it has been shown that children with disabilities spend less time in an alert, oriented state than typically developing children (Guess et al., 1993). In this way, children with severe motor impairments learn less from exposure to their environment than their typically developing peers. Further, caregivers spend more time sustaining the basic needs of their children, sacrificing time spent playing and interacting socially with them. This creates a vicious cycle: due to their impairments, the children may not learn as much from exposure to toys and other materials and, due to these same impairments, they spend less time exposed to these materials overall. In reality, children with motor impairments need more time and more support to participate in and learn from these experiences.

Communication constraints. Children with moderate to severe motor impairments may exhibit unclear, inconsistent and/or idiosyncratic behaviors due to their motor limitations (Pinder, Olswang, & Coggins, 1993). For instance, a child with low tone may not be able to produce facial expressions indicating enthusiasm for play. A child with hypertonic reflexes may exhibit a motor reflex that sweeps a desired toy off of the tray when in fact the child is reaching to interact with the toy. When these behaviors are difficult to read or inconsistent, a caregiver may struggle to interpret or infer the intent of the child; therefore, his/her own responses are more unreliable and inconsistent (Matthews-Somerville & Cress, 2005; Spiker, Boyce, & Boyce, 2002). Furthermore, children with motor impairments generally initiate fewer signals overall and have a lower tolerance for sustained interactions when compared to their typical peers. This results in fewer opportunities for back-and-forth interactions (Warren & Brady, 2007). This pattern fuels a

compounding cycle: the child produces signals that are uninterpretable, causing confusion for the caregiver, who in turn struggles to establish a common ground with the child, and therefore has difficulty determining the zone of proximal development. The caregiver may provide too little or too much support, and the contingent facilitative behaviors may be less appropriate or absent due to the caregiver's inability to read the child's signals. The child then has more difficulty understanding the means-end relationship between his/her own actions and the response of the caregiver as communication partner (Matthews-Somerville & Cress, 2005).

A delay in the development of intentional behaviors also serves to complicate continued caregiver-child interaction. Ambiguity in signals and frequent communication breakdowns may lead caregivers of children with disabilities to be more directive in their interactions, while children become more passive (Cress, Andrews, & Reynolds, 1998; Spiker, et al., 2002). Overuse of directives and the children's resultant passivity likely lead to a less balanced reciprocity and a less dynamic interaction, with caregivers spending more time on focusing (i.e., gaining and maintaining the child's attention) to the detriment of other facilitative behaviors. A predominance of focusing without the context of the full mediated learning experience may actually be detrimental to the child's prelinguistic communication development (Klein, et al., 2010).

Caregivers of children with motor impairments clearly are challenged in their efforts to interact with their children. The challenges facing both children and their caregivers make the need for positive reciprocal interactions even more critical. Because of the children's array of deficits, the caregivers' role may be even more crucial for facilitating cognitive, social, and communication development. Caregivers will need to utilize facilitative behaviors that best

match their children's unique characteristics. This is no easy task. As described above, children have a large range of abilities and deficits, many of which severely impact their ability to engage physically with the environment. In addition, children with motor impairments may require more intensive support from caregivers to achieve actions like reaching, grasping and manipulating toys. Children with sensory impairments may require caregivers to facilitate arousal if their children are hyposensitive to sensory stimuli, or conversely, modulate their children's behaviors if hypersensitivity is the problem. Ultimately, caregivers of children with motor impairments must provide clear, structured, and supportive opportunities for a child to communicate and interact with his/her environment. Caregivers will need to help their children focus and attend, and show excitement about objects and actions in the environment. Further, caregivers will need to provide maximum exposure to learning opportunities, guide their children's behaviors, and highlight the meaning of experiences. Finally, caregivers will need to demonstrate excitement and give feedback to help their children understand their achievements. However, much of the caregiver's ability to provide effective opportunities is dependent upon the child's joint attention ability, a skill which is often delayed in children with motor impairments but may be even more important for these children because it is crucial to establishing the common ground for learning (Rogoff, 1993; Wertsch, 1984). Early intervention for young children with motor impairment is critical to ensure positive interactions and learning. Clearly, interventions must consider the caregivers role in providing facilitative behaviors and the children's ability to produce conventional, clear and consistent communicative signals.

Intervention

Intervention for children with communication impairments and concomitant moderate to severe motor impairments can be conducted using multiple approaches, each conceptualizing the relationship between the speech-language pathologist (SLP), caregiver, and child in different ways. In a caregiver-directed approach, the intervention targets the caregiver as the “client” and the SLP teaches the caregiver interactive techniques for facilitating child communication. In the child-directed approach, the SLP targets the child as the “client,” and the caregiver may be involved as a passive observer, an active observer or possibly not involved, instead taking the time for respite. Each approach has its merits as will be highlighted in the following review.

Caregiver-directed treatment. Many interventions focus on the SLP interacting directly with caregivers. This is a logical approach given the importance of the caregivers’ role in shaping communication during interactions with their children. The SLP’s goal is to teach the caregivers more interactive skills to facilitate practice, mastery and extension of their children’s current communicative behaviors. Intervention has primarily focused on enhancing caregiver responsivity as described above. Some specific examples of the caregiver-directed treatment approach include the Hanen Program (Girolametto & Weitzman, 2006) which targets different populations such as late talkers and children with autism; Playing and Learning Strategy (PALS) (Landry, et al., 2006) developed for children at risk for delay due to premature birth and very low birth weights, Responsive Teaching (Mahoney, et al., 2006) developed for children with developmental disorders such as Down syndrome, and Responsivity Education/Prelinguistic Milieu Teaching (RE/PMT), a hybrid intervention targeting both prelinguistic children with intellectual disabilities and their caregivers (Yoder & Warren, 2002). These interventions, which

have been implemented with the caregivers of children exhibiting a variety of disabilities, have shown significant increases in caregiver responsivity, as well as significant but lesser effects on child language outcomes (Brady, Warren, & Sterling, 2009). Focusing on caregiver-directed treatments specifically with children with motor impairments, administration of the Hanen program revealed that communication initiations of young children with cerebral palsy increased while their mothers' initiations decreased, indicating an increase in the mother's contingent responses (Pennington, Thomson, James, Martin, & McNally, 2009). Using a different caregiver-directed treatment for caregivers of children with severe motor impairments, Olswang, Pinder & Hanson (2006) saw an increase in caregivers' provision of communication opportunities after a period of caregiver-directed intervention. The caregivers' rate of recognizing and responding to their children's communicative signals also increased, but the caregivers' production of shaping behaviors did not. An increase in the children's engaged behaviors was also observed during this study.

In addition to the treatments described above, which have focused primarily on communication development, Klein and colleagues have developed a caregiver-directed intervention for enhancing caregivers' mediation skills for facilitating their children's cognitive development. This intervention, called Mediation Intervention for Sensitizing Caregivers (MISC), focuses on increasing the level of awareness caregivers have of the mediation behaviors crucial to the caregiver-child interaction, which include (a) Focusing; (b) Exciting/Affecting; (c) Regulation of Behavior; (d) Expanding; (e) Encouraging, as described above. The intervention, conducted through home visits, pairs positive reinforcement of mediation behaviors with interactive teaching techniques such as role playing or reviewing videos of caregivers interacting

with their own children. In this way, caregivers learn the mediation behaviors that contribute to positive child communication outcomes and they gain confidence in their own ability to effect change in their children (Klein & Hundeide, 1996a). Klein et al. have used this intervention with multiple populations across cultures including caregivers in Israel, Sri Lanka, Ethiopia, the United States, Sweden and others (Klein & Hundeide, 1996a). They have also implemented MISC with caregivers of children with developmental delays of various kinds, including children with Down syndrome (Klein, et al., 2010); children with sensory disorders (Jaegermann & Klein, 2010); very low birth weight children (Klein, 2006; Klein & Hundeide, 1996a); and even caregivers of adults with severe intellectual disabilities (Lifshitz, Klein, & Cohen, 2010). The intervention has been shown to be effective with caregivers for all of these populations. For children with sensory disorders, caregivers that received a modified version of MISC showed greater increases in communication, teaching, and emotionally supportive behaviors than both caregivers who received no intervention and caregivers whose children received a child-directed intervention based on the Sensory Integration approach (Jaegermann & Klein, 2010). In addition, children born at very low birth weight (VLBW) who scored significantly below typical peers on measures of language and cognition actually scored higher than their typical peers on these same measures following MISC intervention for their caregivers. The caregivers of these VLBW children were also rated higher in their use of mediation behaviors than the parents of the typical counterparts. Three years post-intervention, both of these trends held true in favor of the experimental group (Klein & Hundeide, 1996a).

While caregiver-directed treatment is a valuable and evidence-based approach, children with motor impairments often need additional direct services to maximize change; this may be

particularly true for learning conventional, yet hard to produce signals of communication (Pinder, Olswang, & Coggins, 1993; Pinder & Olswang, 1995).

Child-directed treatment. The other intervention approach is direct treatment for the child. The value of this treatment is the fact that the SLP brings special expertise in multiple arenas pertaining to the challenges faced by children with motor impairments.

The SLP's overall goals are to teach or induce behaviors that may not otherwise be learned by the child or to teach signals that are more conventional and therefore more interpretable. This is achieved by tapping the expertise of the SLP's training as a master mediator; this is particularly true for children with severe impairments across multiple developmental domains. First, the SLP has the training to structure clear, salient communication opportunities appropriate for the child's physical, cognitive and sensory limitations and that serve to elicit a variety of communicative functions from the child, such as requesting objects, requesting repeated action, commenting, etc. These opportunities are designed to focus the child's attention and support the child's communicative initiation, while accommodating the child's impairments. The SLP is adept in recognizing subtle communicative signals and providing appropriate prompts in a variety of modalities (e.g., tactile, verbal, visual) to support the child's performance. The SLP then responds to the child's signal with contingent, highly reinforcing consequences coupled with specific praise for factors that led to the child's success in communicating. Pinder and colleagues (Pinder, Olswang, & Coggins, 1993; Pinder & Olswang, 1995) successfully utilized these techniques to teach triadic eye gaze to young children with severe motor impairments.

The truly challenging and unique part of this teaching paradigm is facilitating successive approximations of a new behavior; that is, gradually “shaping” the child’s communicative signals over time. Shaping is a process that requires analysis and dissection of a novel, complicated behavior into smaller components, teaching the child to approximate each component until the full behavior is mastered (Hegde, 1998). It requires the skillful negotiation of the child’s ZPD and analysis of which types of supports a child needs to progress from actual performance to potential performance, with gradual and methodical fading of support to facilitate independence. Shaping is particularly challenging to implement with children who have severe impairments because of their unique motor, sensory, and cognitive characteristics. In fact, caregivers of children with motor impairments have difficulty learning shaping techniques, which are instrumental to teaching new behaviors (Olswang, et al., 2006). The evidence also suggests that caregiver responsivity serves primarily to generally enhance behaviors already in use, rather than to establish new behaviors (e.g., Mahoney et al., 2006; Yoder & Warren, 2007), which for children with disabilities, could reinforce and perpetuate unconventional signals.

Overall, an SLP’s training lends her expertise in using mediation behaviors and establishing a zone of proximal development, much like teachers. Wertsch, Minick & Arns (1984) showed that teachers may be more expert in utilizing mediation strategies to rapidly teach new behaviors when compared to caregivers. In the study, dyads of caregiver-child and teacher-child were instructed to complete a puzzle together. The caregivers supported the children in performing primarily at the level of actual performance, meaning little learning or skill development was supported. The researchers concluded that the caregivers’ goal for the task was accurate and efficient task completion. In the case of the teachers, the researchers concluded that

their ultimate goal for the task was to support learning. The teachers negotiated with the children to establish a ZPD, then systematically challenged the children to take more responsibility in the task, even if this strategy resulted in an inaccurate or less efficient completion of the puzzle. The teachers used more indirect means of support which challenged the children to engage cognitively. The caregivers tended to delegate and direct which required the children to perform an action but did not require the children to *learn how* to perform the action (Wertsch, et al., 1984). SLPs, like teachers, are trained in using mediation both consciously and intentionally and have the luxury of interacting with the child in situations where learning, not task completion, is the primary goal of the interaction.

If the SLP is successful in increasing the clarity of the child's communication via child-directed treatment, the transactional model of development would indicate that both parties in the caregiver-child dyad would benefit. Research supports this proposition, demonstrating that the child's behaviors do affect the caregiver's facilitative behaviors. In fact, the communicative behaviors of children with impairments may affect their caregivers' behaviors to a greater degree than their typical counterparts. Slonims & McConachie (2006) found that mothers of children with Down syndrome had responsivity scores that correlated more highly with the behaviors of their children rather than maternal variables, such as depression. Research also shows that caregivers recognize and respond to intentional behaviors at a higher rate than pre-intentional behaviors, so if child-directed treatment succeeds in teaching the child intentional communication, it may also have a positive impact on caregiver's facilitative behaviors (Adamson, Bakeman, Smith, & Walters, 1987; Matthews-Somerville & Cress, 2005; Yoder, et al., 1994). Yoder, Warren, Kim & Gazdag (1994) noted that mothers of children with cognitive

impairments showed increases in linguistic mapping/expansion which coincided with child-directed intervention to increase the children's intentional communication. This seems supportive of the fact that a caregiver's facilitative behaviors can be positively impacted by their child's increasingly clear and conventional communication signals.

However, even in successful child-directed interventions the caregiver's role is still critical. Mahoney (1998) found that if a caregiver's patterns of interactions with his/her child did not change, the child's progress was negligible. This was true for *both* caregiver-directed and child-directed treatments. Yoder (1998) showed that children's communication outcomes in child-directed treatments were dependent on their mothers' baseline level of responsivity. While this research addresses caregiver responsivity, the implications would be relevant to mediation behaviors as described by Klein and others.

Given the importance of the relationship between caregiver and child during the first year of life, one would assume that if intervention focused on one partner, the outcomes would generalize to some extent to the other. However, more evidence is needed to determine this relationship as it might impact service delivery to young children with motor impairments. Better understanding the strength of intervention in regards to its generalization to communication partners would help clinicians better plan more efficacious service. Since children with severe motor impairments very often require the direct services of speech-language pathologists, evidence to suggest whether child-directed intervention can in fact change the way caregivers interact with their children would be valuable. Ideally, intervention to support clear, intentional communication on the part of the child would serve as a catalyst for improving the symbiotic

relationship present in caregiver-child interactions, aiding the child in development and serving to promote facilitative behaviors on the part of the caregiver.

Purpose of the Study

The purpose of the current study was to investigate changes in caregiver facilitative behaviors comprised of both responsivity and mediation behaviors as they may be related to child-directed treatment. In this case-control design, the facilitative behaviors of caregivers were rated using 5-point Likert scales both before (at baseline) and after (follow up) a treatment phase in which some children received direct treatment for triadic eye gaze (TEG) (experimental group) and some children received standard care from their Birth-to-Three centers (control group). The ratings of caregivers' facilitative behaviors at baseline and follow up were compared between caregivers of children in the experimental and caregivers of children in the control group. By comparing changes in facilitative behaviors of caregivers in the treatment and control group, the study will examine whether the child-directed treatment targeting children's prelinguistic communication has an indirect impact on facilitative behaviors of caregivers.

Research Questions

This study addresses the following research questions:

1. Do caregivers of children with severe motor impairments who received child-directed TEG treatment show greater change in facilitative behaviors than caregivers whose children did not receive this treatment?
 - a. Do caregivers demonstrate significant changes over time in the domains of facilitative behaviors (contingent responsivity, emotional support, structuring support, quality of language input) from baseline to short term for each group (treatment and control)?

- b. Is there a significant difference in the changes in the domains of facilitative behaviors observed between treatment and control groups?
2. Are there unique patterns in rating of facilitative behaviors?
- a. Are there unique patterns of ratings across the facilitative behaviors (i.e., are there specific facilitative behaviors that are consistently rated high versus low on the 5-point scale)?
 - b. Are there unique caregiver behavioral profiles that result from the ratings (i.e., are there caregivers who receive ratings at the high versus low end of the 5-point scale on some or all of the seven facilitative behaviors)?

Method

Study Overview

Participants in this study were caregiver-child dyads, initially enrolled in a larger randomized controlled study examining the effects of child-directed treatment for triadic eye gaze (TEG) in children with moderate to severe motor impairments. This research was conducted at the University of Washington (hereafter called the TEG research). Dyads were recruited from seven local Birth-To-Three Centers.

The current retrospective study focused on a small subset of the participants and examined the indirect effect of child-directed treatment on caregiver facilitative behaviors. All video recordings were collected as part of the original TEG research.

Participants

The current study involved 7 caregiver-child dyads from the treatment group and 7 from the control group in the TEG study. Child participant characteristics will be described first, followed by caregiver participant characteristics.

Child participants. To participate in the TEG research, all children had to meet the following inclusionary and exclusionary criteria: (a) 10-24 months of age at the time of enrollment; (b) a moderate to severe motor delay as measured by an average composite motor score of 2 standard deviations below the mean on the *Bayley Scales of Infant Development* (Bayley, 1993) as administered by an assessment SLP; (c) >80% dyadic eye gaze and <20% triadic eye gaze observed during a structured probe of 25 communication opportunities, as administered by an assessment SLP; (d) adequate vision and visual tracking ability as measured by passing five of the first seven items on the *Visual Reception Subtest* from the *Mullen Scales of Early Learning (MSEL)* (Mullen, 1995); (e) adequate hearing as measured by passing four of the first six items on the *Receptive Language Subtest* from the *MSEL* plus behavioral observation consistent with functional hearing or an otoacoustic emissions test; and (f) interest in toys and people (as evidenced by facial expressions, changes in muscle tone, eye gaze, etc.) as measured by informal observation by the assessment SLP. Table 1 provides a summary of child participants, including gender, age, treatment/control group assignment, and diagnoses. In addition, informal indicators of the children's motor abilities are addressed. First, it is noted whether the child can hold his/her head up independently, sit without supports, and reach and point communicatively. Only the skills the child was able to demonstrate are listed. Other pertinent comments about the child's overall motor impairments are also included (e.g., comments on tone, involuntary movements, etc.).

Table 1
Child Characteristics

Child ID #	Gender	Age in Months at Initial Assessment	Treatment or Control	Diagnosis (as reported by caregiver)	Informal motor characteristics
102	M	12	Treatment	Down syndrome	Able to hold up head, sit, and reach independently. Hypotonia
106	M	20	Treatment	Osteogenesis Imperfecta -type IV	Able to hold up head, sit, and reach independently. Good fine motor.
120	F	19	Treatment	Congenital abnormalities w/unknown genetic syndrome	Able to hold up head and reach independently. Oculomotor deviation.
122	F	22	Treatment	Non-accidental head trauma; Cerebral palsy; developmental delay	Able to hold up head independently. Hypotonia.
127	F	15	Treatment	Velo-Cardio Facial Syndrome (VCFS)	Able to hold up head and reach independently. Possible motor overflow, highly uncoordinated fine motor. Oculomotor deviation.
136	F	24	Treatment	Infantile spasms; chromosomal abnormality (XYY aneuploidy); global developmental delay	Severe hypotonia.
153	M	23	Treatment	Cerebral palsy; kernicterus; significant neurological impairment	Severe hypertonia.
107	M	16	Control	“Brain injury at birth, fluid in head”	Able to hold up head independently. Hypotonia. Possible oculomotor deviation.
121	M	10	Control	“slow development”	Able to hold up head independently. Hypotonia
135	M	24	Control	Epilepsy, developmental delay	Able to hold up head independently. Hypotonia.
140	M	17	Control	“Intractable epilepsy”	Able to hold up head independently. Involuntary/choreatic movements.
145	M	23	Control	Speech delay, motor delay, P.E. tubes	Able to hold up head and sit independently. Hypotonia. Oculomotor deviation.

Table 1 continued

Child ID #	Gender	Age in Months at Initial Assessment	Treatment or Control	Diagnosis (as reported by caregiver)	Informal motor characteristics
147	F	23	Control	Apert's Syndrome	Able to hold up head, sit, and reach independently.
148	F	17	Control	Down syndrome	Able to hold up head and reach independently. Hypotonia. Oculomotor deviation.

Although the children were characterized by a wide variety of diagnoses and severity of impairments, the previously described eligibility criteria were used to ensure some degree of homogeneity amongst the participants; this was particularly true for motor (gross and fine motor combined) and communication skills. All children had evidence of significant motor impairment based on their *Bayley* and *MSEL* performances. None of the children were walking independently. All but one child, participant 106, had some degree of fine motor involvement, resulting in moderate to severe challenges in toy manipulation. Gross motor impairments were also evident in children; presenting variously as hypotonicity, hypertonicity, or through involuntary, sometimes choreatic movements that occurred as the children attempted to engage in play with toys. Many children were unable to sit independently, and were supported by some type of positioning device (e.g., foam seat inserts, special chairs). Many children in this study also demonstrated hypersensitivity to input (e.g., sounds, textures, lights), or hyposensitivity to input, characterized by unresponsive behavior.

Further the children performed similarly in communication development. They all scored 1.5 standard deviations below the mean on the *MSEL* in the receptive and expressive language domains, and were deemed “preintentional” communicators based on eye gaze performance

following Bates, et al. (1979). They displayed intentional behaviors (e.g., looking at objects sometimes accompanied by reaching), but did not use these behaviors to explicitly communicate with another individual as a means to an end, as exhibited by TEG.

The requirements for vision and hearing also provided a commonality amongst participants, ensuring all had roughly equivalent opportunity to experience visual and auditory input throughout the study. This was particularly important for the visual modality, as some children demonstrated oculomotor difficulties as related to motor involvement.

Caregiver participants. Since entry criteria for the larger TEG research were based on child characteristics, caregiver characteristics were more variable in regards to age, socio-economic status, education and cultural backgrounds. However, all caregivers had to meet minimum requirements for participation in this study, as follows. All children enrolled had a primary caregiver who was able to participate in the research, including attending sessions in the home. These caregivers needed adequate vision and hearing to discern their child's vocalizations and eye gaze patterns. Caregivers also had to have adequate English skills to interact with the study SLPs and understand and consent to the terms of the study. Caregiver/child dyads were excluded if the caregiver was unable to identify any objects or activities that seemed to be preferred by the child. For this study, caregivers who primarily used a language other than English while interacting with their children in the videos were excluded. However, some caregivers still reported multiple languages used in the home. Caregiver demographics (as reported by the caregivers themselves) are detailed in Table 2.

Table 2
Caregivers' Demographic Information

Participant ID#	Primary caregiver	Treatment or Control	Language in Home per Caregiver Report	Total Household Income	Highest Caregiver Education Level
102	Parent/Mother	Treatment	English, Spanish & Norwegian	Over \$100,000	High School/GED
106	Parent/Mother	Treatment	English	Over \$100,000	4 Year College
120	Parent/Mother	Treatment	English	No data reported	4 Year College
122	Foster Parent/Mother	Treatment	English & Spanish with Biological Parents 1x week	Between \$50,000-59,999	High School/GED
127	Parent/Father	Treatment	English	Between \$50,000-\$59,999	2 Year Associates Degree
136	Parent/Mother	Treatment	English	No data reported	Graduate School
153	Parent/Mother	Treatment	Spanish/English	Between \$70,000-\$79,999	2 Year Associates Degree
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107	Parent/Mother	Control	English	Less than \$9,999	High School/GED
121	Parent/Mother	Control	Spanish	Less than \$9,999	Some High School
135	Parent/Mother	Control	English	No data reported	2 year associate
140	Adoptive Parent/Mother	Control	English	No data reported	4 year college
145	Parent/mother	Control	English	Over \$100,000	4 year college (2 bachelor's degrees)
147	Parent/mother	Control	English	Between \$10,000-\$19,999	High school/GED
148	Parent/mother	Control	English	Between \$60,000-\$69,999	2 year associate

TEG Research General Procedures

All children in the original TEG study were initially evaluated for participation in the TEG research by an assessment SLP. After meeting inclusion criteria, participants were enrolled and randomly assigned to either the treatment or control group. For the duration of the study, all participants (treatment and control) were seen every three weeks by a measurement SLP. During this session, the SLP interacted in a structured way with the children for the purpose of measuring the children's progress in learning TEG. These sessions will be referred to as SLP-child measurement sessions.

All children were also seen, again in their homes, by the measurement SLP every four weeks. During these sessions, the caregivers were observed interacting with their children during a free play activity. These interactions will be referred to as caregiver-child measurement sessions.

Children in the treatment group were seen an additional two times a week by a treatment SLP. In these child-directed sessions, the treatment SLP worked directly with the child, giving treatment designed to teach TEG. In an effort to preserve blinding, the assessment, measurement and treatment SLPs were different individuals in each case. Both the children in the control and treatment groups continued standard care treatment at their Birth-to-Three Centers, but this treatment did not target TEG as a communication signal. See Figure 1 for a summary of experimental visits.

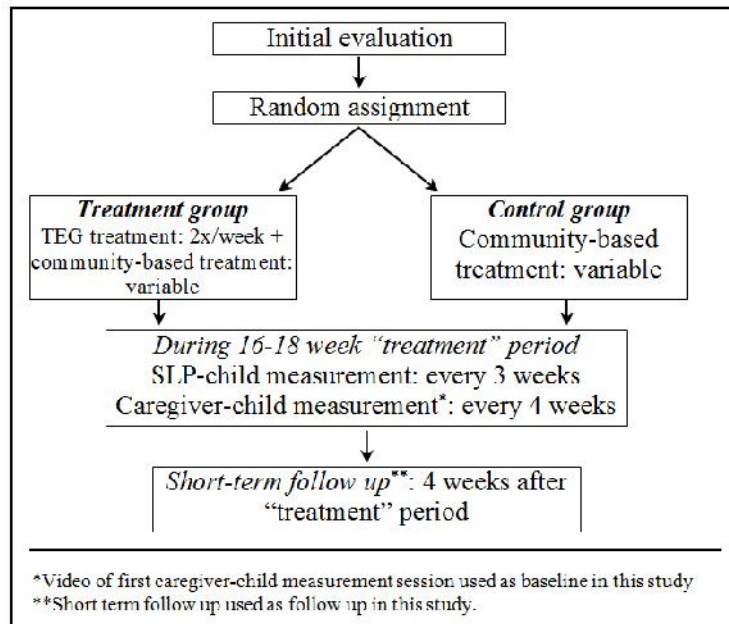


Figure 1: Synopsis of experimental visits.

Caregivers of the children assigned to the treatment group received specific information about the aims and goals of the research. They were given a written manual outlining the early signals of communication, challenges for children with motor impairments, the importance of TEG, and suggestions for implementing communication opportunities at home. While the communication opportunities outlined in the manual were identical to those used in treatment (i.e., request and choice see below for details), the caregiver manual did not offer specific guidelines regarding shaping of more sophisticated behaviors. Caregivers of the children in the treatment group were invited to observe assessment, treatment and SLP-child measurement sessions.

Caregivers of the children in the control group were also given a written manual; their manual contained only information about early signals of communication and challenges for children with motor impairments. No information about providing communication opportunities

was included. Control caregivers were invited to watch the sessions conducted by the assessment and measurement SLPs. TEG treatment and measurement procedures will be described in detail below.

Treatment. As mentioned, 7 children participated in treatment for TEG. This treatment consisted of two, 30 minute sessions per week over the course of 16-18 weeks. Sessions were performed in the child's home and were characterized by child-directed treatment (i.e., the SLP directly taught each child to produce TEG). The basic teaching sequence followed by the treatment SLP to induce TEG behavior was responsive in nature, meaning the teaching component occurred in response to a child's communication attempts. The treatment sequence followed the antecedent, behaviors, consequence paradigm. First, the SLP provided a communication opportunity as an antecedent. These opportunities took the form of a *request* (e.g., demonstrating a toy, then stopping, holding it up and saying, "Do you want more?"), or a *choice* (e.g., holding up two toy and saying, "Do you want bubbles or ball?" or "Which one do you want?"). The second step in the treatment sequence was waiting. After providing the communication opportunity, the SLP waited for the child to respond with a communicative behavior (e.g., looking at a toy). The SLP recognized and responded to the child's behavior by naming it (e.g., saying "Oh, I see you looking at the toy!"). Next, using visual, verbal, auditory and/or tactile cues, the SLP shaped the child's response into a more sophisticated signal (i.e., TEG or approximation of TEG). For example, the SLP would bring a toy close to her own face in order to draw the child's gaze to her eyes, or instruct the child to "Look at me if you want more!" Finally, the SLP provided the consequence by following through on child's communication behavior by rewarding the child with the desired object and playing. See Table 3

for the full treatment sequence. Caregivers were encouraged to observe the treatment, but not required. Caregivers were never directly taught the treatment procedures.

Table 3

TEG Treatment Sequence

-
1. The SLP **provides a communication opportunity** during a toy or snack interaction. The opportunity consists of both a *verbal* and *visual* antecedent. These opportunities can take the form of:
 - A. A **request** (e.g., Show child bubbles and say “Do you want more bubbles?”)
 - B. A **choice** (e.g., Show child two toys simultaneously and say “Do you want car or ball?”)
 2. The SLP **waits** approximately 15 seconds for the child to respond in some manner
 3. The SLP **recognizes and responds to the child’s signal** (e.g., “Oh, you’re looking at the ball” or “You made a sound and reached for the ball!”)
 4. The SLP **shapes the child’s attempt into a triadic eye gaze** by providing visual, verbal and tactile cues that guide the child towards a coordinated gaze that includes the desired object and the adult.
 5. The SLP rewards the child’s attempts to produce TEG by following through on the intention of the communication by **playing** with the desired toy
-

Both children in the treatment and control group were allowed to continue receiving early intervention through their Birth-to-Three Centers. This treatment focused on objectives that were established prior to entry into the study and could involve a range of professionals (e.g., physical therapists, occupational therapists) and service delivery schedules. However, community-based treatment did not target eye gaze as a communicative signal.

SLP-child measurement sessions. Children in both groups were seen by the measurement SLP every three weeks in their home to monitor progress for learning TEG. The measurement SLP provided approximately 25 communicative opportunities, including 10 request, 10 choice, and five joint attention. Request and choice opportunities are described above. Joint attention refers to opportunities in which the SLP attracted the child’s attention (e.g., suddenly activating a toy’s sound out of sight of the child or pointing to a picture in a book) to provide an opportunity for the child to comment on a common interest. Joint attention opportunities were unique to the measurement sessions. The measurement SLP also used different toys than those

used in treatment sessions. The sequence of antecedent, behavior and consequence employed during the measurement sessions was identical to the treatment protocol, with the exception that shaping was not included. Both treatment and control caregivers were able to watch these SLP-child measurement sessions.

Caregiver-child measurement sessions. Every four weeks throughout the study, children in both the treatment and control groups were seen by the measurement SLP for caregiver-child measurement sessions. The purpose of caregiver-child sessions was to measure child eye gaze behaviors. Caregivers were video recorded interacting with their children in two contexts: 10 minutes with toys and 10 minutes without toys. The measurement SLP did not interact with the caregiver or child at all during the filming, except to provide a reminder at the 10 minute mark to introduce toys into the interaction. The caregiver was instructed to face his/her child and play as they normally would. The caregiver was given the option of using either toys from home or toys provided by the measurement SLP. The measurement SLP used the following script to introduce the interaction:

We are interested in watching you and your child play together for about 20 minutes. We have brought a bag of toys for you to use. Feel free to use any of your own toys during play as well. In fact, if you would like, use some of your child's favorite toys or games; we want (child's name) and you to feel comfortable. (If you want to include snack for part of the time, perhaps 10 minutes, please do so.) We'll be videotaping, so we would like to have (child's name) in the highchair. But otherwise, just play naturally with (child's name).

The video recordings of the caregiver-child measurement sessions were made at baseline (prior to the beginning of the treatment or control phase), every four weeks during the 16-18 week treatment or control phase, and at a short term follow up, which was four weeks after the treatment or control phase ended. Recordings of caregiver-child measurement sessions made at baseline and short term follow up for both groups will provide data for this study.

Caregiver Study

In the current research, caregiver facilitative behaviors during the caregiver-child measurement session were examined. Caregiver facilitative behaviors were rated during 5 minutes of caregiver-child measurement sessions (with toys) from recordings made at both baseline and short-term follow up sessions. The procedures used to obtain videorecorded samples and the details of the caregiver behavior rating scale and its implementation follow.

Videorecording procedures. All videorecordings used in the current study were collected during the original TEG research and converted to DVD format. The measurement SLP used a digital camera to record 20 minutes of caregiver-child interactions during the caregiver-child measurement sessions. For the first 10 minutes, the caregiver and child interacted without toys and for the second 10 minutes toys were introduced. The camera was positioned so that the child's face could be seen in order to record eye gaze behaviors along with accompanying gestures. A mirror was placed at an angle behind the child so that the caregiver's face could be clearly viewed in the video, as well the child's behaviors. Based on research by Landry (2006), 5 minutes of the toy-based interaction were used in the caregiver study. The total corpus included 28 videos: one baseline and one follow up video for each of the 14 total dyads (7 in the treatment group, 7 in the control group).

Video preparation procedures. After recording, the videos were selected and prepared for the caregiver study. These procedures involved matching and blinding clips.

Matching clips. The majority of the toys used in the videos were from a limited set provided by the measurement SLP; these toys were not used in treatment. Caregivers were also able to use their own toys. Because of this, the types of toys in both videos (baseline and follow up) were matched as closely as possible in order to reduce the possibility of certain toys influencing the caregivers' behaviors. For example, a toy with buttons and switches may provide more opportunities to regulate the child's behavior than a toy with no comparable features, such as a pink feather boa. Considerations included: (a) the *number* of toy introductions; (b) The *types* of toy used; and (c) the *complexity* of the toys. First, the clips chosen featured an *equal number* of toys introduced in each of the baseline and follow up videos, plus or minus one toy. As often as possible, toys of the same *type* were included in both of the clips. For example, if a caregiver and child interacted with a book, blocks, and a ball in one clip, the same types of toys, though not necessarily the identical toys would be included in the second clip. When matching toy types was not possible, the toys' complexity was taken into account. Toys were divided into dynamic and static categories. Dynamic toys included those with cause and effect components, such as a jack-in-the-box, or toys with multiple features to explore, such as a busy box with various buttons and colors. Static toys were those that primarily had one defining feature or function, such as balls, rattles or rainsticks. The ratio of dynamic to static toys was held as close as possible for each dyad in the baseline and follow up videos.

Blinding. Before rating began, a PhD student not associated with the current study assigned random numbers to all 28 videos. She flagged 14 videos (50% of the corpus) to be rated

for reliability, ensuring that one video of each of the 14 caregiver-child dyads was included in the videos rated for reliability purposes. Both the primary and the reliability observer were blind to both the time (baseline or follow up) and the group (control or treatment) conditions.

Caregiver facilitative behaviors scale. In this study, caregiver facilitative behaviors were examined using a 5-point Likert scale. The behaviors rated and the measurement techniques were based on research conducted by Landry and colleagues (Landry, et al., 2002; Landry, et al., 2006; Landry, et al., 2001) and Klein and colleagues (Klein, 1997, 2006; Klein, et al., 2010; Klein & Feldman, 2007; Klein & Hundeide, 1996b) with supplements from Mahoney (1999). Their research was synthesized and used as touchstones to best capture caregiver facilitative behaviors that would be relevant for children with motor impairments. First, the general aim of the scale will be explained as influenced by different researchers, followed by a presentation of the scale itself.

Landry and colleagues as well as Mahoney and colleagues served as a basis for using a rating scale to examine caregiver facilitative behaviors for this study. While Landry used a mix of rating scales and frequency counts in her measurement tool study, Landry et al. (2006) noted that rating scales “reflect a disposition that permeates all of a [caregiver’s] interactive behaviors” (p. 630). She originally used 5-point Likert scales to measure five out of her 10 behaviors: Contingent Responsiveness, Positive Affect, Warm Sensitivity, Physical Intrusiveness and Harsh Voice Tone. Mahoney’s *Maternal Behavior Rating Scale* used exclusively 5-point Likert scales to capture caregiver behaviors. In this study, we were trying to create a measure of the caregivers’ overall facilitative “dispositions” to do an exploratory investigation of their interaction with their children. Therefore, rating scales seemed appropriate to the aim of the study. In addition, rating

scales are less time-intensive than frequency counts and therefore may have more clinical application.

Landry and colleagues' (2006) research provided the basis for grouping behaviors into four domain level categories, as follows: (a) Contingent Responsiveness; (b) Emotional Support; (c) Responses to Infant Foci of Attention; (d) Quality of Language Input. Three of the four domains (Emotional Support, Responses to Infant Foci of Attention, Quality of Language Input), were comprised of two behaviors each. The fifth domain, Contingent Responsiveness, existed as a single behavior. This domain, and associated behavior, was viewed as a "gestalt" of facilitative behaviors, capturing the extent to which the caregivers generally recognized and responded to their children's signals, an important component of a truly reciprocal interaction.

While the domain organization was drawn from Landry, the definitions of the specific behaviors are primarily drawn from Klein's mediation behaviors (Klein, 2006). Klein allowed us to examine caregiver facilitative behaviors that emphasized mediation/guidance. Caregivers facilitating through guidance is especially important for children with motor impairments since these children have significant limitations in their ability to independently interact with the environment and to produce clear, predictable signals for communication. As a result, caregivers must be clear, direct and supportive in their behaviors to optimize development. *Mediation* captures the active supports caregivers provide their children in order to facilitate learning. While Landry described many similar caregiver behaviors as Klein, Klein's definitions better captured the teaching power of the behavior. For instance, Focusing captures the caregiver's intentional efforts to gain and maintain the attention of the child (called Focusing), an important element to structure the optimal learning environment and establish a common ground for negotiation of the

ZPD. Focusing does not have a comparable behavior in Landry's research but is a particularly important behavior for caregivers of children with motor impairments, as arousal for children with disabilities may be less than their typical peers (Siegel & Cress, 2002). The following behaviors from Klein were incorporated in the caregiver facilitative behavior scale: (a) Exciting/affecting; (b) Focusing; (c) Regulation of Behavior; (d) Expanding; and (e) Encouraging. They are defined below.

The components of mediation may also better measure caregiver behaviors that are likely to change due to observing a clinician provide direct treatment to a child. The clinician actively uses mediation behaviors such as Focusing, Expanding and Encouraging to teach the child new behaviors and structure the incremental progress towards an ultimate behavioral goal (i.e., using TEG to communicate). Furthermore, many aspects of Klein's mediation taxonomy are compatible with Landry et al.'s definitions of caregiver responsivity behaviors.

Considering the unique qualities of the population, Landry's domains and Klein's behavioral definitions have also been altered to better suit a population with moderate to severe motor impairments. Mahoney's (1999) *Maternal Behavior Rating Scale Revised* and observations made during rating of training videos were used to fine tune definitions of specific behaviors.

Definitions of domains and behaviors. As described above, the caregiver facilitative behaviors scale is divided into four domains based on Landry's research (Landry, et al., 2006) with some modifications in terminology to better match the study population. Note that these domains are not mutually exclusive, but rather interactive. They serve, however, to provide a framework to group related behaviors. The domains are as follows:

1. **Contingent Responsivity:** This domain captures whether the caregiver promptly provides appropriate responses to child's apparent cues, interests, behaviors, or focus of attention to objects or people in the environment.
2. **Emotional Support:** This domain captures the emotions the caregiver displays toward the child, which may include verbalizations to the child, tone of voice, facial expressions, body language, and/or posture toward the child.
3. **Structuring Success:** This domain captures the manner in which a caregiver directly mediates both the environment and the child's behaviors to support the child's successful interaction with the toy or completion of a specific task.
4. **Quality of Language Input:** This domain captures the amount and quality of verbalizations directed toward the child during the interaction. Non-verbal behaviors are not considered when rating the behaviors in this domain.

Specific behaviors for each domain are described below. Contingent Responsivity and Restrictiveness/Physical Intrusiveness come primarily from Landry, with other behaviors following Klein's research. Expanded definitions and examples of each behavior are included in Table 4 below. In brief, the seven behaviors are defined as follows:

1. Contingent Responsivity

- 1a. Contingent Responsivity:** The degree to which a caregiver recognizes and responds to a child's signal promptly and appropriately.

2. Emotional Support

2a. Exciting/Affecting: The degree to which the caregiver uses excitement, enthusiasm, affect, and tone of voice to enrich the interaction (e.g., highlight certain elements/emotions) for the child.

2b. Restrictiveness AND Physical Intrusiveness: The degree to which the caregiver exhibits behavior that is controlling or dominating, reflecting the caregiver's own agenda in play without regard to the child's signals. The caregiver may manipulate toys or the child to meet his/her own ends, ignoring how the child wants to interact with the toy.

3. Structuring Success

3a. Focusing: The degree to which the caregiver manipulates the toy or the environment to gain or maintain the child's focus, engagement and learning with a toy or part of a toy.

3b. Regulation of Behavior: The degree to which the caregiver attempts to help the child modulate his/her behavior so as to be successful with a toy, guiding perception (e.g., exploration), planning, or accelerating or inhibiting impulses (especially motor impulses in this population).

4. Quality of Language Input

4a. Expanding: The degree to which the caregiver helps the child make connections through verbalizations with input that fits the child's pace and follows the child's attention, mapping meaning onto the child's behaviors and focus of attention.

4b. Encouraging: The caregiver's verbalizations that express satisfaction with the child's behaviors. This includes general statements of encouragement/excitement about the child's achievements but optimally should include statements about specific

components of the child's response that led to success (e.g., "good reaching," "yay, you closed it," "good job looking").

Table 4

Domain and Behavior Definitions with Reference to Landry and Klein

Domain	Behaviors rated within each domain
1. Contingent Responsivity	1a. Contingent responsivity*: The degree to which the caregiver promptly provides appropriate responses or reactions to the child's behaviors at a pace that fits the child's abilities. <i>For example, a child may push away a toy and the caregiver may say, "Oh, you're done with that" or simply take the toy away. Other caregiver behaviors may include imitating a child's play (e.g., banging, facial expression or vocalization), or establishing turn taking by following a child's actions with complementary ones (e.g., closing a pop-up door after the child opened it).</i>
2. Emotional Support	2a. Exciting/affecting*: The degree to which the caregiver displays smiling, laughing, and facial animation, manifesting delight, pleasure, and enjoyment of the child. Examples include gasping, exaggerated volume or pitch, clapping, smiling, and laughing. 2b. Restrictiveness* AND Physical Intrusiveness: The degree to which the caregiver physically or verbally restricts, interrupts, <i>dominates or controls</i> the child's activities. This includes comments such as "get that toy out of your mouth" or <i>dominating toy play without regard to the child's signals (e.g., withholding toy from reach). The caregiver may physically manipulate either the child (e.g., pulling child's hands) or the toys the child is engaged with (e.g., pushing toys out of the child's hands). This is distinct from facilitative positioning, (e.g., when the caregiver moves the child's arms to midline to facilitate interacting with toys.)</i>
3. Structuring Support	3a. Focusing: <u>The degree to which the caregiver acts in a manner that encourages the child to attend to or engage with an object or event. The caregiver may use verbal or nonverbal behaviors. Examples include bringing objects closer to the child; repeating; sequencing/grouping; exaggerating or accentuating sights, sounds, etc.; highlighting different functions or characteristics of toys; playing with one toy in a variety of ways to maintain the child's attention; moving or shaking objects to gain attention; repetition of directions; and covering up distracting stimuli to assure that the child focuses on the relevant object or person.</u> 3b. Regulation of Behavior: <u>The degree to which the caregiver assists the child in regulating his/her behavior in relation to the specific requirements of a task. The caregiver uses modeling, demonstrating, or verbal instructions/suggestions to help the child modulate his/her behavior when performing an action, rather than merely requesting the execution of an action. The caregiver may help guide the child's perception through systematic exploration of a toy (e.g., using hand over hand guidance to push a button on a toy or saying "turn this key to open it") or mediate the child's engagement with a task or object by suggesting the need to think or plan before doing, for example, "Be careful now, slowly, gently", or "Reach higher." The caregiver may mediate the child's responses in light of the task/context, helping the child to regulate his/her behavior either to accelerate or inhibit impulses, e.g., "slow down" or "try harder."</u>
4. Quality of Language Input (continued on next page)	4a. Expanding: <u>The degree to which the caregiver verbally builds on the child's performance. The caregiver labels or describes objects, actions, persons, activities, or functions, mapping meaning onto the child's behaviors or building on the child's behaviors by transcending the immediate context. This can include, but is not limited to, asking questions, making statements, describing the toy or activity, talking about feelings and emotions, teaching cause and effect, specifying the function or activity that can be done with</u>

Table 4 continued

the object, or relating the object or activity to a previous experience. For a younger population, examples might be the caregiver saying "It's a yellow star"; "Monkey, zebra, lion! We saw these at the zoo" as child is pointing to animals in a book; "You're rolling the ball to me- my turn" "oh, you like the butterfly!"

4b. Encouraging: The degree to which the caregiver verbally expresses satisfaction with the child's behaviors. The caregiver encourages or praises the child's efforts (e.g., "way to go!") or serves to encourage *or praise* the child's actions or communication (e.g., "yeah, that's it!" or "*good reaching!*"). The verbal encouragement may identify a specific component or components of the child's behavior which contribute to the experience of success. For example, the mother might say, "very good, you opened it", or "good boy, you put every toy back into its box."

Italics indicate changes to Landry's (2006) definitions. Asterisk (*) indicates the behavior was coded as a frequency count in Landry (2006)'s study. Underline indicates definitions pulled from Klein et al.'s (2006) research.

Each of the seven behaviors was rated using a 5-point Likert scale with verbal qualifiers (Spector, 1992). In an effort to make the distance between points on the scale meaningful, the scales for all behavior include general numerical guides that serve to define the verbal qualifiers more clearly:

5 = behavior is displayed almost constantly (>75% of the time)

4 = behavior is frequently displayed (50-75% of the time)

3 = behavior is sometimes displayed (about 50% of the time)

2 = behavior is infrequently displayed (25-50% of the time)

1 = behavior is rarely displayed (<25% of the time)

These numerical guides provide a fixed reference point for the raters. In addition, anchor videos (described in reliability training procedure below) provided external reference points for each end of the spectrum for each the behaviors being rated.

Rating collection procedures. Based on Landry's procedures, ratings were made on 5 minute clips of the video recordings for each of the baseline and short term follow up sessions for each dyad in the treatment and control groups. Each of the seven caregiver facilitative

behaviors across the four domains was rated. The order of rating domains was randomized and assigned for each video, so that across videos, domains were not always rated in the same order.

Ratings were made by a master's level student, the author of this paper. In order to make a rating decision, the observer watched two and a half minutes of the video and paused to make an initial judgment (1-5) of the specific behavior. The observer then continued watching the final two and a half minutes of the video, modifying her score if needed based on the overall interaction. This process was repeated for each of the seven behaviors. Liberal use of comments and timestamps was encouraged to provide rationale and promote discussion in the case of rating discrepancies.

Reliability

Training procedure. The author of this paper, a second year master's student in the Department of Speech and Hearing Sciences, served as the primary observer. The reliability observer was a first year master's student in the department. Training of observers began with the two observers reading foundational literature and discussing the definitions of each of the seven caregiver facilitative behaviors as outlined in literature and operationally defined in the training manual. The observers then viewed four anchor videos that represented a spectrum of caregiver profiles. The anchor videos consisted of 5 minutes of an interaction between four different caregiver-child dyads screened for but not enrolled in the study. All seven behaviors were rated for each video. Numerical ratings (1-5) were provided for each of the caregiver behaviors depicted in the specific anchor videos as determined by the primary observer and the faculty supervisor. To facilitate training, these numerical ratings also included rationale for their assignment as well as examples of standout instances of the specific facilitative behavior

After viewing and discussing all anchor videos, observers worked with practice videos, 5 minute segments of caregiver-child interactions with toys featuring dyads screened but not enrolled in the study. Two initial practice videos were rated simultaneously, with real-time discussion about the behaviors observed and ratings assigned by consensus. Then, three were rated simultaneously but independently, with discussion occurring immediately after each observer assigned a rating. Finally, nine practice videos were rated independently until 6 out of 7 of the behaviors were within one point on the five point scale. Disagreements of 1 or more point on the scale were discussed by both observers to arrive at a rating by consensus during training. A total of 30 hours was spent training (i.e., reviewing anchors, rating videos and discussing discrepancies) prior to actual rating.

Reliability rating procedure. As mentioned above, the reliability observer rated 50% of the entire corpus while the primary observer concurrently rated the entire corpus. In order to prevent drift, the primary and reliability observers met weekly throughout the rating period to discuss video ratings. They arrived at a consensus for each behavior that was not rated in exact agreement. However, the primary observer's original ratings were used for the final data. At the midpoint of rating, the observers reviewed and discussed the anchor videos used in training to recalibrate rating overall.

Reliability results. Interrater reliability was monitored in two ways: (a) exact agreement meaning both raters selected the same numerical rating score for a behavior; and (b) within one agreement meaning raters were within plus or minus one point in selecting the rating score for a behavior. The precedent in the literature is to report within one point agreement for five point scales (Mahoney, et al., 1986).

Exact agreement for all of the videos was 60%. Agreement within one point on the scale was 99% overall. Exact agreement for each domain ranged from 42% for the Structuring Success domain to 79% for Encouraging domain. Within one agreement was 93% for the Structuring Success domain and 100% for Contingent Responsivity, Emotional Support and Quality of Language Input.

Data Reduction and Analyses

Overview of reduction and analysis. Data reduction utilized ratings (1-5) made by the primary observer for each of the seven facilitative behaviors at baseline and follow up sessions for each caregiver. Recall a behavior rated as 5 was viewed as occurring almost constantly by a caregiver versus a behavior rated as 1 was viewed as occurring rarely. For all behaviors, with the exception of Restrictiveness/Physical Intrusiveness, this rating would match the literature suggesting behaviors rated at the upper end of the range would be positively interpreted. Since Restrictiveness/Physical Intrusiveness at high frequencies has been shown to negatively impact child outcomes (Landry, et al., 2006), the scores for Restrictiveness/Physical Intrusiveness were inverted (i.e., a score of 5 became 1, 4 became 2, 3 remained 3, 2 became 4, 1 became 5), to match the polarity of the other behavior ratings.

Data were reduced to enable two forms of analyses: (a) statistical analyses of the data; and (b) descriptive exploratory analyses. Recall also that there were two main independent variables in the study, henceforth called: (a) the *group* variable, referring to treatment versus control group assignment; and (b) the *time* variable, referring to performance at baseline (BL) versus follow up (FU) sessions.

The data for the purpose of statistical analyses were reduced and analyzed in two ways. The first was from an overall perspective, using the sum of rating values across all seven behaviors to examine overall change in production of facilitative behaviors within and between groups. These data will be referred to as *overall scores*. The second way in which the data were reduced and analyzed was at the domain level, called *domain level scores*. These scores utilized ratings of behaviors grouped in each of the four domains. These scores allowed for the examination of domain performance within and between groups.

The data for the purpose of descriptive exploratory analyses were reduced and analyzed in two ways as well. First, the data were examined to look at the *patterns* in the behaviors rated, across group and time variables. Second, the data were examined to look at *profiles* of individual caregiver domain ratings and comparing them to group domain mean performance. Each of these reduction and analyses will be detailed below. A synopsis of data collection, reduction and analysis is provided in Table 5.

Table 5
Synopsis of Data Collection, Reduction and Analysis

Data Collection: Rating values (1-5)	Data Reduction: Scores		Statistical Analyses	Exploratory Analyses
Behavior level^b: 1a. Contingent Responsivity 2a. Exciting/Affecting 2b. Restrictiveness/Physical Intrusiveness 3a. Focusing 3b. Regulation of Behavior 4a. Expanding 4b. Encouraging	Overall^a scores	Overall^a difference scores	1. Between group BL comparison of mean overall rating score, unpaired <i>t</i> test 2. Within group BL to FU mean overall rating score comparison, paired <i>t</i> tests 3. Between group comparison of mean individual difference scores, unpaired <i>t</i> tests	Behavior patterns: 1. <i>Behavior level^b corpus means:</i> examination of each behavior's corpus mean (across groups and time) Caregiver profiles: n/a
	1. <i>Overall^a rating scores:</i> Sum of rating values across behaviors 2. <i>Mean overall rating scores:</i> means of rating values across behaviors	1. <i>Overall^a difference scores:</i> FU minus BL values for individual caregivers summed across behaviors		
Domain level^c 1. Contingent Responsivity (Contingent Responsivity) 2. Emotional support (Exciting/Affecting + Restrictiveness/Physical Intrusiveness) 3. Structuring Support (Focusing + Regulation of Behavior) 4. Quality of Language Input (Expanding + Encouraging)	Domain level^c scores	Domain level^c differences	1. Within group BL to FU mean domain level rating score comparison, paired <i>t</i> tests 2. Between group comparison of mean group difference scores, unpaired <i>t</i> tests	Behavior Patterns: 1. <i>Domain level^c corpus means:</i> Examination of each domain's corpus mean (across group and time) Caregiver Patterns: 1. <i>Individual caregiver mean:</i> average of BL-FU values compared to corpus mean
	1. <i>Domain level rating scores:</i> sum of rating values for each domain 2. <i>Mean domain level rating scores:</i> means of rating values for each domain	1. <i>Domain level difference scores:</i> mean domain level rating score at FU minus mean domain level rating score at BL		

BL baseline; FU follow up; Treatment Treatment group; Control Control group

^a**Overall level:** Across all behaviors, calculated by group and time (Treatment-BL, Treatment-FU, Control-BL, Control-FU)

^b**Behavior level:** Each behavior across groups and time

^c**Domain level:** For each of the 4 domains, calculated by group and time (Treatment-BL, Treatment-FU, Control-BL, Control-FU)

Statistical analyses: Overall rating scores. In order to reduce data for overall scores, the following calculations were conducted. Recall, the overall score is comprised of rating values across all seven behaviors for each caregiver. Data were further reduced by summing rating values across all behaviors for each group at each measurement time, to create a group-by-time *overall rating score* (i.e., treatment group at baseline, treatment group at follow up, control group at baseline, control group at follow up). Then, the group-by-time mean for each of these groups and times were calculated, resulting in a *mean overall rating score* for (a) treatment group at baseline (treatment-BL); (b) treatment group at follow up (treatment-FU); (c) control group at baseline (control-BL) and (d) control group at follow up (control-FU).

An unpaired *t* test comparing the mean overall rating scores of treatment-BL and control-BL was used to determine the significance of difference between groups in overall production of facilitative behaviors at baseline. Then, paired *t* tests of mean overall scores comparing (a) treatment-BL versus treatment-FU; and (b) control-BL versus control-FU were conducted to determine if change over time within each group was significant.

Individual difference scores between baseline and follow up performance were also calculated for each behavior for each caregiver. The difference score per behavior for each caregiver was calculated by subtracting the baseline rating value from the follow up rating value. Then, *overall difference scores* were calculated per group by summing the individual difference scores for each group. Finally, *mean overall difference scores* for each group were calculated. Unpaired *t* tests were used to compare the mean overall difference scores between groups to determine the significance of change in production of facilitative behaviors from baseline to follow up.

Statistical analyses: Domain level rating scores. Domain level data reduction essentially mirrored those described above. However, instead of summing across all behaviors, behavior level data were grouped by domain. As discussed above, the four domains each contained two behaviors, with the exception of contingent responsivity, which contained only one behavior. Domain level scores were calculated as follows. First, a total sum was calculated for each domain for each caregiver by summing the rating values for each behavior included in the domain. Then, group-by-time *domain level rating scores* (e.g., treatment- baseline) were calculated by summing the rating values within each domain for each group at each time. Then, the group-by-time mean for each of these groups and times were calculated, creating a *mean domain level rating score* for each of the four domains at (a) treatment-BL; (b) treatment-FU; (c) control-BL and (d) control-FU. Paired *t* tests of mean overall scores comparing (a) treatment-BL versus treatment-FU; and (b) control-BL versus control-FU were conducted to determine if change over time within each group was significant at the domain level.

Difference scores were also computed on a domain level for comparing groups. The *mean domain level difference scores* per group were calculated by subtracting the mean domain level rating score at baseline from the mean domain level rating score at follow up per group (i.e., treatment-FU minus treatment-BL; control-FU minus control-BL). Unpaired *t* tests were used to compare the domain level difference scores between groups to determine the significance of change in production of facilitative behaviors in each of the four domains from baseline to follow up.

Exploratory analyses: Behavior patterns. In order to examine patterns across all behaviors, a mean for each of the seven behaviors (*behavior level corpus means*) were calculated

across the entire corpus, including all groups and all time points. The mean for each domain (*domain level corpus means*) was also calculated using the entire corpus. This allowed for determining whether some behaviors were on average rated high on the 5-point rating scale (mean above 3), or low on the 5-point rating scale (mean below 3).

Exploratory analyses: Caregiver profiles. In order to examine caregiver performance profiles, *individual caregiver means*, consisting of averages between the ratings of baseline and follow up, were calculated for each behavior for each caregiver. These behavior means were combined for domain level analyses to create *individual caregiver domain means*. Then, caregivers with facilitative behaviors rated above the mean in all four domains (“high rated”) and those with facilitative behaviors rated below the mean (“low rated”) in all four domains were identified. These caregivers were examined in terms of their education and their children’s motor abilities.

Results

Statistical Analyses: Overall and Domain Level Rating Scores

The primary research question in this study was as follows: *1. Do caregivers of children with severe motor impairments who received child-directed TEG treatment show greater change in facilitative behaviors than caregivers whose children did not receive this treatment?* This question was answered using the mean overall rating scores which were calculated by summing ratings of each individual caregiver and then averaging them to arrive at a mean overall score *per group*. Figure 2 illustrates the mean overall rating scores for each group at each time period.

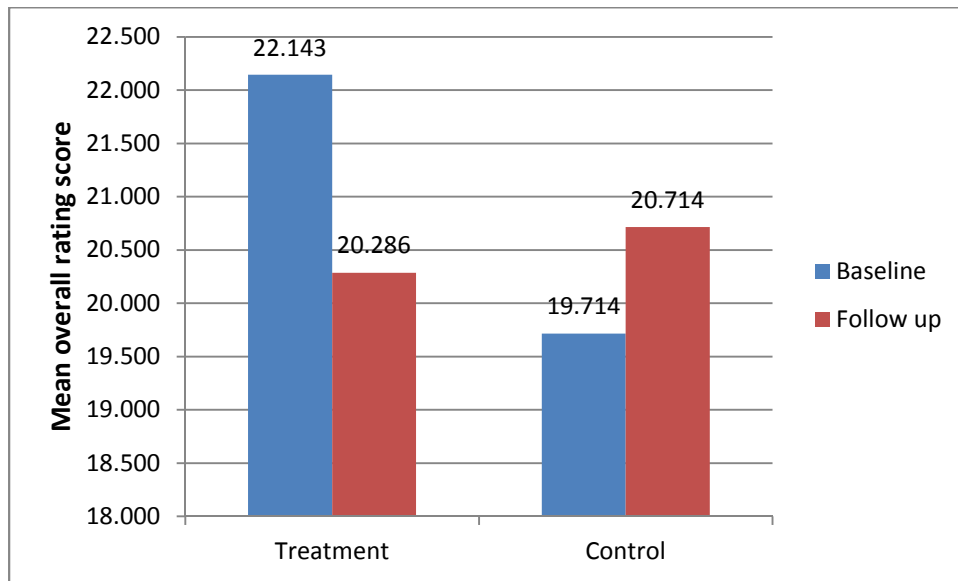


Figure 2. Mean overall rating scores per group per time.

To answer our main question, we first asked whether the *groups' baseline scores were statistically different*. According to the unpaired *t* test, there was not a statistically significant difference between treatment ($M = 22.143$, $SD = 3.132$) and control ($M = 19.714$, $SD = 4.231$) in the production of facilitative behaviors at baseline, $t(12) = 1.221$, $p > .05$. We then asked: *Do either of the groups show statistically significant change between baseline and short term follow up?* Paired *t* tests revealed that there was a statistically significant difference between baseline and follow up scores for the treatment group (mean difference = -1.857): $t(6) = -2.635$, $p < .05$. Interestingly, this reflected a decline in overall facilitative behavior scores in the treatment group. No statistically significant difference occurred between baseline and follow up scores for the control group (mean difference = 1.000), $t(6) = -0.764$, $p > .05$.

To compare the change from baseline to follow up between the two groups, we examined difference scores calculated for each caregiver then summed and averaged to find the mean overall difference scores for group. Figure 3 presents the mean overall difference scores

for each group. Although the difference scores reveal an obvious disparity between groups, the unpaired t test revealed these scores were not statistically different (treatment $M = -1.857$, $SD = 1.864$ and control $M = 1.000$, $SD = 3.464$), $t(12) = -1.9215$, $p > .05$. As Figure 2 reveals and as mentioned above, the treatment group actually showed a negative change from baseline to follow up.

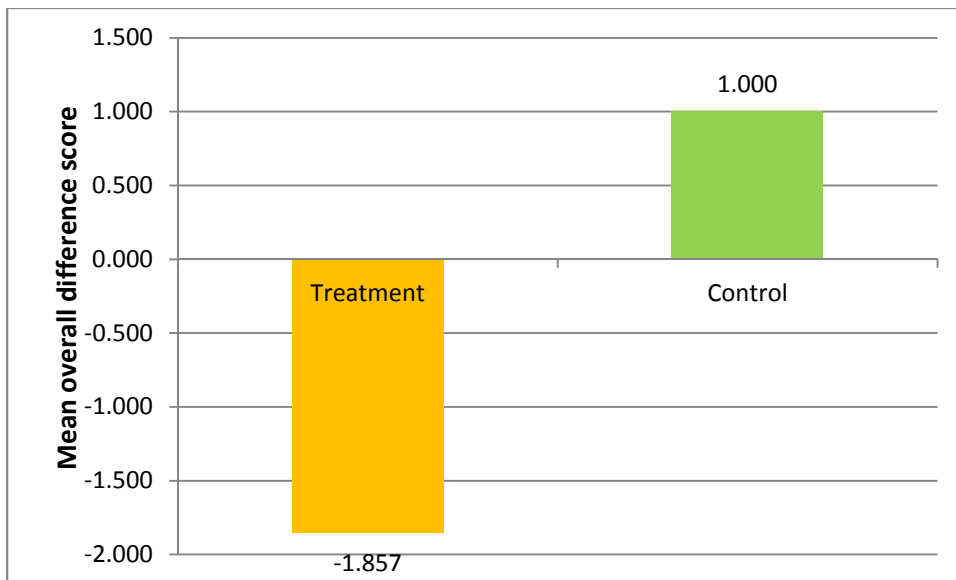


Figure 3. Mean overall difference scores per group.

The next set of data addressed domain performance and the following question: *Do caregivers demonstrate significant changes over time in the domains of facilitative behaviors (Contingent Responsivity, Emotional Support, Structuring Support, Quality of Language Input) from baseline to short term for each group (treatment and control)?* Figure 4 displays the mean domain level rating score at baseline and follow up for each group. When examining the performance of caregivers within groups using paired t tests, the treatment group showed no statistically significant differences between baseline and follow up for any domain. When examining the performance of caregivers in the control group, paired t tests showed no

significant difference in scores for three domains: Contingent Responsivity, Structural Support, and Quality of Language Input (henceforth called Language Input). There was, however, a significant difference between baseline and follow up for the domain of Emotional Support ($M = 0.715$), $t(6) = -2.500$, $p < .05$, reflecting an increase in performance over time. See Table 6 for exact t and p values for each domain for both groups.

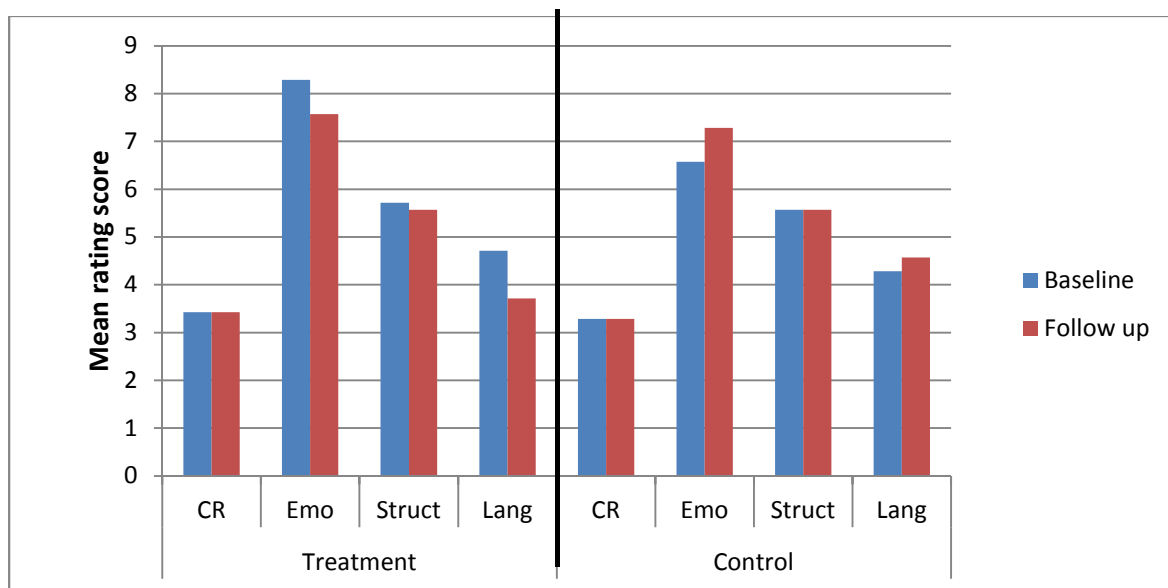


Figure 4. Mean domain level rating scores per group per time.

Table 6

T test results Comparing Baseline to Follow Up Within Each Group (Within- group Analyses)

Treatment group					
Domain	Type of <i>t</i> test	Mean difference between BL and FU mean scores	df	<i>t</i> value	<i>p</i> value
Contingent Responsivity	Paired	0.000	6	0.000	1.000
Emotional Support	Paired	-0.715	6	-1.369	0.220
Structuring Support	Paired	-0.143	6	-0.311	0.766
Quality of Language Input	Paired	-1.000	6	1.225	0.267
Control group					
Domain	Type of <i>t</i> test	Mean difference between BL and FU mean scores	df	<i>t</i> value	<i>p</i> value
Contingent responsivity	Paired	0.000	6	0.000	1.000
Emotional Support	Paired	0.715	6	2.500	0.047*
Structuring Support	Paired	0.000	6	0.000	1.000
Quality of Language Input	Paired	0.286	6	0.679	0.522

**p* < .05

Finally, we wished to determine if there was a *significant difference within and between groups in the performance change from baseline to follow up for each of the domains using domain level difference scores as the metric of change*. Figure 5 displays the domain level difference scores by group. One can see that the treatment group changed negatively for behaviors in the Language Input, Emotional Support, and Structuring Support Domains. The control group demonstrated positive change for the Emotional Support and Language Input domains. Neither group showed change for the domain of Contingent Responsivity. Based on unpaired *t* tests, the only statistically significant difference score between treatment ($M = -0.715$) and control ($M = 0.715$) occurred for the Emotional Support domain, $t(12) = -2.402$, $p < .05$. See Table 7 for details.

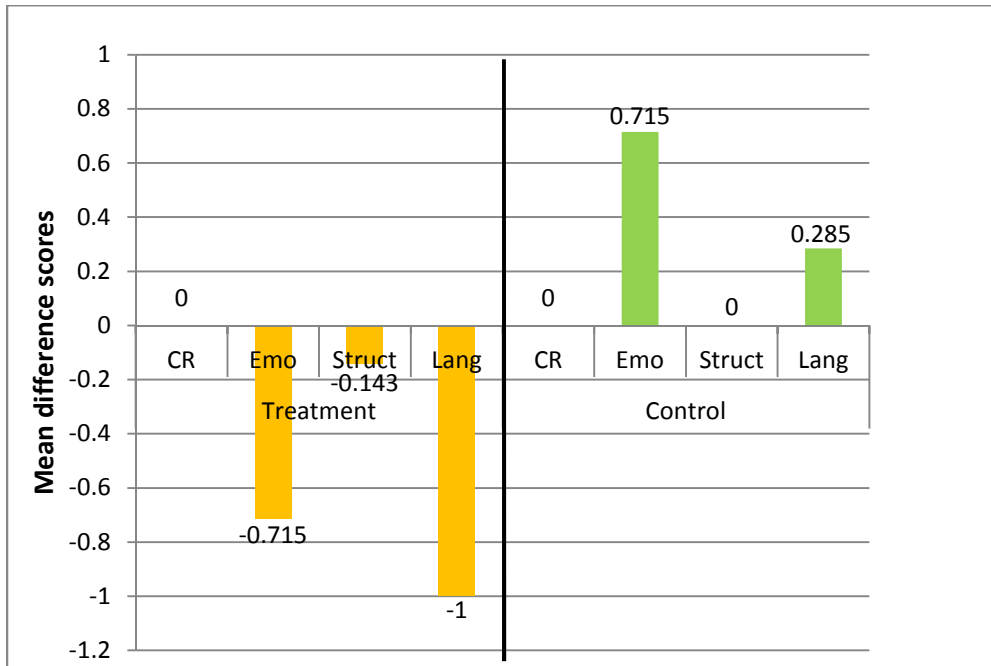


Figure 5. Mean domain level difference scores per group.

Table 7

T tests Comparing Mean Domain Level Difference Scores Between Groups (Between-group Analyses)

Domains	Type of <i>t</i> test	Mean treatment	Mean control	df	<i>t</i> value	<i>p</i> value
Contingent Responsivity	Unpaired, two-tailed	0.000	0.000	12	0.000	1.000
Emotional Support	Unpaired, two-tailed	-0.715	0.715	12	-2.402	0.033*
Structuring Support	Unpaired, two-tailed	-0.143	0.000	12	-0.167	0.870
Quality of Language Input	Unpaired, two-tailed	-1.000	.285	12	-1.3999	0.187

Exploratory Analyses: Behavior Patterns and Caregiver Profiles

The second set of research questions addressed qualitative patterns in the rating of facilitative behaviors and domains, and patterns of caregiver performances. These were considered descriptive exploratory analyses.

Behavior patterns. The first exploratory analysis examined *unique patterns of ratings at the behavior and domain levels (i.e., are there specific facilitative behaviors/domains that are consistently rated high versus low on the 5-point scale)?* As noted earlier, behavior level corpus means were calculated across all caregivers. Figure 6 displays the behavior level corpus means for each behavior. As can be seen, the behaviors with the highest rating were Restrictiveness and Physical Intrusiveness (Mean = 4.286) and Focusing (Mean = 3.536). These results suggest that on average caregivers do *not* physically restrict their children but help their children focus on toys during play. The behaviors with the lowest ratings were Encouraging (Mean = 1.357) and Regulation of Behavior (2.071). These results suggest that on average, caregivers were rated low for providing positive verbal feedback to their children during play and helping their children modulate their behavior to achieve success in play.

Domain level corpus means were also calculated; these values are presented in Figure 7. Emotional Support had the highest mean rating (Mean = 3.714) and Language Input the lowest mean rating (Mean = 2.161). These data suggest that overall, caregivers most frequently enrich their interaction with their children with positive affect and tone while limiting their physical intrusiveness. Caregivers least frequently use language to extend their interactions with their children by labeling, linking present to past and future events, or providing positive feedback based on their children's actions and achievements.

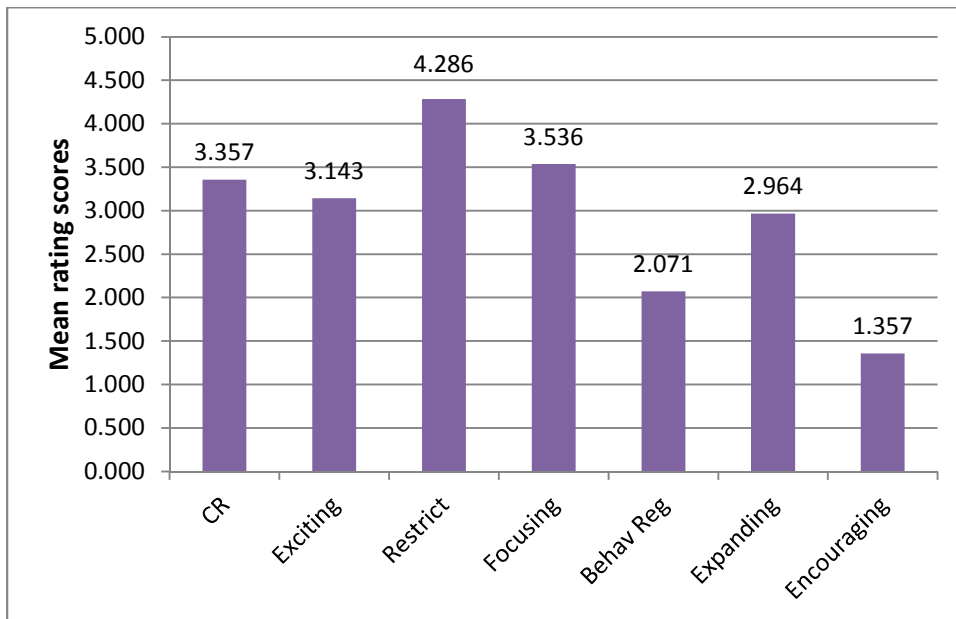


Figure 6. Behavior level corpus means.

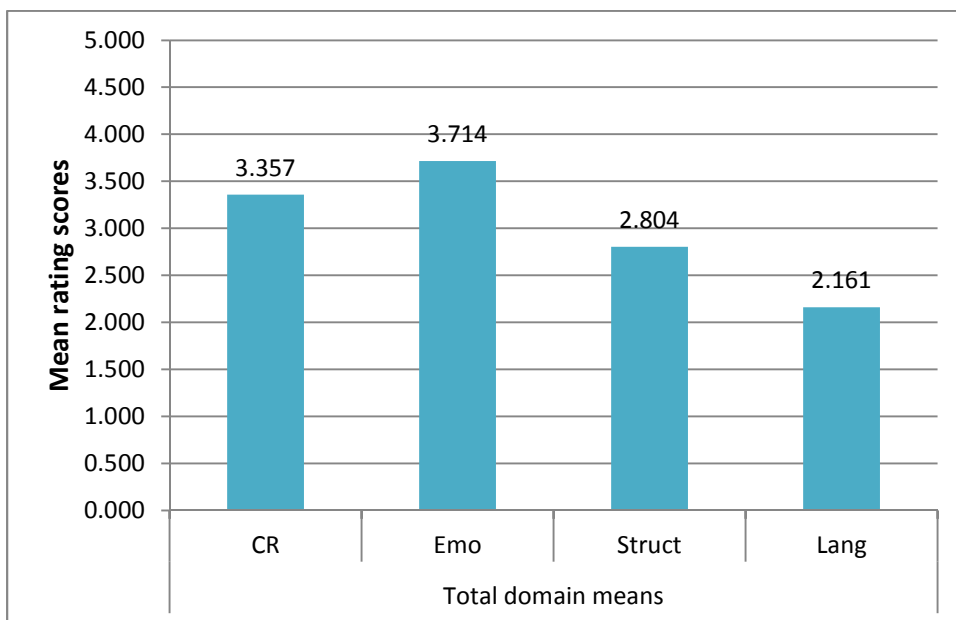


Figure 7. Domain level corpus means.

Caregiver profiles. The second exploratory analysis investigated caregiver performance profiles by comparing individual caregiver means (average of baseline and follow up rating values) with the domain level corpus means. The data for the descriptive analysis at the domain

level are presented in Figures 8-11. Each figure illustrates a different domain, presenting each caregiver’s mean performance in comparison with the mean for the entire corpus in the following order: Contingent Responsivity, Emotional Support, Structuring Support and Quality of Language Input.

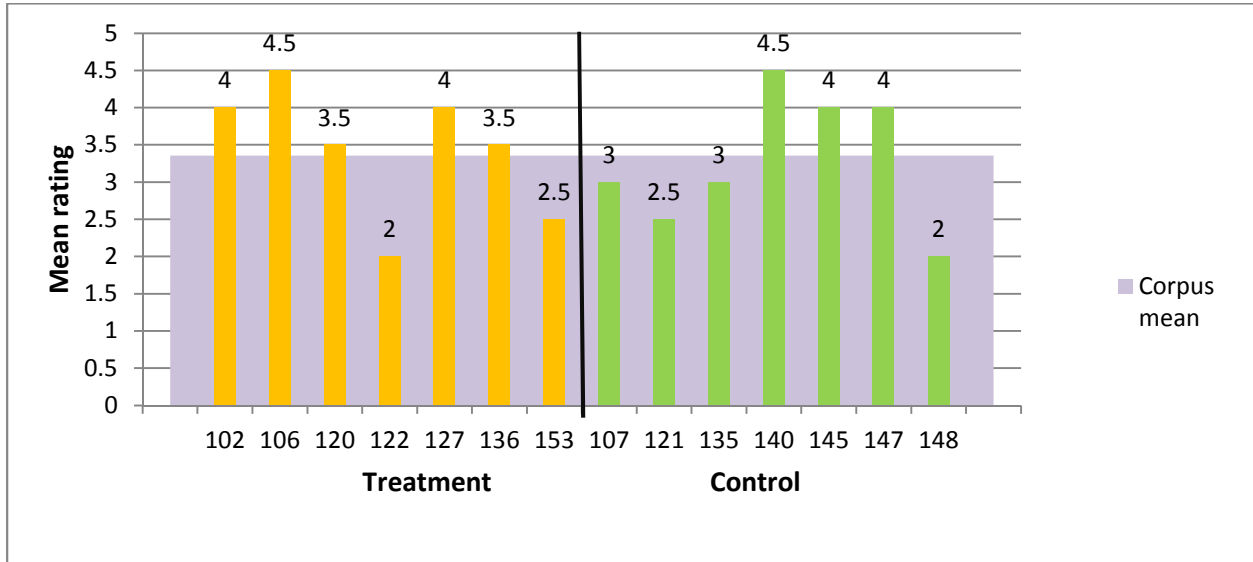


Figure 8. Contingent Responsivity: Domain level corpus mean and individual caregiver means.

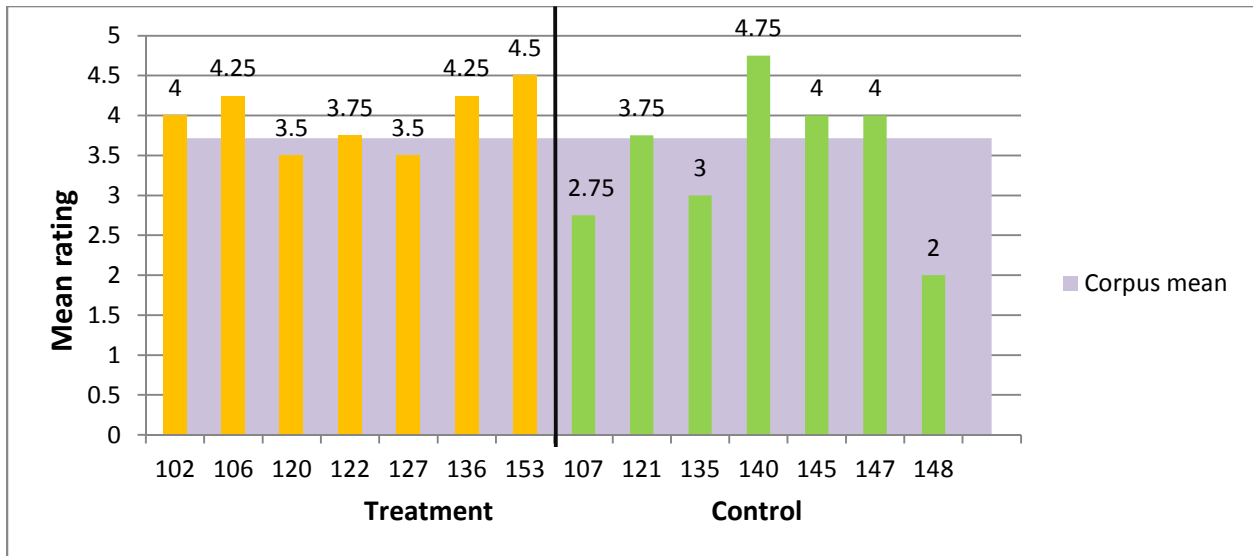


Figure 9. Emotional Support: Domain level corpus mean and individual caregiver means.

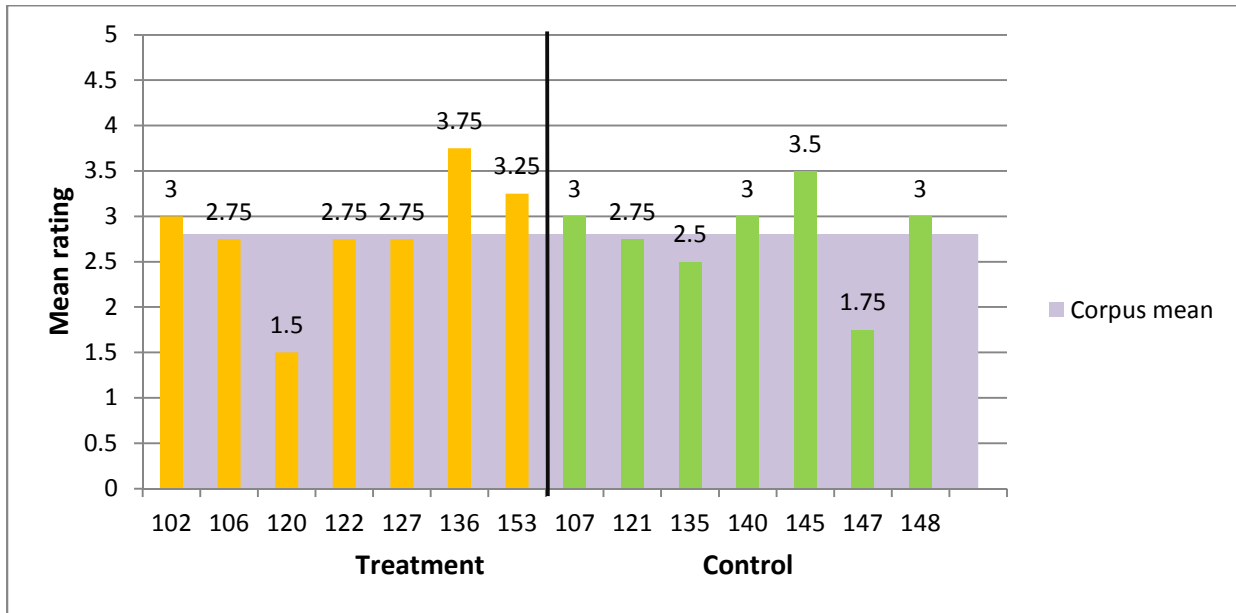


Figure 10. Structuring Support: Domain level corpus mean and individual caregiver means

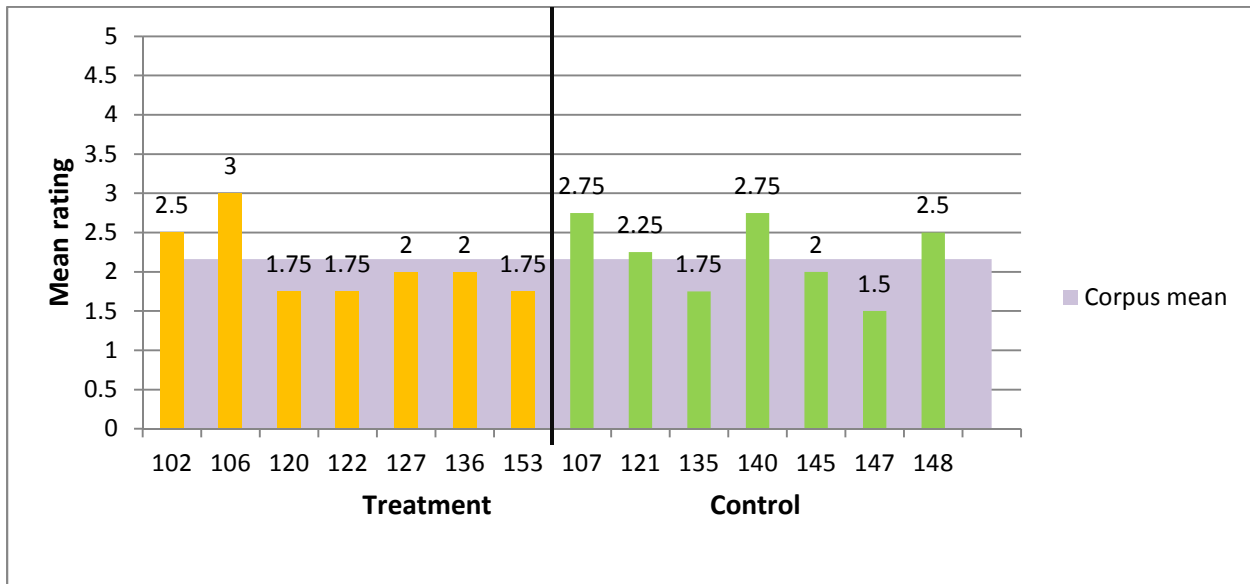


Figure 11. Quality of Language Input: Domain level corpus mean and individual caregiver means

As can be seen in Figures 8-11, individual caregivers across groups were rated above and below the mean. No trend was noted for caregivers in one group versus another. The next level of analysis was to determine which caregivers were rated above and below the domain level

corpus mean to determine the “profiles” of caregivers rated at the high end of the range versus the low end of the range. Table 8 displays these comparisons for each caregiver by domain.

Table 8

Tallies of Caregiver Domains Rated Above and Below Domain Level Means.

Caregiver	Contingent Responsiveness	Emotional Support	Structuring Support	Language Input
102	+	+	+	+
106	+	+	(+)	+
120	(+)	(--)	--	--
122	--	(+)	(+)	--
127	+	(--)	(+)	--
136	(+)	+	+	--
153	--	+	+	--
107	--	--	+	+
121	--	(+)	(+)	(+)
135	--	--	--	--
140	+	+	+	+
145	+	+	+	--
147	+	+	--	--
148	--	--	+	+

+ = solidly above mean (+) = barely above mean

-- = solidly below mean (--) = barely below mean # = treatment group

The caregivers with facilitative behaviors rated above the mean in all four domains were identified. Two caregivers, 102 and 140, met this criterion. Caregiver number 106 barely met this criterion as well.

The caregivers with facilitative behaviors rated below the mean in all four domains were also identified. Caregiver 135 met this criterion. Caregivers 120, 122 and 121 approached this criterion as well. This information was used to group caregivers with “high rated” and “low rated” facilitative behaviors. Then, these groups were examined on the basis of caregivers’ education levels and an informal measure of children’s motor abilities. Children’s motor abilities were described during the initial assessment and were reported earlier in this paper (Table 1). For the

current analysis of caregiver domain ratings and child characteristics, we examined each child's ability to hold up his/her head and sit independently as well as point and reach communicatively. These characteristics serve to illustrate the severity of children's deficits. See Tables 9 and 10 for details on this comparison.

Table 9

Caregivers with High Rated Facilitative Behaviors: Education and Child Motor Abilities.

Caregiver	Education level	Motor abilities ^a
102	High school/GED	1. Holding head up independently? Yes 2. Sitting independently? Yes 3. Reaching to request? Yes 4. Pointing to request? No
140	College degree	1. Holding head up independently? Yes 2. Sitting independently? No 3. Reaching to request? No 4. Pointing to request? No
(106)	College degree	1. Holding head up independently? Yes 2. Sitting independently? Yes 3. Reaching to request? Yes 4. Pointing to request? No

^aAs determined in baseline video

() indicate caregivers who nearly made the criterion of 4/4 domains rated above the corpus

Table 10

Caregivers with Low Rated Facilitative Behaviors: Education and Child Motor Abilities.

Caregiver	Education level	Motor abilities ^a
135	Associate's degree	1. Holding head up independently? Yes 2. Sitting independently? No 3. Reaching to request? No 4. Pointing to request? No
(120)	College degree	1. Holding head up independently? Yes 2. Sitting independently? No 3. Reaching to request? No 4. Pointing to request? No
(121)	Some high school	1. Holding head up independently? Yes 2. Sitting independently? No 3. Reaching to request? No 4. Pointing to request? No
(122)	High school/GED	1. Holding head up independently? Yes 2. Sitting independently? No 3. Reaching to request? Yes 4. Pointing to request? No

^aAs determined in baseline video
() indicate caregivers who barely met the criterion of 4/4 domains rated above the corpus

As can be seen in Table 9, of the caregivers with “high rated” facilitative behaviors, two out of three had college degrees. All of their children could hold up their head independently and none of the children could point. Two of the caregivers (102 and 106) had children who could sit and reach independently. Caregiver 140 had a child with more deficits as reflected by his inability to sit and reach independently. These results suggest that caregiver education level and child characteristics were not purely responsible for caregiver performance for caregivers with “high rated” facilitative behaviors. Of the caregivers with “low rated” facilitative behaviors, two out of four had college degrees. While all of the children were able to hold their head independently, none could sit independently. Only one of the children (122) was reaching and

none of the children were pointing. These results suggest that the caregivers with “low rated” facilitative behaviors did not differ substantially from the caregivers with “high rated” facilitative behaviors in terms of education, but that the caregivers with “low rated” behaviors had children with more severe deficits than their “high rated” counterparts.

Discussion

The discussion that follows will focus first on caregiver facilitative behavior changes within and between groups as documented through a 5-point Likert rating scale. This discussion will include a summary and interpretation of findings, and consideration of the strengths and weaknesses of the rating scale. The discussion will continue with an appraisal of the behaviors comprising the scale, including an interpretation of the patterns that appeared through the performance of the caregivers of children with severe motor impairments. The focus will then turn to a discussion of individual caregivers’ profiles and style differences that appeared through the data. Finally, an exploration of the limitations of the research, clinical implications, and future directions for investigation will be presented.

Research Questions

1. Do caregivers whose children with severe motor impairments received child-directed TEG treatment show greater change in facilitative behaviors than caregivers whose children did not receive this treatment? This question was motivated by wanting to know whether the child-directed treatment aimed at improving the children’s prelinguistic communication had an indirect impact on the facilitative behaviors of their caregivers, thus prompting an increase the caregivers’ use of behaviors that serve to facilitate development. The findings would have important implications for service delivery to children with severe impairments.

This question was addressed through a three step analysis: first, baseline mean overall rating scores were compared between groups and results indicated the lack of a statistically significant difference. Second, within-group measures at baseline and follow up were used to determine change over time. These data revealed that the treatment group had a statistically significant decrease in overall facilitative behaviors from baseline to follow up, although there were no significant differences in any of the specific domains. While the control group did not show a statistically significant difference overall, there was a significant increase in the frequency of Emotional Support domain behaviors. Third, and finally, individual caregiver difference scores were calculated between baseline and follow up and combined into a mean overall difference score allowing for a comparison between groups in change over time. This analysis was designed to document a treatment effect. The analysis showed no significant difference between groups overall. However, visual inspection revealed that the treatment group showed an overall decrease in facilitative behavior performance from baseline to follow up, while the control group showed an increase over the same timeframe. In the domain level analysis, a significant difference between groups in the Emotional Support domain was found, indicating that the control group's increased frequency of Emotional Support was significantly different than the decreases seen in the treatment group. In regards to the main question of this research, the findings suggest that caregivers who observe child-directed treatment do not increase their production of facilitative interaction behaviors. The lack of significant difference in change between groups and specific trends in the data between groups prompts consideration of several explanations for the findings.

The relative lack of significant difference in the ratings of facilitative behaviors within and between groups between baseline and follow up may suggest that the rating scale captured caregivers' *styles* of interaction rather than identifying contributory behaviors. That is, the rating scale may have accurately described the typical way in which caregivers interacted with their children. In fact, rating scales are argued to be valid ratings of overall/gestalt performance, capturing the general disposition of the caregiver-child interaction (Landry, et al., 2006). As such, perhaps "style" itself does not change over time, with or without observation of a professional. The baseline and follow up may have merely sampled two time points of a caregiver's typical interaction style. However, worthy of note is the decrease in the treatment group's ratings over time and the control group's slight increase. This was certainly an interesting and surprising finding. Several factors could explain this finding and provide information pertinent to planning early intervention.

For one, the lack of significant difference between groups suggests that the caregivers in the treatment group did not change their facilitative behaviors by simply observing their children receiving direct treatment. However, the trends in the data (i.e., decrease in behaviors by caregivers in the treatment group versus increases in behaviors by caregivers in the control group) suggest something else may have been occurring. Certainly, the decrease may have been influenced by external factors related to sampling and the demographics of caregivers to each group. For example, differences in time spent observing treatment, or time spent playing with children in the home, or caregiver occupation, etc. may have had effects on the caregivers' outcomes. More directly tied to the study design are factors related to differences in reasons for

caregiver participation in the study as they might have influenced caregiver attitude, motivation, or expectations.

These external factors aside, one possible interpretation is that the caregivers in the treatment group were attempting to emulate the SLP's manner of interaction with their children but were not successful in integrating all of the behaviors demonstrated by the SLP. As noted earlier, caregivers have been shown to be successful in learning some components of the TEG treatment process, namely providing opportunities and waiting, but experience difficulty learning and integrating other critical aspects of the treatment process, specifically shaping (Olswang, et al., 2006). The significant difference between the treatment group's decrease in the use of Emotional Support and the control group's increase might be a reflection of the efforts made by the caregivers to actually imitate the SLP. Caregivers in the treatment group may have been trying to implement the more structured opportunities presented by the SLP during treatment and in their effort to "teach," may have reduced their more general spontaneous supportive behavior. Caregivers in the control group, because they were not exposed to child-directed treatment for TEG, may not have tried to alter their manner of interaction and their increases in Emotional Support domain may be attributed to the evolving interactions as posited by the transactional model of development (e.g., Yoder, et al., 1994).

Nonetheless, a more statistically powerful *t*-test revealed a lack of significant difference in the difference scores between groups indicates that there was no treatment effect for the caregivers in the treatment group. According to these results, the caregivers did not appear to alter their interactive style after observing their children being directly treated by a SLP. This finding would suggest that rather than simply modeling facilitative behaviors, the SLP may need

to more directly address caregiver style changes by including a caregiver-treatment approach as a part of intervention. This finding will be further explored in the Clinical Implications section of this paper.

Another possible explanation for the findings is that the 5-point Likert scale used in this study may not have been sensitive enough to capture fine differences in facilitative behaviors, and/or more general style characteristics. Had the range been larger (for example, a 7-point rating) perhaps more performance variability would have been documented. Another possible explanation for the findings in the current study is that sampling of caregiver performance might have influenced the results. Perhaps broader samples of performance might have revealed different outcomes. This would include more sampling points over time and/or longer sampling windows (10 minutes versus 5 minutes). A related point, if we argue that the rating scale sampled caregiver “style” then perhaps style change takes longer, and thus the study period itself was too short. Further, perhaps the study period was not long enough to result in *child* behavior changes that might influence the caregivers’ interactive behaviors, as might be posited in a transactional model.

The rationale for using a 5-point rating scale to capture 5 minutes of caregiver-child interaction was based on previous research by Landry et al. (2006) and Mahoney (1986) who demonstrated the reliability and validity of a 5-point range. However, worthy of note is the fact that their scales were used to measure caregiver behaviors as outcomes for *caregiver*-directed (as opposed to *child*-directed) treatment in which the caregivers were taught only those target behaviors that comprised the scale (e.g., Landry, et al., 2006; Mahoney, et al., 1986). Thus, in their research a 5-point scale might have been a more sensitive measurement tool because of

their use of direct, rather than indirect, teaching thus resulting in more salient changes in caregiver performance. Furthermore, the method of using rating scales as opposed to frequency counts may have influenced the results: the strength of rating scales, besides clinical facility, is that they capture the gestalt or the disposition of the interaction (Landry, et al., 2006). Again, this leads to the conclusion that the scale may be capturing *styles* of caregiver interaction, which are more gestalt and less likely to change without direct instruction.

The second main research question in this study asked: *Are there unique patterns in rating of facilitative behaviors?* This question encompassed both *unique patterns of ratings across the facilitative behaviors (i.e., are there specific facilitative behaviors that are consistently rated high versus low on the 5-point scale?)* as well as *unique caregiver behavioral profiles that result from the ratings (i.e., are there caregivers who receive ratings at the high versus low end of the 5-point scale on some or all of the seven facilitative behaviors?)*. Patterns of ratings across behaviors will be addressed first, followed by an examination of individual caregiver profiles.

Behavior patterns. In the realm of patterns of behaviors, the results showed that there was a low occurrence of Restrictiveness/Physical Intrusiveness (recall, this behavior is inverse to other behaviors, so the high mean reported above indicates *low* occurrence of restrictiveness/physical intrusiveness). The second highest rated behavior overall was Focusing. The highest rated domain overall was the Emotional Support domain. This domain was comprised of Restrictiveness/Physical Intrusiveness and Exciting/Affecting behaviors.

These results are important for caregivers of children with motor impairments for several reasons. First, these results refute many studies that have claimed that caregivers of children with

impairments are more highly restrictive and intrusive than caregivers of typical children (see Crawley & Spiker, 1983 for a review of these studies). In the present study, the corpus of caregivers was identified as having low levels of restrictiveness and intrusiveness overall. Caregivers in this study did not dominate or control play, despite the extreme limitations some children experienced, such as the inability to reach or difficulty in maintaining interactions due to choreatic movements.

Second, the fact that the Emotional Support domain was also highly rated indicates that caregivers also expressed warmth, positive affect and excitement coupled with low intrusiveness while engaging with their children. These findings suggest that strengths exist for SLPs to build upon during caregiver-directed treatment. These highly rated caregiver facilitative behaviors also provide the children a platform for learning since components of Emotional Support have been correlated with children's preverbal communication scores (Klein, et al., 2010). Low levels of restrictiveness/physical intrusiveness and high levels of Emotional Support has also been associated with developing social skills, such as the children's own affect and social engagement (Landry, et al., 2008). Unlike previous studies showing highly restrictive and intrusive behaviors by caregivers of children with impairments, our data reveal low restrictivness and high emotional support which can be advantageous for the child and for implementing caregiver-directed treatment.

Focusing, the second most highly rated behavior overall, may also have special significance to this population, although its influence is less straightforward. In some ways, the predominance of Focusing aligns closely with the unique limitations of children with impairments. Caregivers may have to spend more time gaining, maintaining and facilitating

children's attention since children with motor impairments initiate less and are unable to maintain interaction as long as their typical counterparts. However, Klein (2010) also showed that the importance of Focusing behaviors is primarily derived from the sequence in which it is used. She found that when Focusing is followed by Exciting/Affecting or Expanding it is more highly correlated with cognitive and communicative outcomes for children with Down syndrome. Isolated Focusing actually had a negative correlation with these same outcomes. Our results suggest that the behaviors that were most rated on the high end of the scale were those that are especially significant for children with severe impairments. As such, one could view the findings of this study as supporting the importance of emphasizing these facilitative behaviors when working with caregivers and while simultaneously teaching all of the facilitative behaviors as a complementary set rather than isolated skills.

The two behaviors rated the lowest in the corpus were Encouraging and Regulation of Behavior. The domain with the lowest rating was Language Input, comprised of Expanding and Encouraging. In fact, Encouraging was most frequently rated a 1 out of 5, meaning caregivers rarely used this facilitative behavior. A few caregivers gave generic feedback such as "good job!" or "yay!" but even this was rare, and specific feedback, a keystone of the SLP's treatment approach, was nearly nonexistent. One participant gave feedback on his child's reaching behavior. Several participants mentioned their children's eye gaze behavior but only in passing and more as narration (e.g., "Hm, you seem to be looking at the ball" or "Are you looking for more toys?") than as feedback expressing satisfaction and excitement about the children's communication. This, coupled with low ratings in the Quality of Language Input domain, indicate that the caregivers did not frequently map verbal meaning onto activities, nor did they

provide feedback for their children during the interactions, two important pieces of contingent responsiveness and facilitation. As mentioned above, Klein (2006) found that expanding and encouraging behaviors were most frequently related to positive cognitive outcomes. This indicates that the caregivers in our study needed support in optimizing language input for their children.

Regulation of behavior was also rated low for the caregivers in this study. This is rather counterintuitive because in theory, this facilitative behavior is even more salient and essential for children with motor impairments, as they struggle to physically interact with toys. Regulation of behavior reflects caregivers' efforts to guide their children's actions on toys in the environment and to assist them in planning before acting. For example, caregivers might instruct the child to "reach higher and push" to help their children activate a toy, or say, "Find the hole that looks like a star" to guide their children in a shape-sorting task. The caregivers are not frequently giving their children this support, which may help their children engage more readily and more successfully with the environment, facilitating learning through exposure to toys, etc. The caregivers' efforts to provide Regulation of Behavior and help their children match their abilities with task demands is critical for cognitive and social development (Klein, et al., 2010), and thus worthy of attention when working with caregivers.

Caregiver profiles. Recall that the data were also examined to determine caregiver profiles of performance as suggested through the rating scale. When compared to the corpus mean at the domain level, three caregivers were identified as having all four domains rated solidly or barely above the corpus mean (102, 140, 106) and four were identified as having all four domains rated solidly or barely below the corpus mean (135, 120, 121, 122). These two sets

of caregivers were examined based on their education level and children's motor abilities, as these are two factors that may shape the caregivers' interaction style with their children.

Education and socio-economic status have been shown to be variables that affect caregiver facilitative behaviors, with more years of education correlated with more developmentally facilitative interaction styles (Landry, et al., 2001). However, in the present study, two of the three caregivers in the "high rated" category had a college education, as opposed to two of the four caregivers in the "low rated" category. Education in this study did not appear to differentiate the caregivers in the "high rated" versus "low rated" groups.

The children's motor abilities were also examined in relationship to caregiver performance. The rationale for this examination was that children with more severe deficits tend to have more difficulty initiating and sustaining interactions, as well as more difficulty interacting with toys (e.g., coordinating their motor system to push buttons, roll balls, reach and grasp rattles, etc.) and caregivers (e.g., lower levels of communicative initiation, decreased affect due to hypotonia, etc.). In the present study, the children whose caregivers were placed in the "high rated" category varied with respect to their motor abilities. Two of the three children were motorically very capable, able to hold their heads up, sit and reach independently. However, one child was only able to hold his head up independently, presenting with more severe deficits. From the standpoint of these caregivers, the data suggest that the children's motor abilities are not a determining factor in the caregivers' use of facilitative behaviors. However, when examining the children of caregivers in the "low rated" group, none of the children were sitting independently and only one was reaching. These data might suggest that the caregivers with "lower ratings" had children with more physical limitations. Therefore, children's motor abilities

may provide additional challenges to caregivers, and should be considered when working with caregivers to achieve higher levels of facilitative behaviors.

Clinical Implications

Several clinically relevant conclusions can be drawn from this study. First, the clinical usefulness of the scale used in the study will be discussed, followed by a discussion of the clinical relevance of the outcomes found in this study.

The 5-point Likert scale used in this study achieved similar interjudge reliability scores as scales previously used in the literature (e.g., Mahoney & Perales, 2003). However, the findings from our study's scale suggest that it should not be used as a tool to measure treatment outcomes, as it warrants future studies to validate its sensitivity to treatment effects. Nonetheless, the scale may serve as a useful clinical tool to help identify treatment targets for caregivers, helping the clinician arrive at a gestalt awareness of the caregiver's facilitative behavior strengths and weaknesses, and the profile of these behaviors. The scale is a more expedient alternative to frequency counts and provides operational definitions and examples of each of the target behaviors to orient clinicians to research-based behaviors that affect child outcomes.

Assuming that the scale was adequately reliable and valid for the purposes of this study, the data are suggestive that caregivers of children with severe motor impairments cannot learn more facilitative behaviors simply by observing child-directed treatment and receiving a packet of written information. Therefore, it is important to include a caregiver-directed element in treatment to increase the likelihood that caregivers will increase facilitative behaviors that will help their children in the development of communication. The child-directed treatment goals should be complementary to caregiver-directed treatment goals to facilitate maximum outcomes

for both partners in the interaction. The results of this study may also suggest particular areas of emphasis for caregiver-directed treatment. Behaviors that were rated high across the corpus, like the lack of Restrictiveness/Physical Intrusiveness and Focusing are more readily produced and thus could be pointed out to caregivers and used to bolster confidence and awareness. However, it would also be important for the SLP to teach the facilitative behaviors as sequences or complementary behaviors in order to avoid isolated Focusing. The SLP can help the caregiver couple these strengths with new facilitative behaviors in order to optimize support for the child.

In addition, the two behaviors Encouraging and Regulation of Behavior that were identified as low frequency across the corpus would be important treatment targets as they have been shown to be challenging for this population of caregivers. Teaching caregivers to use specific, frequent Encouraging behaviors may help increase generalization of children's behavior to the caregivers through identification and reinforcement of child behaviors such as eye gaze. Regulation of behavior is essential for a population of children with severe motor impairments, as they have more difficulties physically engaging with toys and possible concomitant cognitive deficits, which make planning and sequencing actions more difficult. The support of their adult counterparts in establishing a zone of proximal development and providing guidance may be even more critical than for their typical peers.

Finally, the results of this study suggest that the severity of children's motor impairments may not be a determining factor in their caregivers' use of facilitative behaviors. However, some caregivers whose children are more severely affected may need extra support and guidance in order to effectively facilitate learning and development in their children. Certainly, any

caregiver-directed treatment would tailor instruction to best match the children's characteristics and the caregivers' natural interaction style.

Study Limitations

Two primary factors contribute to the main limitations of the current study: the nature of the study participants and the data collection procedures and tools. First, the small sample size ($N = 14$) did not allow for sophisticated statistical analysis. It also reduced the power of the statistical conclusions and may not have been of adequate size to capture differences and patterns in outcomes. In addition, because the caregivers were pulled from a study that controlled for child variables but not for caregiver variables, there are threats to the validity of this study due to the unknown history of the caregivers and possible differential subject-selection effects for the treatment and control groups. Even though the baseline scores between groups showed no difference, there still may have been demographic factors influencing outcomes. Furthermore, the larger study did not measure the involvement of the caregivers in the treatment group; while the treatment SLPs estimated that the caregivers were present and attentive to therapy about 75% of the time, this may have varied widely between individual caregivers (Treatment SLP, personal communication, August 9, 2011).

Second, the 5-point scale in combination with "accuracy" of rating raises questions about validity of the data. The inter-observer exact agreement (i.e., both observers rating the behavior the exact same number on the 5-point scale) was only 60%. One point variation in rating could significantly alter the outcome. While there is precedent in the literature for reporting reliability within one point on a 5-point scale, the data must be interpreted with caution. A more sensitive way to have approached the rating and to account for the variability between observers is to have

two observers rate all of the video segments. Differences in rating between the two observers would be averaged to yield a “true” rating value capturing both observers’ opinions. This averaged rating value would be used in data analysis along with ratings that were in exact agreement (R. Abbott, personal communication, June 28, 2012).

Future Directions

Future studies may address the limitations or extend the findings of the current study. For instance, the scale used in this study could be further refined. This may either be achieved through altering its structure (e.g., using 7 or 10 points), refining its use (e.g., using it at multiple points throughout the treatment) or increasing its reliability by having both observers rate the entire corpus. Validity of the scale may also be established by comparing the outcomes of the current study with outcomes based on frequency counts.

Other areas of investigation that would extend the current study would be to include children’s outcomes as a complement to caregivers’ outcomes and investigate their relationship. Additional research to investigate caregiver styles of interaction is warranted. Rating scales seem to capture style and style differences among caregivers. Investigating how child characteristics interact with style would be interesting to explore, as would examining the effects of caregiver-directed treatment on style.

In conclusion, this research allowed for an investigation of how caregivers might change as a result of observing child-directed treatment. The need for caregiver involvement in early intervention is critical, but how to efficiently accomplish it remains unanswered. Children with severe impairments benefit from child-directed treatment offered by SLPs, but the results of this

study suggest that this must not be the only approach to employ in order to create maximum change in child development. Caregivers should be involved and more directly than not.

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