

Improving Question-Asking Initiations in Young Children with Autism Using Pivotal Response Treatment

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Abstract Social initiations make up a core deficit for children with autism spectrum disorder (ASD). In particular, initiated questions during social interactions are often minimal or absent in this population. In the context of a multiple baseline design, the efficacy of using the motivational procedures of Pivotal Response Treatment to increase social question-asking for three young children with autism was assessed. Results indicated that participants initiated a greater number of targeted questions following intervention. Additionally, all children exhibited increases in initiation of untargeted questions during social interaction in novel settings. Furthermore, post intervention data revealed collateral gains in communication and adaptive behavior. Theoretical implications of incorporating motivational strategies into intervention to improve social initiations in young children with ASD are discussed.

Keywords Initiations · Early intervention · Motivation · Question-asking · Autism spectrum disorder · Pivotal response treatment

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Introduction

Social initiations, such as question-asking, have been suggested as a key variable in improving long term outcomes in children with autism (Koegel et al. 2010). However, children with autism spectrum disorder (ASD), in contrast to typically developing children, experience significant limitations in both quality and quantity of verbal and non-verbal initiations (Mundy et al. 1986; Newman 2005; Stone et al. 1997; Warreyn et al. 2007; Wetherby and Prutting 1984). In particular, initiated questions are persistently and pervasively absent in individuals with ASD throughout the life span (Koegel and Koegel 2012). That is, independent of a child with ASD's cognitive and communicative level, the number of initiated questions and question forms appear to be limited (Koegel et al. 1999). Children with autism use language almost exclusively for requesting objects, requesting actions, and protesting, unlike typical language learners who exhibit early forms of question-asking within their first group of words. This deficit may be evident in early play and social language interactions (Harper et al. 2008; Koegel et al. 2001, 2010; Oke and Schreibman 1990) and may continue throughout life, as adolescents and adults with autism often initiate a limited number of questions during social interactions (c.f. Carr et al. 1994; Frea 1995; Harper et al. 2008; Koegel et al. 2013, 1997; Koegel and Koegel 1995).

Additionally, as asking wh-questions is a developmental milestone that sets the groundwork for language learning and vocabulary acquisition (Koegel et al. 1997), failing to initiate questions in the preschool years could have an especially profound impact on language development. This pervasive problem of a lack of question-asking may severely limit verbal learning opportunities and present as pragmatically inappropriate during social interactions

(Peck 1985; Volkmar et al. 2004). Therefore, initiations and question-asking has been discussed as an important intervention variable (Harper et al. 2008; Koegel et al. 1997; Koegel and Koegel 1995; Mundy and Crowson 1997; Mundy and Sigman 1989; Mundy et al. 1990; Paul 2008; Warren et al. 1981). Interventions targeting question-asking for children with autism have been shown to be especially useful for increasing language skills and improving social interactions. For example, Koegel and Koegel (1995) reported that teaching question-asking to children with autism resulted in acquisition of prepositions, pronouns and attention-seeking utterances. Additional research extends these findings by demonstrating that interventions for question-asking, if implemented with motivational strategies, may result in generalization of targeted questions to novel settings, which can result in increased social opportunities outside of the clinical setting (Koegel et al. 2010). Given the importance of question-asking in child play and adolescent and adult conversation (Koegel et al. 2013), identifying an intervention that produces flexible, generalized skills with lasting effects may have a significant impact for children with ASD. However, current research has not assessed whether gains in question-asking in preschool children with ASD result in additional gains in initiations of other forms of untargeted questions that are not directly taught during the intervention.

In regard to intervention strategies, Pivotal Response Treatment (PRT) has been shown to lead to collateral improvements in outside settings and in other core areas of autism (Koegel and Koegel 2006). PRT is a naturalistic intervention designed to target pivotal behaviors, such as motivation, and produce widespread gains in other areas. The use of the motivational procedures of PRT in the context of a question-asking intervention has resulted in generalized gains of learned questions in novel settings (Koegel et al. 1997). This research built upon other studies that did not incorporate motivational components into intervention for question-asking and observed limited generalization and maintenance of gains or the necessity of prompting for question-asking to occur (Hung, 1977; Taylor and Harris 1995). Further, these studies taught question-asking to older individuals. Motivational intervention to improve question initiations in young children with ASD has not yet been assessed for changes in terms of the overall frequency and quality of initiated questions or for measurable collateral gains in communication. The current study aimed to extend this research by assessing improvements in question-asking, in addition to gains in standardized measures of communication, following the use of motivational components described in PRT to teach initiated question to very young children with ASD. Therefore, this study assessed the following: (1) Will

increases in initiating untargeted questions occur in young children with ASD when motivational (PRT) procedures are incorporated into a question-asking intervention; (2) Will gains in targeted question asking occur and maintain over time following intervention; and (3) Will an intervention focused on increasing initiated questions lead to improvements in expressive and receptive communication and adaptive behavior?

Methods

Participants

Three 3-year-old children participated in this study. Each child met the following criteria: (a) A diagnosis of an ASD by an outside agency, confirmed by our center according to the DSM-IV TR and an ADOS classification of Autism or ASD (Lord et al. 2000); (b) Hearing and visual acuity within normal limits; (c) No presence of a co-morbid neurological disorder; and (d) At least 50 different functional, spontaneous, and intelligible words. None of the participants received Pivotal Response Treatment prior to the start of the study. An outside record of intervention and target behaviors was maintained throughout the study, and participants did not receive additional behavioral or speech and language intervention related to question-asking during the study. Table 1 presents further information on participants and standardized assessments prior to the intervention.

Experimental Design and Procedures

A multiple-baseline across participants design was employed to assess the effects of intervention focused on improving question-asking using motivational procedures for young children with ASD. Systematic staggered baseline probes were conducted in accordance with the multiple baseline design for two, three, and four sessions for Child 1, 2, and 3, respectively.

In order to assess improvements outside of the treatment sessions, each parent–child dyad participated in videotaped interactions analogous to the baseline probes during the intervention phase. Given that there is an expected delay for children with ASD to exhibit generalized improvements in a naturalistic setting and in the use of novel questions (Koegel et al. 1997), predicted delayed effects were built into the experimental design to more confidently establish a functional relationship (Kratowchwill et al. 2010). A delay of 2 months was expected to be adequate to measure generalized gains in use of targeted questions and 2–4 months was anticipated to be long enough to detect lagged improvements in generalized use of untargeted questions. Communication probes were collected at designated points

Table 1 Participant characteristics and standardized assessments with standard scores (and percentiles) pre-intervention

	Child 1	Child 2	Child 3
Age	3:7	3:6	3:2
Gender	Male	Male	Male
Race	White (European)	White (European)	White (Middle Eastern)
Diagnosis	Autism	Autism	Autism spectrum
ADOS social communication total	17	12	11
Vineland communication total	91 (27th)	78 (7th)	87 (19th)
Vineland daily living skills total	73 (4th)	71 (3rd)	73 (4th)
Vineland socialization	72 (3rd)	74 (4th)	63 (1st)
Vineland adaptive behavior composite	86 (18th)	73 (4th)	74 (4th)
Expressive one-word	106 (66th)	84 (14th)	83 (13th)
Receptive one-word	107 (68th)	55 (<1)	98 (45th)
CELF core language	90 (25th)	Unable to establish basal	22 (14th)
CELF receptive language	86 (86th)	Unable to establish basal	23 (18th)
CELF expressive language	94 (34th)	Unable to establish basal	15 (8th)

All assessment scores are presented in standard scores with a mean of 100 and standard deviation of 10

throughout the 10-month intervention, as described below, and took place in a setting in which the intervention did not occur (e.g., play room). No instructions were provided to the parent or child during these interactions. Rather, the parents were asked to interact with their child as they normally would during typical play.

Baseline

Baseline probes for each dependent measure were collected for all participants. Each baseline probe consisted of the parent–child dyad interacting for a period of 10 min in a play setting with age appropriate toys available. No specific instructions were provided to the parents or child during these interactions. That is, the parents were asked to interact with their child as they normally would during typical play.

Intervention

Intervention was conducted by doctoral student clinicians and took place for 10 h per week, including two parent education hours, for 10 months. Sessions were implemented three times per week for Child 1 and 3 and four times per week for Child 2 with the hours being approximately equal across sessions. Intervention consisted of teaching a series of social questions using the motivational procedures of PRT; no other treatment goals were targeted for the duration of the intervention. The procedures used in PRT include child choice, interspersal of maintenance and acquisition tasks, rewarding attempts, and the use of direct and natural reinforcers (Koegel and Koegel 2006, 2012). Examples of the specific PRT procedures used in the

intervention, with corresponding PRT components, are shown in Table 2. Over the course of intervention, four questions were taught to each child in a sequence consistent with the acquisition of wh- questions in typically developing 2–3 years old children (Bellugi 1965; Rowland et al. 2003). This sequence was as follows: “What is it?”, “Where is it?”, “Who is it?” and “What happened?” Each question was targeted for 2 months during the first 8 months of intervention. The ninth and tenth months were spent providing opportunities for the child to initiate all four targeted questions in each intervention session. Communication probes were taken every 2 months to assess acquisition of the targeted question as well as untargeted questions in a novel setting. It was hypothesized that after 2 months of intervention, targeted questions would increase in the natural environment.

Consistent with PRT models, a parent education component along with fidelity of implementation was incorporated. Parents were provided 2 h per week of “practice with feedback” in the intervention procedures. Parents who stayed at home with the child during the day or spent the most time with the child participated in parent education. Parents were not involved in treatment during clinician intervention sessions. Fidelity of Implementation measures were scored for all clinicians and parents in order to insure that they were using the procedures according to the manualized definitions, and to be sure that only targeted questions were being taught to the children.

Fidelity of Implementation

All intervention clinicians attended weekly supervision with a doctoral level psychologist or speech-language

Table 2 Pivotal response treatment focused on teaching initiations

	PRT component	PRT intervention for initiations
Stimulus items	Intersperse maintenance and acquisition tasks	Gradually introduce neutral items (such as less desired targeted vocabulary items) and fade prompts
Opportunity	Child choice	Begin with highly desired items and provide an opportunity for child to <i>initiate</i> a question about the item, then gradually intersperse neutral items. For this study, opportunities should only be provided for the four targeted questions: What, Where, What Happened, and Who
Response/ interaction	Reinforcement of attempts	<i>Child</i> asks an approximation of a question about stimulus item or action (e.g., approximation of “What’s that?”); <i>Adult</i> answers the question
Consequence	Natural reinforcer	Child provided with natural reinforcer, such as an opportunity to interact or play with the item

pathologist. Treatment was delivered according to manualized procedures (Koegel and Koegel 2012). In addition to weekly supervision sessions, 10 min video clips were scored for fidelity of implementation for the clinicians as well as the parents who participated in the parent education. For each 10-min recording, fidelity of implementation was scored in 1-min intervals. The following procedures were used to assess fidelity of treatment implementation: within each interval of the 10-min recording, a trained but naïve observer scored the treatment provider for (a) correct implementation of the procedures in each of the categories listed Table 2 and (b) prompting and reinforcing only targeted questions. Eighty percent correct use of each procedure as listed in Table 2 was required in order to consider a treatment provider to be effectively implementing the intervention procedures. All treatment providers (clinicians and parents) met fidelity of implementation.

“*What is it?*” was taught by providing opportunities using the following procedures (Koegel et al. 1997). In order to increase the child’s motivation to ask “What’s that?” the clinician placed a variety of highly desired objects in an opaque bag and verbally prompted the child to initiate “What is it?” or an approximation such as “What that?” After the child asked the question the clinician opened the bag, labeled the desired object, and waited for the child to repeat the label. After the child repeated the label, a natural and direct reinforcer was provided by giving the child the highly desired object. After the child successfully initiated “What’s that?” following a verbal prompt for 20 consecutive trials, a time delay was incorporated so that the child had an opportunity to ask the question “What’s that?” without prompts. After the child asked “What’s that?” without prompts across two sessions, fading began. Specifically, neutral items were gradually incorporated and the opaque bag was faded.

“*Where is it?*” This target question was taught using similar methods by incorporating motivational procedures. Specifically, the clinician hid a variety of desired items and verbally prompted the child to ask an approximation of “Where is it?” Natural and immediate reinforcement was

provided by the clinician, which involved responding with the location of the desired item, at which point the child could find the desired item. For example, a clinician might hide a desired item under the rug and verbally prompt the child to ask, “Where is it?” The clinician would then point to the missing item and respond, “Under the rug!” Thus, the child was naturally rewarded by gaining access to, and playing with, the desired item. After the child initiated with verbal prompts across approximately 20 consecutive trials, a time delay was incorporated so that the child had the opportunity to ask, “Where is it?” without prompts.

“*Who is it?*” Children were taught the question “Who is it?” by incorporating child preferred miniature characters into intervention sessions. Motivation to ask, “Who is it?” was incorporated into pretend-play activities. First, the clinician would prompt the child to ask, “Who is it?” when a new, unknown, character was incorporated into play, at which point the clinician would name the character and give it to the child. Once the child began to initiate “Who is it?” with verbal prompts for approximately 20 trials, time-delay opportunities were provided to produce an opportunity for question-asking without prompts.

“*What happened?*” Motivation to initiate the final question, “What happened?” was increased by providing a cue indicating that something surprising or exciting had just happened. For example, the clinician intentionally created a pause in a game, such as discretely taking apart a train track and making a loud sound as the train fell off the track. The child was then prompted to ask, “What happened?” at which point the clinician immediately and naturally reinforced the child by saying, “The train track broke!” while fixing the track so that the play interaction could continue. After the child initiated “What happened?” with a verbal prompt for approximately 20 trials, a time-delay was introduced to allow the child to spontaneously ask, “What happened?”

The last 2 months of intervention were spent targeting all four questions together so that multiple question-asking opportunities were provided during each intervention session.

Dependent Measures

This study aimed to assess the effects of an initiations intervention focused on question-asking in regard to whether the targeted intervention would lead to general improvement in question-asking, including initiation of new, untargeted questions. As such, the following dependent measures were analyzed: (1) The total number of untargeted questions initiated by the participants; (2) The number of each type of targeted and untargeted question initiated by the participants; and (3) Supplemental measures of collateral gains in communication, daily living skills, and socialization as measured by standardized assessments. The analysis for questions included only spontaneous initiation of social questions that were asked in a novel setting, as defined below.

Untargeted Question Initiations

Data on the total number of novel, untargeted, question initiations, i.e. questions that were not taught in intervention sessions, were collected to evaluate whether the children made general improvements in the skill of question-asking. Untargeted questions asked by each participant were collected through 10-min videotaped communication probes while the child interacted with his caregiver. Communication probes consisted of natural parent–child interactions and took place in a novel setting in which weekly intervention did not occur. Although these parents were taught PRT procedures and met fidelity during treatment sessions, communication probes were representative of natural interactions and parents did not utilize all treatment procedures required to meet fidelity. Additionally, parents did not prompt targeted or untargeted questions and were blind to the hypothesis of the study. Stimulus materials used in the intervention sessions were not available during these generalization probes. Further, as noted above, the parents were asked to play with their child as they would typically play at home.

Questions analyzed in this measure were spontaneous, social in nature, and took place in a novel setting. A social question was defined as a question the child asked with the purpose of initiating or continuing a play interaction. Examples of untargeted questions that were considered social in nature, included “How did you do that?” “Why’d the train stop?” or, “Will you play with me?” Table 3 displays additional examples of targeted and untargeted questions. Questions that were modeled or prompted were not included. For example, questions followed by an adult phrase such as “Ask me ‘What is it?’” or “You can ask me ‘Where is it?’” were not considered spontaneous and were not included in the analysis. Additionally, non-social

questions, such as requests (e.g. “Can you help me?” or “Will you move please?”) were not included in this study.

Types of Question Initiations

The type of questions asked from each category of targeted questions was analyzed to assess if participants were incorporating multiple questions during each interaction as well as maintaining previously learned questions while in a novel setting with novel stimulus items (toys). For example, when the intervention was completed for the target question “What is it?” and we began intervention for a new target question “Where is it?” we analyzed whether the child maintained the use of the question “What is it?” during social interactions or terminated this behavior and constricted questions to only the current intervention target, “Where is it?”

Supplemental Measures of Collateral Gains

In order to systematically understand the effectiveness of a treatment focused on social question-asking, supplemental measures of expressive and receptive communication, daily living skills, and socialization were administered. Measures included standardized direct assessments, the Expressive One-Word Picture Vocabulary Test, Receptive One-Word Picture Vocabulary Test (EOWPVT; ROWPVT; Brownell 2000), as well as parent report, the Vineland Adaptive Behavior Scales II (VABS-II; Sparrow et al. 2005). These assessments were given at baseline and upon completion of the 10-month intervention program to examine any changes in communication and adaptive behavior. Assessments were administered by graduate students beyond the Master’s level who were enrolled in a doctoral program or by a licensed speech-language pathologist. All examiners were naive to the experimental hypothesis of this study.

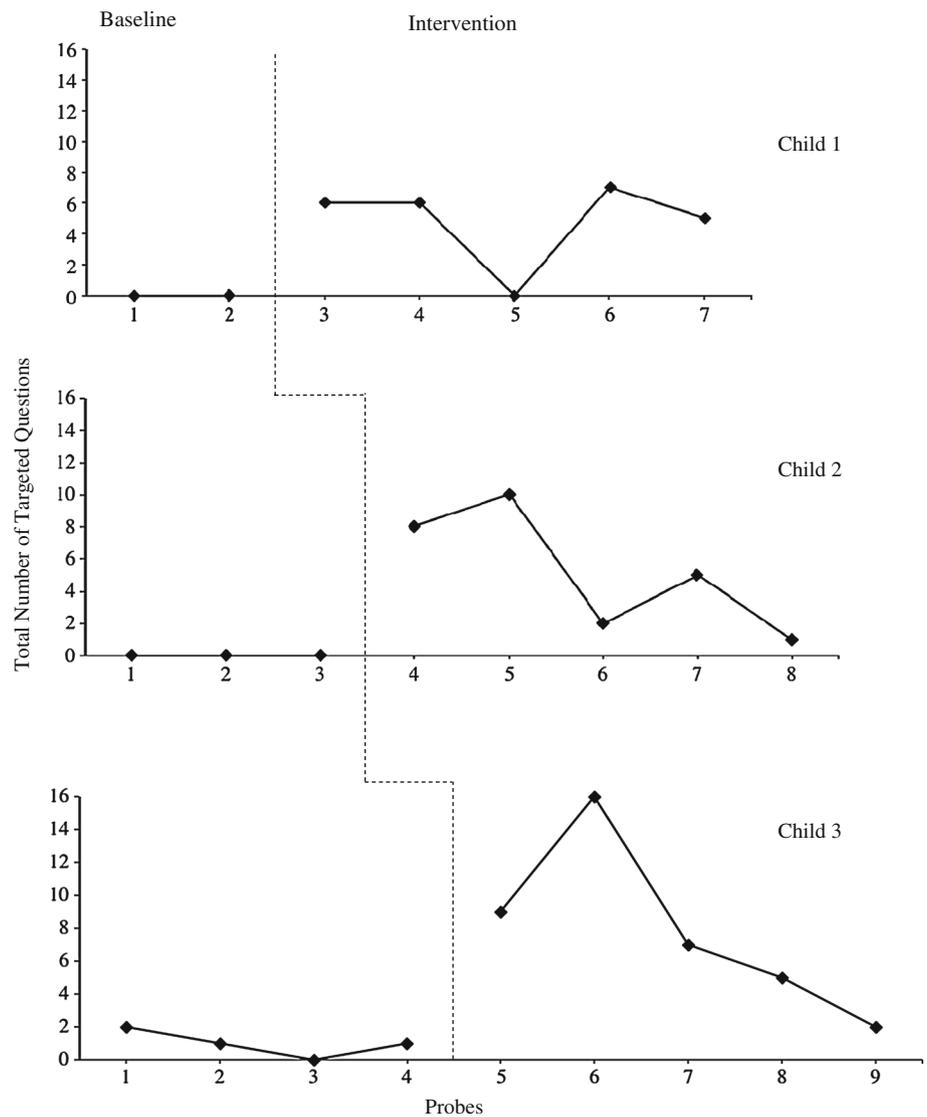
Interobserver Reliability

Videotaped probes were independently viewed and scored for the number and type of initiated question by two observers using the same operationalized definitions, as described above. Reliability was calculated for 20 % of the

Table 3 Example list of targeted and untargeted questions

Targeted questions	Untargeted questions
“What is it?”	“How do we do it?”
“Where is it?”	“Did you see that?”
“What happened?”	“You want this one?”
“Who is it?”	“Want to play?”

Fig. 1 Total number of targeted questions initiated during the 10-min play interaction probes during baseline and intervention



videotaped probes (selected at random) throughout baseline and intervention for each child. Percentage agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100 to yield a percentage. An agreement was defined as each observer scoring a child’s utterance as an initiated question in the same interrogative category (e.g. “What”, “Where”, “Who”, “What happened”, or “Untargeted”). The average percentage agreement for number of questions and type of questions was 89 % with a range of 80–100 %.

Results

Visual analysis of the intervention target, question-asking, was conducted to establish a causal relation between the

implementation of PRT for question-asking and improvements in the target behavior. Analysis of the level, trend, and variability of these data in baseline and intervention phases suggest an effect of PRT on question-asking. Additionally, there are no overlapping data points for Child 1 and 2 and one overlapping data point for Child 3 and the data patterns across similar phases for each participant are consistent. Finally, as mentioned previously, the primary measures of this study were predicted to be delayed effects following the intervention, thus onset of data collection was, by design, delayed. Together, this visual analysis replicates previous research and suggests a functional relation between the intervention and improvements in the treatment target of question-asking (Kratochwill et al. 2010). Results of the primary dependent measures assessing improvements following intervention implementation are presented below (Fig. 1).

Improvement in Untargeted Questions

The first aim of this study was to assess whether children would demonstrate improvements in overall initiated questions, including untargeted questions that were not taught during the intervention. Figure 2 shows the number of untargeted questions initiated by each child during each baseline and intervention probe. These results illustrate that all three children increased the number of untargeted questions subsequent to a targeted question-asking intervention using PRT.

Specifically, Child 1 exhibited zero questions in the two interaction probes with a caregiver during the baseline condition. He began to initiate novel questions in the first intervention probe after only being taught, “What is it?” Throughout intervention, Child 1 spontaneously initiated

an average of 3 (range: 0–6) novel questions per 10-min probe that were not directly taught during the intervention.

Child 2 also did not exhibit any initiated questions during the baseline condition. By the second intervention probe, he initiated three novel questions in a social interaction and continued to maintain this level for the duration of the intervention. Child 2 initiated an average of 2.8 (range: 0–4) novel questions that were not directly targeted in treatment per 10-min probe throughout the intervention period.

Finally, Child 3 did not initiate any untargeted questions during the baseline observations. Gains in untargeted questions were observed again at the second intervention probe when he increased from zero to eight untargeted questions in a novel environment. For this participant, the intervention resulted in initiation of an average of 2.6

Fig. 2 Total number of untargeted questions initiated during the 10-min play interaction probes during baseline and intervention

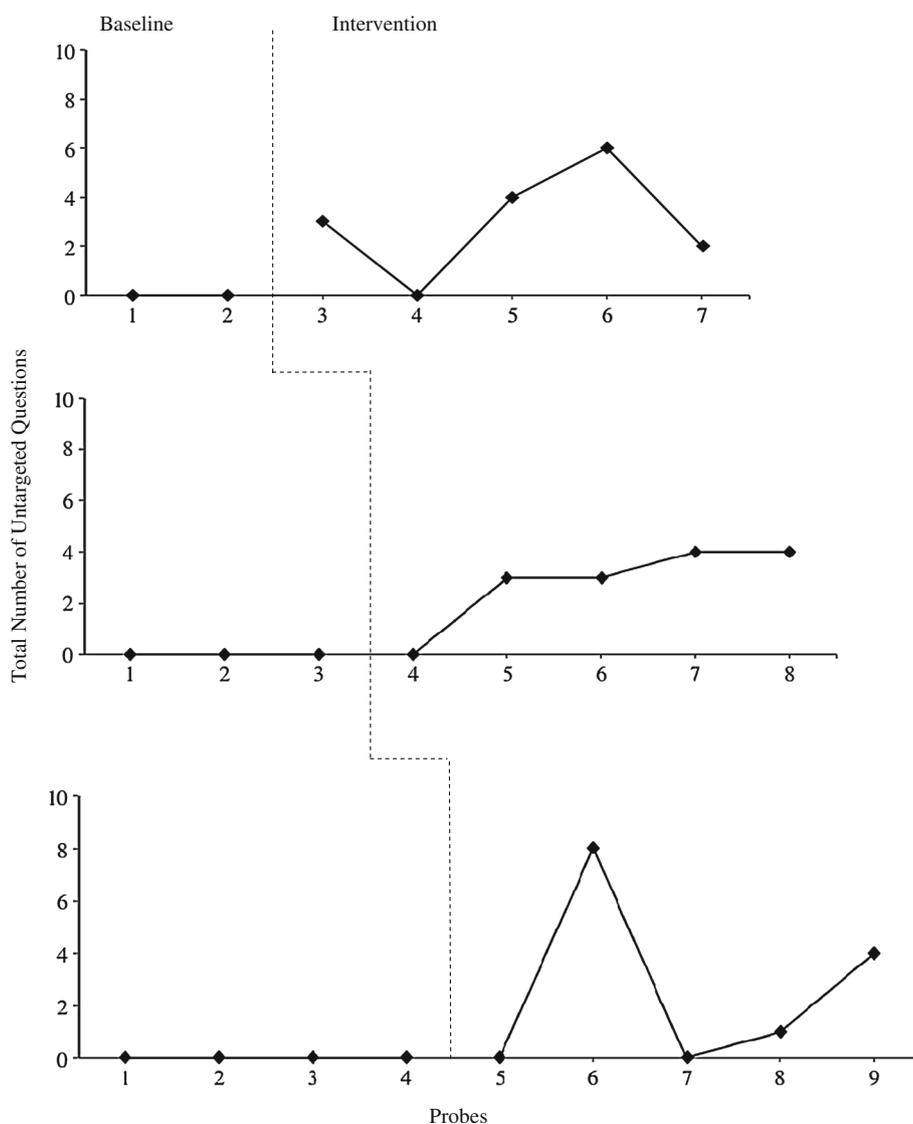
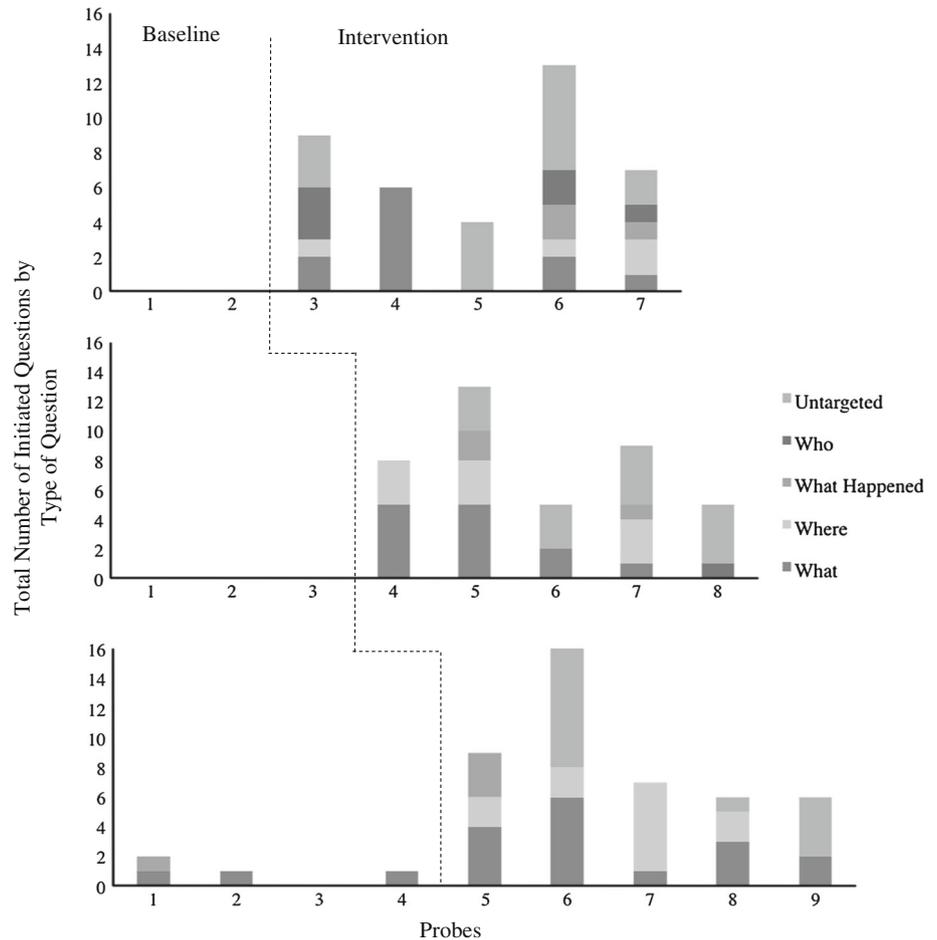


Fig. 3 Total number of spontaneously initiated targeted and untargeted questions, separated by Type, during 10-min play interaction probes during baseline and intervention



untargeted questions (range: 0–8) during a 10-min social interaction probe.

All participants increased the number of untargeted questions initiated in a natural social setting, suggesting that this intervention improved overall question-asking.

Type of Initiated Questions

Intervention consisted of teaching four questions: “What is it?” “Where is it?” “Who is it?” and “What happened?” In order to assess the extent to which each child incorporated each targeted question as well as novel questions into an interaction with their caregiver in a novel setting, the initiation of each interrogative form within the interaction probe was analyzed. Figure 3 shows the initiation frequency of all targeted and untargeted questions separated by type of question as follows: Untargeted, Who, What Happened, Where, and What.

Child 1 initiated the targeted question for that month in the first intervention probe following the onset of intervention and also initiated three additional types of questions not yet targeted. This trend continued for the duration of intervention and for three out of the four intervention probes, the child initiated more than one type of question in a single 10-min

interaction. As a whole, this participant fluidly incorporated multiple questions during natural play interactions with his caregiver. Similarly, Child 2 exhibited the multiple types of questions throughout the intervention. During the first probe following intervention Child 2 initiated two different types of questions in an interaction with his caregiver. During the second through fourth probe he exhibited continued initiation of targeted and untargeted questions in each of the 10-min probes. A similar pattern was observed with Child 3. At the first communication probe during intervention, this child initiated three different types of questions and continued to ask at least two types questions in each additional probe. Together these results illustrate that all three children initiated more than one type of question during each play interaction and continued to maintain previously learned questions throughout intervention.

Supplemental Measures of Collateral Gain

Supplemental measures of gains in communication were included to evaluate consistency with primary observational measures following intervention. A summary of these results can be found on Table 4.

Table 4 Standardized assessment scores pre and post treatment: standard score (percentile)

	Child 1		Child 2		Child 3	
	Pre	Post	Pre	Post	Pre	Post
Vineland communication	91 (27th)	102 (55th)	78 (7th)	97 (42th)	87 (19th)	87 (19th)
Vineland daily living skills	73 (4th)	83 (13th)	71 (3rd)	103 (58th)	73 (4th)	87 (19th)
Vineland socialization	72 (3rd)	85 (16th)	74 (4th)	95 (37th)	63 (1st)	79 (8th)
Vineland adaptive behavior composite	86 (18th)	88 (21st)	73 (4th)	100 (50th)	74 (4th)	74 (4th)
Expressive one-word	106 (66th)	113 (81st)	84 (14th)	97 (42nd)	83 (13th)	109 (73rd)
Receptive one-word	107 (68th)	102 (55th)	55 (<1st)	77 (6th)	98 (45th)	103 (58th)

All three children improved on standardized tests of expressive language. Child 1 scored in the average range on a direct assessment of expressive vocabulary (EOWPVT) before the intervention and improved to the high average range following the intervention. Both Child 2 and Child 3 scored in the low average range for expressive language before intervention and improved to an average score following treatment.

Gains in direct assessment of receptive language (ROWPVT) were seen for two out of the three children. Child 2 improved from a very low score on receptive language to a below average score following the intervention program. Child 3 improved his receptive vocabulary performance slightly, while maintaining a score in the average range.

Supplemental collateral gains in adaptive behavior were assessed with the Vineland Adaptive Behavior Scales parent interview. Two out of three parents reported an increase in communicative skills. While Child 3 maintained his communicative skills based on the parent interview, parents of Child 1 and Child 2 reported improved communicative skills following the question-asking intervention. In regard to daily living skills, all three children improved their engagement in everyday tasks, including getting dressed, eating, and cleaning up. The socialization subscale of the Vineland assesses a child's engagement socially with others including caregivers, siblings, and peers. Although socialization was not directly targeted in the intervention, each participant's parent reported an increase in socialization skills. Finally, the adaptive behavior composite, which provides a composite score of the three aforementioned subscales, showed an increase in Child 1 and Child 2 while it maintained at the same level for Child 3 from pre- to post-intervention.

Discussion

The results of this study extend previous research findings (Koegel et al. 1997, 2010) demonstrating that young children with ASD who do not use questions in communication

can learn to spontaneously initiate social questions during play interactions. The consistency of the pre-post supplemental measures of collateral gain and the repeated observational measures of improvements in communication probes lends itself to the study's findings. Gains were observed in both targeted and untargeted questions, suggesting the possibility of global improvement in the general skill of question-asking following an intervention with motivational components. It is interesting to note that the participants incorporated several types of questions into each interaction, illustrating that questions were fluently integrated into their unstructured play. This indicates that teaching children specific questions in a systematic intervention can produce gains in their overall initiations of questions. These findings have implications for using procedural components of interventions that increase motivation for children with ASD to initiate and interact with others.

Initiations have been identified in the literature as a prognostic indicator of favorable long-term outcomes for children with autism and a pivotal area in terms of collateral gains (Koegel et al. 1999). Further, research has shown that increased initiations are associated with gains in social engagement and more satisfying relationships in children with autism (Rogers 2000; Koegel 2000), suggesting that intervention to improve social question initiations can assist children in core areas of autism including: learning language, joining play opportunities, and participating in collaborative play with peers (Nelson et al. 2007). Thus, this study addressed the need to identify early interventions that can successfully teach question initiations to young children with ASD. At the conclusion of intervention, participants in this study demonstrated increases in their use of targeted and untargeted questions during natural play interactions in a novel setting. These results suggest that the use of PRT focused on initiations led to increases in motivation to ask questions in order to initiate and continue social interactions. Additionally, all children spontaneously produced multiple question forms during each single social interaction, suggesting

maintenance of initiation skills. Lastly, standardized assessments indicated that expressive and receptive communication was improved for each participant following the intervention. These gains were reflected in both direct clinical assessments of language and parent interviews of adaptive functioning, revealing improvements in the functional use of communication in daily living. The inclusion of an adaptive skills assessment as a proposed measure of collateral gains following an initiations intervention is significant given the importance of both cognitive ability and adaptive functioning for functional outcome in children with ASD (Kanne et al. 2011; Klin et al. 2007). Improvements in adaptive functioning indicate that participants were better able to translate their language abilities into real-life skills following the intervention. Together, these findings have theoretical and applied implications for the role of motivational procedures in producing collateral gains and improving core areas of autism.

As the children's initiation of questions improved and their social motivation increased, gains were seen in regard to communication, socialization, and daily living skills. Improvement of behaviors beyond treatment targets was also evidenced by the increase in several types of questions at the start of intervention, subsequent to treatment targeting only one question type. As such, this intervention may indirectly help to improve a wide array of core deficits for children with autism and provides preliminary data suggesting that question-asking may be an important component of the pivotal area of initiations for children with autism. A noteworthy finding is the resulting increases in initiation of *social* questions rather than questions related to restricted interests or behavior regulation (e.g. requests), suggesting that the use of PRT procedures provides a potentially necessary foundation for the emergence of social motivation early in life.

In future studies it may be interesting to investigate the effect of initiations on other variables, such as peer social interaction, mean length of utterance, pragmatics, and responsiveness (Koegel et al. 2003, 2010). Additional research is warranted relating to long-term outcomes of children with autism who receive intervention focused on question-asking, as preliminary research suggests that it may be important for improved long-term outcomes. It may be valuable to assess the impact of question-asking on peer engagement in social environments, such as improving friendships and participation in social activities (McConnell 2002; Rogers 2000).

Results indicate that there was variability within each child's performance and between the children in the outcome variables. For example, Child 3 made substantial gains in expressive communication, but remained stable in his ability to utilize communication as measured through

the Vineland. This may be due to initial difficulties in word production and articulation for Child 3, and this treatment involved explicit teaching and reinforcement of language productions. Furthermore, Child 2 exhibited significant behavior problems prior to intervention, as evidenced by the inability to establish a basal on the CELF despite having the communication abilities to meet a basal. For this child, the intervention may have provided the necessary communicative abilities to replace his disruptive behavior as seen by improvements in behavior, socialization, daily living skills and communication.

There are several limitations to the current study that warrant further research. First, this intervention targeted four specific initiations, but there are a variety of other initiations that could be targeted in future treatments. Research relating to the types of initiations that yield the greatest outcomes, the time period necessary to target initiations, and the child characteristics and age of intervention in relation to best outcomes would be beneficial. Next, the degree to which each child's improvements in question-asking may have been due to parent-implemented PRT strategies during communication probes is uncertain. Parents did not prompt their child to ask questions during interaction probes, though it remains possible that they naturally provided more opportunities for their child to initiate. However, during the generalization probes, the parents were instructed to interact with their children in a naturally playful manner and did not target any of the questions even when PRT procedures were not implemented. Additionally, the inclusion of supplemental skill-based measures in this study helps support the conclusion that these children increased in language and social skills. The field would benefit from additional research measuring child improvements during interactions with unfamiliar adults or peers. Finally, it is unknown how much change occurred between each intervention probe, thus conducting more frequent probes throughout the intervention period may enhance the understanding of the effect of this type of intervention focusing on question initiations. It would additionally help to assess the immediacy of the effect and strengthen this design in its establishment of a functional relation between the implementation of PRT for question-asking and improvement in untargeted behaviors (Lieberman et al. 2010). The questions assessed in this study were spontaneous and occurred in the context of natural conversational interactions during play. Therefore, it appeared as though it was a true indication that the children were able to utilize their newly learned target behaviors in order to initiate other untargeted behaviors outside of the clinic setting. Further research in this area is likely to be very informative.

In summary, this study suggests that a question-asking initiations intervention using motivational components for

young children with ASD resulted in the acquisition and maintenance of targeted questions and the incorporation of untargeted questions during social interactions in novel settings. Moreover, the intervention appears to have a meaningful effect on communicative abilities and adaptive skills for young children with ASD. Further research is necessary to assess the long-term outcomes of this intervention, which could reveal additional widespread improvements in core symptoms of autism.

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