Autism Spectrum Disorders (ASD) are considered to be neuro-developmental disorders; they involve language delays, social and communication challenges, and unusual behavior and interests. Autism has been commonly diagnosed around 3 years of life. However, the clinical onset of autism appears to be preceded by an excessive increase in head size between six to 14 months (Courchesne, Carper, & Akshoomoff, 2003), and the behavioral characteristics appear around 12 (Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2008) to 18 months (Robins, Fein, Barton, & Green, 2001). In recent years, the number of children diagnosed with autism spectrum disorders has dramatically risen. So it is a pressing challenge to develop an early screening system and effective educational program for young children with autism spectrum disorders.

In the past four decades, evidence has demonstrated that the intellectual, communicative, and social functions of many children with autism spectrum disorders improved as a result of interventions based on applied behavior analysis (Dawson, Rogers, Munson, Smith, Winter, Greenson, Donaldson, A. &
Applied behavior analysis (ABA) is a scientific approach for modifying human behavior by analyzing the correlation between the behavior and the environment. Applied behavior analysis programs for autism spectrum disorders include several teaching techniques, most notably discrete trial teaching and a naturalistic behavioral approach. Several studies related to discrete trial teaching and the naturalistic behavioral approach have supported the effectiveness of these methods by using randomized controlled trials (Dawson et al., 2010; Smith et al., 2000).

Discrete trial teaching involves breaking down skills into small sub-skills, and teaching the sub-skills intensively, one at a time, according to a curriculum. In that training, children repeat small sequences of contingencies, including an antecedent stimulus, their behavior, and consequent reinforcement, so that they learn the desired skills. Although this technique definitely improves children’s skills, it usually requires intensive and long-term training. Also, without specifically planned curriculum, this method has a difficulty generating the desired skills. On the other hand, the naturalistic behavioral approach, in which therapists teach target behaviors within child-led activities, is more child-centered. It would seem easier for children to initiate and generate the acquired skills, because they would have learned the skills in situations similar to their natural activities.

Several studies have reported the effects of programs based on a naturalistic behavioral approach. Pivotal response training (PRT), one such program, aims to increase children’s motivation for learning desired skills. It has been most successful for language (Coolican, Smith, & Bryson, 2010), play (Stahmer, 1999), and social interaction skills (Koegel & Koegel, 2006) in children with autism. The positive changes in those behaviors have also been shown to have had widespread effects on other behaviors (Koegel & Koegel, 2006). Pivotal response training uses a guideline for teaching skills mainly to the parents, but it does not have a specific developmental curriculum.

The Early Start Denver Model (ESDM) is a comprehensive developmental behavioral intervention program for children who have been diagnosed with autism spectrum disorders (Rogers & Dawson, 2010). The Early Start Denver Model focuses on supporting all areas of the child’s development, with play and natural family routines as activities for learning (Vismara, Colombi, & Rogers, 2009). Dawson et al. (2010) reported that children who received two years of intervention with the Early Start Denver Model showed significant improvements in IQ, adaptive behavior, and autism diagnosis, compared to children who received a community based intervention.

Because only a few evidence-based intervention programs have released in Japan, the present authors developed the Keio Early Intervention Program 2010 (KEIP10; Yamamoto & Matsuzaki, 2010), an approach that integrates the naturalistic behavioral approach and a developmental approach, for use with young
children with developmental delays including autism. KEIP10 promotes the development of early communication skills in natural settings through interactions between the child and adult. The methodology includes pivotal response training and the Early Start Denver Model, and the curriculum and intervention systems were designed to suit the Japanese culture and educational system. The list of target behaviors consists of six subscales: early communication development, attention to social stimuli, joint attention, imitation, receptive language, expressive language, and social interaction. Each subscale consists of 11 to 24 target behaviors, for a total of 89 items. KEIP10 can be started as soon as adults have concerns about a child’s development, even before getting a final diagnosis.

The distinctive characteristics of KEIP10 include the following: (a) it is an early start intervention program based on principles of a naturalistic behavioral approach and a developmental approach, (b) it targets six subscales related to early communication development; the target behaviors are chosen through an assessment, (c) it aims at collateral changes in social behaviors, (d) the program can be started regardless of the child’s diagnosis, and (e) it can be implemented in several settings and by various people, including the child’s parents at home, teachers in nursery schools, and staff working at regional support centers.

The purpose of the present study was to examine whether a child with autism could acquire early communication skills with the KEIP10 program. His developmental progress was analyzed across a baseline period and during treatment; three months after the end of treatment, follow-up measures were taken. Also, collateral effects of the program were examined.

**Method**

**Participant**

One Japanese boy, Taro (not his real name), participated in this study. Taro was 3 years 4 months old, and had been diagnosed as having autism by a pediatrician not related to this study. Taro’s parents had sought a home program intervention. The experiment was conducted with the parents’ consent, which was given after they had received a detailed explanation of the study.

Prior to the start of the study, Taro was assessed with the Kyoto Scale of Psychological Development 2001 (KSPD; Ikuzawa, Matsushita, & Nakase, 2002). Taro’s KSPD scores yielded a physical-movement age of 10 months (Developmental Quotient; DQ 24), cognitive-adaptive age of 5 months (DQ 13), and language-sociability of 6 months (DQ 14).

Taro had been medicated for episodes of epilepsy. His parents first became concerned about his development when he was 18 months old. They reported that he had showed very limited eye contact, a lack of interest in people, a lack of response to his name, and little language development. Taro could not walk unaided, and had been attending a rehabilitation program once a week. The
cause of his developmental delay was not specified in the physiological examinations.

**Target Behaviors**

During the KSPD assessment, Taro looked at sound sources, such as the sound of toys and musical instruments. He reached objects that he was interested in by crawling to and grabbing toys, and played with them by tapping or flapping them repetitively. He barely made eye contact with adults and seemed to look through rather than at them. He smiled in response to physical stimulation, such as tickling, blowing air at him, or holding him up high. He did not have functional speech, but vocalized when he was excited. He used gestures, such as moving the therapist’s hand to requesting help and reaching out his arms in order to be picked up. As a result of direct observation, three target subscales were selected: attention to social stimuli, responding to joint attention (RJA), and imitation. The target behaviors were chosen from the KEIP10 check list. The target behaviors are described in Table 1.

**Setting**

The baseline, treatment, and three-month follow-up sessions took place at Taro’s house in a room about 7 m². A child-sized table, chair, assortment of developmentally and age-appropriate toys (e.g., a toy piano, picture books, balls, mechanical toys, stuffed animals), and video camera were in the room. The door was left open, and Taro’s parents watched the treatment sessions from the next room.

**Procedures**

**General procedure.** Prior to the experiment, KSPD and other developmental tests were administered. In addition, an opportunity was provided for Taro to interact with the therapists before the study started.

For the baseline measures, three 1-hour sessions were held to assess each target behavior. Treatment consisted of 11 consecutive sessions, each of which lasted 1 hour. Three months after the last day of the treatment sessions, three 1-hour follow-up sessions were carried out. The baseline and follow-up sessions were held once a week, and treatment sessions, 2 to 3 times per week. Treatment sessions were conducted primarily by the first author, a graduate student who was one of the developers of the KEIP10. One or two other graduate students majoring developmental psychology worked as assistant therapists. All sessions were video recorded with a camera in the room and supervised by the second author, a clinical psychologist and professor of developmental psychology.

**Baseline.** Target behaviors were assessed by the first author as therapist. She sat on the floor facing Taro, approximately at his eye level, 50 cm away from him. Taro was sitting either on his chair or on an assistant therapist’s lap. The therapist talked, pointed, gestured, and played by using toys as antecedent stim-
<table>
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<tr>
<th>Target behaviors and Descriptions</th>
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<tr>
<td><strong>1. Attention to social stimuli</strong></td>
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<tr>
<td><strong>Target behavior</strong></td>
</tr>
<tr>
<td>A) Attends to adult’s gesture or activity by looking, reaching, or touching</td>
</tr>
<tr>
<td>B) Attends to adult’s face or facial expression by looking, reaching, or touching</td>
</tr>
<tr>
<td>C) Attends to adult in social game, such as peek-a-boo, toy play, tickling, or blowing bubbles, by looking, reaching, or smiling</td>
</tr>
<tr>
<td>D) Attends to adult’s singing or dancing by looking, reaching, or smiling</td>
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<tr>
<td><strong>2. Responding to joint attention</strong></td>
</tr>
<tr>
<td>A) Looks at adult’s pointing finger when it is within child’s visual field</td>
</tr>
<tr>
<td>B) Follows adult’s pointing finger after looking at it</td>
</tr>
<tr>
<td>C) Follows adult’s pointing finger to a proximal object or location</td>
</tr>
<tr>
<td><strong>3. Imitation</strong></td>
</tr>
<tr>
<td>A) Imitates adult’s action (showing both palms to the front)</td>
</tr>
<tr>
<td>B) Imitate adult’s action (moving both hands up and down)</td>
</tr>
<tr>
<td>C) Imitates adult’s action (moving both hands from side to side)</td>
</tr>
<tr>
<td>D) Imitates adult’s action (raising up both hands)</td>
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</tbody>
</table>
uli, and acknowledged Taro when he interacted socially with the therapist. All of the activities and materials were chosen by Taro, and interactions between the therapist and Taro proceeded in a natural setting.

**Treatment.** The setting was kept identical to that of the baseline phase. In treatment, 11 tactics, based on pivotal response training (Koegel & Koegel, 2006), were implemented. The tactics are described in detail in the KEIP10 manual (Yamamoto & Matsuzaki, 2010). The tactics included the following components: (a) capture the child’s attention by using big gestures and facial expressions, (b) give instructions or questions after confirming that the child is paying attention, (c) give clear instructions, (d) choose activities according to the child’s preference, (e) offer both a maintenance task and an acquisition task, (f) provide a model when introducing a new task, (g) prompt appropriately, (h) reinforce approximate behaviors, (i) take turns with the child when teaching play skills, (j) reinforce the child immediately after the child behaves appropriately, and (k) reinforce the child’s behavior contingently.

The target behaviors were decomposed into small steps, and the therapist intensively repeated the set of contingencies, antecedent stimulus, behavior, and reinforcement. Throughout the intervention, positive interactions were built by reinforcing occurrences of the target behaviors in child initiated activities. Table 2 shows detailed examples of the treatment procedures for the target behaviors.

**Three-month follow up.** Three follow-up sessions were conducted 3 months after the completion of the treatment. The setting and procedures were same as in the baseline phase.

**Experimental Design**

A multiple-baseline design across behaviors (Barlow, Nock, & Hersen, 2008) was used to evaluate effects of the intervention.

**Dependent Measures**

All sessions were video recorded to enable behavioral coding and qualitative observation. All behaviors are described in Table 1. Coding procedures were as follows: (a) Attention to social stimuli: each session was divided into 4 blocks of 15 minutes each. Each of the 4 target behaviors was observed and scored as either 1 for occurrence or 0 for non-occurrence. The sum of the scores (maximum 16) was used as the score for attention to social stimuli for each session. (b) Responding to joint attention: occurrences of responding to joint attention were scored for each trial, and the percentage of trials on which responding to joint attention had occurred was calculated. An occurrence of responding to joint attention was counted when Taro responded within 5 seconds after the onset of an antecedent stimulus, such as looking at the therapist’s index finger or moving the therapist’s finger to one side. (c) Imitation: occurrences of imitation were scored for each trial, and the percentage of trials in which imitation had occurred was calculated. An occurrence of imitation was counted when Taro
responded within 5 seconds after the onset of a stimulus, such as looking at the therapist’s hands or moving the therapist’s hands up or down. (d) Duration of attentiveness: duration of Taro’s attention to social activities was measured as a multi probe (Barlow et al., 2008) in order to examine whether KEIP10 program had collateral effects. The definition of attention to social activity was (i) the duration that Taro looked at the therapist, (ii) the duration that he looked at toys that the therapist was using, and (iii) the duration that he played socially with toys. Durations in which he exhibited repetitive behavior, crying, requested to be picked up, or was fretful were excluded.
Social Validity

To determine the social significance of the intervention, video clips of the intervention were shown to 10 undergraduate and graduate psychology majors who were unfamiliar with the purpose of the study. Two clips were taken from the baseline phase to represent pre-treatment, and two from the end of the treatment phase, to represent post-treatment. The order in which the video clips were shown was randomized, and presented blind to the raters. The raters were asked to rate the video clips using a questionnaire composed of 6 questions; (a) is the child frustrated, (b) is the child unwilling to interact with the adult, (c) is the child bored, (d) is the child enjoying the activities, (e) is the child looking at the adult, and (f) is the child enjoying being with adult. The question were rated on a 5-point Likert-type scale with poles marked (1) disagree completely, (3) neither agree nor disagree, and (5) agree completely. Questions (a) through (c) targeted the child’s negative behavior, and questions (d) through (f), the child’s positive behavior. Items on negative and positive behavior were intermixed when presented to the raters.

Reliability

Inter-observer reliability was obtained for a randomly selected 23% of sessions, including sessions from the baseline, treatment, and follow-up periods. The first author and an independent coder coded each behavior. Cohen’s $\kappa$ (Cohen, 1968) was .77, which was considered to be a high level of agreement.

Result

Taro’s performance during baseline, treatment, and 3-month follow-up phases is presented in Fig. 1.

Attention to Social Stimuli

The scores for attention to social stimuli represent the total number of occurrences of the four behaviors in each session. The average score increased from 0.5 (range=0 to 2) in the baseline phase to 9.6 (range=2 to 16) in the treatment phase. The best score was 16 at the end of the treatment phase. In the follow-up phase, the scores for attention to social stimuli decreased slightly to 12 in the first of the three follow-up sessions, but rose again to 14 in the third session.

Moreover, Taro’s behavior changed qualitatively as well. In the baseline phase, Taro glanced at sound sources or toys when the therapist made noise or was playing with a toy, but immediately went back to repetitive behavior, such as hand flapping or tapping toys. After the treatment started, he made an eye contact for more than 1 minute, and smiled at the therapist. Although he laughed aloud before the treatment, it was only when he was held up high or was tickled. After the treatment phase started, he looked fixedly at a toy and smiled.
when it moved. Also, he laughed when he expected that he would be tickled or massaged.

**Responding to Joint Attention**
The percentage of correct responses averaged 7% (range=0% to 11%) in the baseline phase, and increased to 58% (range=28% to 84%) in the treatment phase. The best score was 84% at the end of treatment phase. The score dropped to 33% in the first session of the follow-up phase, and did not change much during the next two sessions.

**Imitation**
The percentage of correct responses averaged 9% (range=0% to 22%) in the baseline phase, and increased to 57% (range=40% to 67%) in the treatment phase. The score had decreased to 36% at the beginning of the follow-up phase, but increased again to 86% by the end of the three-consecutive follow-up sessions.

![Graph showing changes in scores for each target behavior](image)

**FIG. 1** Change in Scores for Each Target Behavior

*Note.* The scores for attention to social stimuli represent the total number of occurrences within a 1-hour session. Data points for responding to joint attention and imitation are the percentage of behavior occurrences per trial.
**Duration of Attentiveness**

The duration of Taro’s attending to activities without crying, fretting, or engaging in repetitive behaviors, increased from an average of 30 seconds in the baseline phase to 156 seconds in the treatment phase (see Fig. 2). Also the total time that he attended to the activities of a session increased from 20 minutes in the baseline phase to 42 minutes in the treatment phase, as Fig. 2 indicates. During the three-month follow-up observations, the duration of attentiveness was found to have been maintained at a high level.

**Social Validity**

Table 3 shows the results of the ratings of social validity by the student raters. Overall, the raters’ scores reflected a decrease in negative behavior and an increase in positive behavior in the treatment phase. All 10 raters consistently reported improvements in looking at the adult and enjoying being with the adult.

**Discussion**

The purpose of the present study was to examine effects of the KEIP10 program on the development of pre-linguistic early communication skills of a 3-year

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**Note.** The data points represent the average duration of attentiveness in social interactions for each period of the study (upper panel) and the total duration of attentiveness in all social interactions within the 1-hour sessions (lower panel).
4-month-old boy with autism.

The results showed that the intervention was effective for improving his attention to social stimuli, responding to joint attention, and imitation skills. His attention improved as the treatment sessions continued, and his skills were well maintained when measured at a three-month follow-up. Taro’s attention to social stimuli showed better maintenance at follow-up than did the other acquired skills. One result of having used a multiple-baseline design across behaviors was that more time was given to intervening on attention skills than the other skills. This suggests that more sessions might be needed in order to have the skills maintained in the child’s repertoire.

The scores on responding to joint attention increased in the treatment phase, but were lower at the time of follow-up, and during the three follow-up sessions, did not recover to the level that had been reached at the end of the treatment sessions. However, the average of the scores on this measure during follow-up was higher than the average during baseline, and the difference between the scores before and after the intervention is apparent. This suggests that he might have had only a few opportunities to use the skill of responding to joint attention in his daily life.

The imitation skill scores had decreased at the time of the three-month follow-up but increased again, to a level even better than before, in the third follow-up session. To be able to imitate, persistence of attention is indispensable. The observed results imply that although he acquired imitation skills, the imitation skill scores would be depend on his attention for steady performance.

Additionally, Taro developed his communication skills qualitatively as well. The main behavioral improvement was that he came to smile and make eye contact more frequently during the treatment phase. In addition, as he became accustomed to the treatment, he tried to get out of the room less often. After the treatment, his parents reported his progress in their daily routines, such as looking at his parents when his name had been called, making eye contact, and imitating a parent’s actions more.

Furthermore, the data indicated improvement in his attentiveness. The duration of attentiveness in the treatment phase increased about 5 times compared to the duration in the baseline phase. In addition, the total time of attentiveness in the treatment phase doubled. The duration of attentiveness increased immedi-

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### TABLE 3 Results of the Ratings of Social Validity

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>At the end of the intervention</th>
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<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Positive behavior</td>
<td>1.6</td>
<td>.15</td>
</tr>
<tr>
<td>Negative behavior</td>
<td>4.5</td>
<td>.08</td>
</tr>
</tbody>
</table>

*Note.* Rating scores were: 1=disagree completely, 2=mostly disagree, 3=neither agree nor disagree, 4=mostly agree, 5=agree completely.
ately after the treatment phase started, before Taro had learned any of the target behaviors. Therefore, it should be considered that the changes in his attentiveness might also be due to positive interactions between the therapists and Taro.

These results indicate that this intervention has advantages in that (a) the child can enjoy learning early communication skills effectively, (b) the child can be attentive to the intervention with positive interactions, and (c) the child can have many opportunities to learn communication skills within a natural setting.

In the present study, the total duration of the intervention, 11 hours, was much shorter than in previous studies by other researchers. One of the distinctions of KEIP10 is that therapists can intervene intensively with focused behaviors, even though the activities themselves are chosen by the child. Therefore, the intervention can be applied in children’s daily life, and they can learn communication skills within a short period.

Also this program might change the way that the parents interact with their child. We did not arrange any parent training, workshop, or homework for Taro’s parents. However, the parents watched what the therapists were doing, and may have tried to apply the intervention techniques by themselves whenever they had a chance.

Further research is required to analyze effects of the KEIP10 program with more participants and with a control group. We have already started studies to examine the applicability of the KEIP10 program for parent and staff training. We seek to develop a program that is cost-effective, easily accessible, and less stressful for young children with delays in early communication development and their caregivers than other currently available programs.

Acknowledgements

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