Published in final edited form as:

J Autism Dev Disord. 2014 April ; 44(4): 816–827. doi:10.1007/s10803-013-1932-6.

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

Robert Koegel, Ph.D., Jessica Bradshaw, M.A., Kristen Ashbaugh, M.A., and Lynn Kern Koegel, Ph.D.

Koegel Autism Center, Department of Counseling, Clinical, and School Psychology, University of California, Santa Barbara, Santa Barbara, CA 93106-9490, (805) 893-2049

Abstract

Social initiations make up a core deficit for children with autism spectrum disorder. 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 untargted 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

Social initiations, such as question-asking, have been suggested as a key variable in improving long term outcomes in children with autism (Koegel, Koegel, Green-Hopkins, & Barnes, 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, Sigman, Ungerer, & Sherman, 1986; Newman, 2005; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Warreyn, Roeyers, Van Wetswinkel, & De Groote, 2007; Wetherby & Prutting, 1984). In particular, initiated questions are persistently and pervasively absent in individuals with ASD throughout the life span (Koegel & 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, Koegel, Shoshan, & McNeerney, 1999). Children with autism used 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,

Correspondence concerning this article should be addressed to Robert Koegel or Jessica Bradshaw, Counseling, Clinical, and School Psychology Department, Graduate School of Education, University of California, Santa Barbara, Santa Barbara, California, 93106-9490. Phone (805) 893-2049, Fax (805) 893-2658, koegel@education.ucsb.edu or jbradshaw@education.ucsb.edu.
Robert L. Koegel, Ph.D., Counseling, Clinical, and School Psychology Department, Koegel Autism Center, University of California, Santa Barbara; Jessica L. Bradshaw, M.A., Counseling, Clinical, and School Psychology Department, University of California, Santa Barbara; Kristen Ashbaugh, Counseling, Clinical, and School Psychology Department, University of California, Santa Barbara; Lynn Kern Koegel, Ph.D., Clinical Director, Koegel Autism Center, University of California, Santa Barbara.
Lynn and Robert Koegel are partners in the private firm, Koegel Autism Consultants, LLC.

Symon, & Frea, 2008; Koegel et al., 2010; Koegel, Koegel, Frea, & Fredeen, 2001; Oke & 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, Ashbaugh, Detar, Register, & Koegel, in press; Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998; Koegel & Koegel, 1995).

Additionally, as asking wh- questions is a developmental milestone that sets the groundwork for language learning and vocabulary acquisition (Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998), 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, Lord, Bailey, Schultz, & Klin, 2004). Therefore, initiations and question-asking has been discussed as an important intervention variable (Harper et al., 2008; Koegel et al., 1998; Koegel & Koegel, 1995; Mundy & Crowson, 1997; Mundy & Sigman, 1989; Mundy, Sigman, & Kasari, 1990; Paul, 2008; Warren, Baxter, Anderson, Marshall, & Baer, 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 & 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, Ashbaugh, Detar, Register, & Koegel, in press), 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 untargted 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 & 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, Camarata, Valdez-Menchaca, & Koegel, 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, 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 untargted 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?

Method

Participants

Three 3-year-old children participated in this study. Each child met the following criteria: (a) A diagnosis of an autism spectrum disorder by an outside agency, confirmed by our center according to the DSM-IV TR and an ADOS classification of Autism or Autism Spectrum Disorder (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., 1998), predicted delayed effects were built into the experimental design to more confidently establish a functional relationship (Kratonchwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M. & Shadish, W. R. (2010)). A delay of two months was expected to be adequate to measure generalized gains in use of targeted questions and 2 to 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 throughout the ten-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 ten minutes 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 hours 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 & 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 year old children (Bellugi, 1965; Rowland, Pine, Lieven, & Theakston, 2003). This sequence was as follows: “What is it?”, “Where is it?”, “Who is it?” and “What happened?” Each question was targeted for two months during the first eight 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 two months to assess acquisition of the targeted question as well as untargeted questions in a novel setting. It was hypothesized that after two 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 two hours 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 pathologist. Treatment was delivered according to manualized procedures (Koegel & Koegel, 2012). In addition to weekly supervision sessions, ten minute video clips were scored for fidelity of implementation for the clinicians as well as the parents who participated in the parent education. For each ten-minute recording, fidelity of implementation was scored in one-minute intervals. The following procedures were used to assess fidelity of treatment implementation: within each interval of the ten-minute 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, Camarata, Valdez-Menchaca, & Koegel, 1998). 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 two 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 ten-minute 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 Measure 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 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 supplemental improvements following intervention implementation are presented below.

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 ten-minute 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-minute 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 untargeted questions (range: 0–8) during a ten-minute 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-minute 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-minute 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 Measure 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.

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, Camarata, Valdez-Mechaca, & Koegel, 1998; Koegel, Koegel, Green-Hopkins, & Barnes, 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, Carter, & Koegel, 2003; Koegel et al., 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, parents did not meet PRT fidelity of implementation during communication probes, indicating that these children initiated more 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 untargted 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 untargted 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 untargted 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.

Acknowledgments

This project was supported by NIH Grant Award Number R34 DC010924 from NIDCD (PI: R. Koegel). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Mental Health or the National Institutes of Health. We would like to express our greatest appreciation to the families and children for their dedication to participate in this study. We would also like to thank Crystal Carrillo, Whitney Detar, and Emily Lydston for their significant contribution to the completion of this research study.

References

- Bellugi, U. The development of interrogative structures in children's speech. In: Riegel, K., editor. The development of language functions. Ann Arbor, MI: University of Michigan Language Development Program; 1965. p. 103-138.
- Brownell, R. Expressive and receptive one word picture vocabulary tests. 2. Academic Therapy Publications, California; Novato: 2000.
- Carr, EG.; Levin, L.; McConnachie, G.; Carlson, JI.; Kemp, DC.; Smith, CE. Communication-based intervention for problem behavior: A user's guide for producing positive change. Vol. xxiii. Baltimore, MD, US: Paul H Brookes Publishing; 1994.
- Carter AS, Messinger DS, Stone WL, Celimli S, Nahmias AS, Yoder P. A randomized controlled trial of Hanen's "More Than Words" in toddlers with early autism symptoms. *Journal of Child Psychology and Psychiatry*. 2011; 52(7):741–752.10.1111/j.1469-7610.2011.02395.x [PubMed: 21418212]
- Dawson G, Rogers S, Munson J, Smith M, Winter J, Greenson J, Donaldson A, et al. Randomized, Controlled Trial of an Intervention for Toddlers With Autism: The Early Start Denver Model. *Pediatrics*. 2010; 125(1):e17–23.10.1542/peds.2009-0958 [PubMed: 19948568]
- Frea, WD. Social-communicative skills in higher-functioning children with autism. In: Koegel, RL.; Koegel, LK., editors. Teaching children with autism: Strategies for initiating positive interactions and improving learning opportunities. Baltimore: Brookes; 1995. p. 53-66.
- Freeman BJ. Guidelines for Evaluating Intervention Programs for Children with Autism. *Journal of Autism and Developmental Disorders*. 1997; 27(6):641–651.10.1023/A:1025850715183 [PubMed: 9455726]
- Freeman BJ, Ritvo ER, Needleman R, Yokota A. The Stability of Cognitive and Linguistic Parameters in Autism: A Five-Year Prospective Study. *Journal of the American Academy of Child Psychiatry*. 1985; 24(4):459–464.10.1016/S0002-7138(09)60565-3 [PubMed: 4019975]
- Gillberg C, Steffenburg S. Outcome and prognostic factors in infantile autism and similar conditions: A population-based study of 46 cases followed through puberty. *Journal of Autism and Developmental Disorders*. 1987; 17(2):273–287.10.1007/BF01495061 [PubMed: 3610999]
- Harper CB, Symon JBG, Frea WD. Recess is time-in: Using peers to improve social skills of children with autism. *Journal of Autism and Developmental Disorders*. 2008; 38(5):815–826. [PubMed: 17874290]
- Hung DW. Generalization of "curiosity" questioning behavior in autistic children. *Journal of Behavior Therapy and Experimental Psychiatry*. 1977; 8(3):237–245.
- Kanne SM, Gerber AJ, Quirnbach LM, Sparrow SS, Cicchetti DV, Saulnier CA. The role of adaptive behavior in autism spectrum disorders: Implications for functional outcome. *Journal of autism and developmental disorders*. 2011; 41(8):1007–1018. [PubMed: 21042872]
- Kasari C, Paparella T, Freeman S, Jahromi LB. Language outcome in autism: Randomized comparison of joint attention and play interventions. *Journal of consulting and clinical psychology*. 2008; 76(1):125. [PubMed: 18229990]
- Kasari C, Gulsrud AC, Wong C, Kwon S, Locke J. Randomized Controlled Caregiver Mediated Joint Engagement Intervention for Toddlers with Autism. *Journal of Autism and Developmental Disorders*. 2010; 40(9):1045–1056.10.1007/s10803-010-0955-5 [PubMed: 20145986]
- Klin A, Saulnier C, Sparrow S, Cicchetti D, Volkmar F, Lord C. Social and Communication Abilities and Disabilities in Higher Functioning Individuals with Autism Spectrum Disorders: The Vineland and the ADOS. *Journal of Autism and Developmental Disorders*. 2007; 37(4):748–759.10.1007/s10803-006-0229-4 [PubMed: 17146708]
- Koegel LK. Interventions to Facilitate Communication in Autism. *Journal of Autism and Developmental Disorders*. 2000; 30(5):383–391.10.1023/A:1005539220932 [PubMed: 11098873]
- Koegel LK, Ashbaugh K, Koegel RL, Detar WJ, Regester A. Increasing socialization in adults with asperger's syndrome. *Psychology in the Schools*. in press.
- Koegel LK, Camarata SM, Valdez-Menchaca M, Koegel RL. Setting Generalization of Question-Asking by Children With Autism. *American Journal on Mental Retardation*. 1997; 102(4):346–357. [PubMed: 9475943]

- Koegel LK, Carter CM, Koegel RL. Teaching children with autism self-initiations as a pivotal response. *Topics in Language Disorders*. 2003; 23(2):134–145.
- Koegel LK, Koegel R, Green-Hopkins I, Barnes C. Brief Report: Question-Asking and Collateral Language Acquisition in Children with Autism. *Journal of Autism and Developmental Disorders*. 2010; 40(4):509–515.10.1007/s10803-009-0896-z
- Koegel LK, Koegel RL, Shoshan Y, McNeerney E. Pivotal Response Intervention II: Preliminary Long-Term Outcome Data. *The Journal of The Association for Persons with Severe Handicaps*. 1999; 24(3):186–198.10.2511/rpsd.24.3.186
- Koegel, RL.; Koegel, LK. Pivotal response treatments for autism. Baltimore, MD: Paul H Brookes Publishing; 2006.
- Koegel, RL.; Koegel, LK. Teaching children with autism: Strategies for initiating positive interactions and improving learning opportunities. Baltimore, MD: Paul H Brookes Publishing; 1995.
- Koegel, RL.; Koegel, LK. The PRT Pocket Guide: Pivotal Response Treatment for Autism Spectrum Disorders. Baltimore, MD: Paul H Brookes Publishing; 2012.
- Koegel RL, Vernon TW, Koegel LK. Improving Social Initiations in Young Children with Autism Using Reinforcers with Embedded Social Interactions. *Journal of Autism and Developmental Disorders*. 2009; 39(9):1240–1251.10.1007/s10803-009-0732-5 [PubMed: 19357942]
- Kratochwill, TR.; Hitchcock, J.; Horner, RH.; Levin, JR.; Odom, SL.; Rindskopf, DM.; Shadish, WR. Single-case designs technical documentation. 2010. Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf
- Landa R. Early communication development and intervention for children with autism. *Mental Retardation and Developmental Disabilities Research Reviews*. 2007; 13(1):16–25.10.1002/mrdd.20134 [PubMed: 17326115]
- Landa R, Holman KC, O'Neill AH, Stuart EA. Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: a randomized controlled trial. *Journal of Child Psychology and Psychiatry*. 2011; 52(1):13–21.10.1111/j.1469-7610.2010.02288.x [PubMed: 21126245]
- Lieberman RG, Yoder PJ, Reichow B, Wolery M. Visual analysis of multiple baseline across participants graphs when change is delayed. *School Psychology Quarterly*. 2010; 25(1):28.
- Lovaas OI. Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology*. 1987; 55(1):3–9. [PubMed: 3571656]
- McConnell S. Interventions to Facilitate Social Interaction for Young Children with Autism: Review of Available Research and Recommendations for Educational Intervention and Future Research. *Journal of Autism and Developmental Disorders*. 2002; 32(5):351–372. [PubMed: 12463515]
- Mundy P, Sigman M, Ungerer J, Sherman T. Defining the social deficits of autism: the contribution of non-verbal communication measures. *Journal of child psychology and psychiatry, and allied disciplines*. 1986; 27(5):657–669.
- Mundy P, Crowson M. Joint Attention and Early Social Communication: Implications for Research on Intervention with Autism. *Journal of Autism and Developmental Disorders*. 1997; 27(6):653–676.10.1023/A:1025802832021 [PubMed: 9455727]
- Mundy P, Sigman M. The theoretical implications of joint-attention deficits in autism. *Development and Psychopathology*. 1989; 1(03):173–183.10.1017/S0954579400000365
- Mundy P, Sigman M, Kasari C. A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders*. 1990; 20(1):115–128.10.1007/BF02206861 [PubMed: 2324051]
- Nelson C, McDonnell AP, Johnston SS, Crompton A, Nelson AR. Keys to play: A strategy to increase the social interactions of young children with autism and their typically developing peers. *Education and Training in Developmental Disabilities*. 2007; 42(2):165–181.
- Newman B. Self-management of Initiations by Students Diagnosed with Autism. *The Analysis of Verbal Behavior*. 2005; 21(1):117. [PubMed: 22477317]
- Oke NJ, Schreibman L. Training social initiations to a high-functioning autistic child: Assessment of collateral behavior change and generalization in a case study. *Journal of Autism and Developmental Disorders*. 1990; 20(4):479–497.10.1007/BF02216054 [PubMed: 2279969]

- Paul, R. Communication Development and Assessment. In: Klin, A.; Volkmar, F.; Chawarska, K., editors. Autism spectrum disorders in infants and toddlers: Diagnosis, assessment, and treatment. New York, NY: Guilford Press; 2008.
- Peck CA. Increasing opportunities for social control by children with autism and severe handicaps: Effects on student behavior and perceived classroom climate. *Journal of the Association for Persons with Severe Handicaps*. 1985; 10(4):183–193.
- Rogers SJ. Interventions that facilitate socialization in children with autism. *Journal of Autism and Developmental Disorders*. 2000; 30(5):399–409. [PubMed: 11098875]
- Rowland CF, Pine JM, Lieven EV, Theakston AL. Determinants of acquisition order in wh-questions: Re-evaluating the role of caregiver speech. *Journal of Child Language*. 2003; 30(3):609–636. [PubMed: 14513470]
- Schertz HH, Odom SL, Baggett KM, Sideris JH. Effects of Joint Attention Mediated Learning for toddlers with autism spectrum disorders: An initial randomized controlled study. *Early Childhood Research Quarterly*. 2013; 28(2):249–258.10.1016/j.ecresq.2012.06.006
- Sparrow, SS.; Cicchetti, DV.; Balla, DA. Vineland adaptive behavior scales: (Vineland II), survey interview form/caregiver rating form. Livonia, MN: Pearson Assessments; 2005.
- Stone WL, Ousley OY, Yoder PJ, Hogan KL, Hepburn SL. Nonverbal Communication in Two- and Three-Year-Old Children with Autism. *Journal of Autism and Developmental Disorders*. 1997; 27(6):677–696.10.1023/A:1025854816091 [PubMed: 9455728]
- Szatmari P, Bartolucci G, Bremner R, Bond S, Rich S. A follow-up study of high-functioning autistic children. *Journal of Autism and Developmental Disorders*. 1989; 19(2):213–225.10.1007/BF02211842 [PubMed: 2745389]
- Taylor BA, Harris SL. Teaching children with autism to seek information: acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis*. 1995; 28(1): 3–14.10.1901/jaba.1995.28-3 [PubMed: 7706148]
- Venter A, Lord C, Schopler E. A Follow-Up Study of High-Functioning Autistic Children. *Journal of Child Psychology and Psychiatry*. 1992; 33(3):489–597.10.1111/j.1469-7610.1992.tb00887.x [PubMed: 1577895]
- Volkmar FR, Lord C, Bailey A, Schultz RT, Klin A. Autism and pervasive developmental disorders. *Journal of Child Psychology and Psychiatry*. 2004; 45(1):135–170.10.1046/j.0021-9630.2003.00317.x [PubMed: 14959806]
- Warren SF, Baxter DK, Anderson SR, Marshall A, Baer DM. Generalization of Question-Asking by Severely Retarded Individuals. *Journal of the Association for the Severely Handicapped*. 1981; 6(3):15–22.
- Warren P, Roeyers H, Van Wetswinkel U, De Groote I. Temporal Coordination of Joint Attention Behavior in Preschoolers with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*. 2007; 37(3):501–512.10.1007/s10803-006-0184-0 [PubMed: 16915534]
- Wetherby AM, Prutting CA. Profiles of Communicative and Cognitive-Social Abilities in Autistic Children. *J Speech Hear Res*. 1984; 27(3):364–377. [PubMed: 6482406]
- Yoder PJ, Warren SF. Maternal responsivity mediates the relationship between prelinguistic intentional communication and later language. *Journal of Early Intervention*. 1999; 22(2):126–136.

Figure 1. Total number of targeted questions initiated during the ten-minute play interaction probes during baseline and intervention.

Figure 2. Type of spontaneously initiated targeted and untargeted questions during ten-minute play interaction probes during baseline and intervention.

Figure 3. Total number of spontaneously initiated targeted and untargeted questions, separated by Type, during ten-minute play interaction probes during baseline and intervention.

Table 1

Participant Characteristics and Standardized Assessments with Standard Scores^a (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 (27 th)	78 (7 th)	87 (19 th)
Vineland Daily Living Skills Total	73 (4 th)	71 (3 rd)	73 (4 th)
Vineland Socialization	72 (3 rd)	74 (4 th)	63 (1 st)
Vineland Adaptive Behavior Composite	86 (18 th)	73 (4 th)	74 (4 th)
Expressive One-Word	106 (66 th)	84 (14 th)	83 (13 th)
Receptive One-Word	107 (68 th)	55 (<1)	98 (45 th)
CELF Core Language	90 (25 th)	Unable to establish Basal	22 (14 th)
CELF Receptive Language	86 (86 th)	Unable to establish Basal	23 (18 th)
CELF Expressive Language	94 (34 th)	Unable to establish Basal	15 (8 th)

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

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 provided for the four targeted questions: What, Where, What Happened, and Who.
Response/ Interaction	Reinforcement of attempts	<u>Child</u> asks an approximation of a question about stimulus item or action (e.g., approximation of "What's that?"); <u>Adult</u> answers the question.
Consequence	Natural Reinforcer	Child provided with natural reinforcer, such as an opportunity to interact or play with the item.

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?"

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 (27 th)	102 (55 th)	78 (7 th)	97 (42 th)	87 (19 th)	87 (19 th)
Vineland Daily Living Skills	73 (4 th)	83 (13 th)	71 (3 rd)	103 (58 th)	73 (4 th)	87 (19 th)
Vineland Socialization	72 (3 rd)	85 (16 th)	74 (4 th)	95 (37 th)	63 (1 st)	79 (8 th)
Vineland Adaptive Behavior Composite	86 (18 th)	88 (21 st)	73 (4 th)	100 (50 th)	74 (4 th)	74 (4 th)
Expressive One-Word	106 (66 th)	113 (81 st)	84 (14 th)	97 (42 nd)	83 (13 th)	109 (73 rd)
Receptive One-Word	107 (68 th)	102 (55 th)	55 (<1 st)	77 (6 th)	98 (45 th)	103 (58 th)