Preschool Life Skills Training Using the Response to Intervention Model with Preschoolers with Developmental Disabilities

by

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Abstract

Previous research has examined a variety of methods for teaching young children important social skills in preschool to increase prosocial behavior and reduce classroom behavior problems. Preschool life skills (PLS) programming has taught young children to request teacher assistance, tolerate delays or denial in the delivery of materials, friendship skills, and functional communication skills. The purpose of the current study was to extend the PLS literature by assessing the intrusiveness of instruction necessary to teach children with developmental disabilities to response to their name, request attention and assistance, and tolerant delays and denial. A multiple-baseline across-behaviors design was used to demonstrate the effects of instruction, differential reinforcement, and error-correction procedures that systematically increased in intrusiveness as necessary for participants to acquire skills. Five participants acquired skills using general instructional strategies, and three participants required individualized instruction to learn skills. The training required varied across participants and skills. Pre-baseline and post-mastery probes were conducted in the classroom with adults and peers to test for generalization. In general, poor generalization of the acquired skills with peers and adults was observed.

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Introduction

Preschool and kindergarten programs focus on teaching school-readiness skills to young learners. In addition to targeting the acquisition of academic skills, preschool and kindergarten programs help teach children crucial social skills. In fact, kindergarten teachers view preparing children to satisfy the social demands of schooling as a higher priority than the development of their academic skills (Lin, Lawrence, & Gorrell, 2003; Piotrkowski, Botsko, & Matthews, 2001). For example, in a sample of over 3,000 kindergarten teachers, Lin et al. (2003) identified five social skills teachers reported as most important: communicating wants and thoughts, not being disruptive in class, following directions, taking turns, and being sensitive to others. These reports are consistent with other studies reporting that preschool and kindergarten teachers are frequently concerned with the social and emotional development of their students (Hains, Fowtrler, Schwartz, Kottwitz, & Rosenkoetter, 1989; Johnson, Gallagher, Cook, & Wong, 1995; Wesley & Buysse, 2003). This increased focus on social maturation, or lack thereof, for early learners is warranted, as failure to acquire appropriate prosocial skills in school may interfere with future school success and require expensive or time-consuming interventions (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002; Olson & Hoza, 1993).

The importance of social skills acquisition at school is made evident when considering that nonmaternal, center-based childcare has been linked to problem behavior in young children. In a recent study by the National Institute of Child Health and Human Development (NICHD; 2003), researchers discovered that time spent in childcare during the first 4.5 years of life was positively correlated with reports of aggression and noncompliance. Similarly, Eryigit-Madzwamus and Barnes (2013) found that children who attended center-based childcare before the age of two were at significant risk for developing behavior problems, including tantrums and

noncompliance, later in life. One explanation for these findings is that large-group settings with high children to adult ratios may inhibit the development of appropriate coping strategies (e.g., learning to wait or share) and expressive language abilities (e.g., requesting assistance from a teacher). As more families rely on center-based childcare for their young children, the burden of teaching appropriate social skills falls more heavily on teachers and educators. Unfortunately, failure to acquire appropriate prosocial skills in school may interfere with future school success and require expensive or time-consuming interventions (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002; Olson & Hoza, 1993).

Research on the importance of social skills indicates that specific prosocial skills are especially important in facilitating academic success while minimizing problem behavior in the classroom. For example, functional communication skills, such as appropriately recruiting a teacher's assistance or attention, provide an appropriate means for young children to gain access to reinforcing stimuli or escape from aversive situations (Carr & Durand, 1985; Durand & Carr, 1991; Lalli, Casey, & Kates, 1995). Similarly, the ability to tolerate restricted or delayed access to reinforcers in the absence of problem behavior is also a crucial social skill for young children (Dixon et al., 1998; Vollmer, Borrero, Lalli, & Daniel, 1999). Without appropriate skills in their repertoires, children are more likely to engage in problem behavior (e.g., screaming, aggression) during periods of restricted access or low attention that could result in delivery of the reinforcers by caregivers and teachers. Consequently, if the schedule of reinforcement favors problem behavior over appropriate behavior, and children are able to access reinforcers more readily by engaging in problem behavior (i.e., not having to wait for delivery of an item or assistance), children will be more likely to engage in problem behavior in the future instead of appropriate behavior (Vollmer et al., 1999).

Following directions from teachers is another critical skill that is prioritized by teachers and parents and is necessary to be successful in school (Hamlet, Axelrod, & Kuerschner, 1984; Lin et al., 2003). Previous research has examined ways to increase students' compliance with teacher directives by evaluating precursor responses that increase the likelihood of compliance. For example, making eye contact with the teacher, stopping competing activities, orienting towards the teacher, and saying "yes" when one's name is called are all responses that increase compliance with teacher directives (Hamlet et al., 1984; Kraus, Hanley, Cesana, Eisenberg, & Jarvie, 2012). Failure to acquire such precursor skills at an early age may put children at increased risk for noncompliance, making it difficult for teachers to provide instruction in an effective and efficient manner (Hamlet et al., 1984).

Behavioral Skills Training

There are a variety of procedures used in educational settings to teach social skills to young children. Behavioral skills training (BST) is a treatment package that teaches complex skills through instructions, modeling, rehearsal, and feedback (Miltenberger, 2008). Teaching using BST involves the delivery of clear, concrete instructions, followed by the trainer modeling the correct response. The learner rehearses the correct responses and the trainer provides praise and corrective feedback based on the performance.

BST is used in many teaching programs because it results in acquisition of a variety of complex behaviors with young children. For example, it has been successfully used to train young children to discriminate between appropriate-touch and inappropriate-touch requests (Wurtele, Kast, Miller-Perrin, & Kondrick, 1989), make emergency telephone calls (Jones & Kazdin, 1980), engage in appropriate firearm safety (Miltenberger, et al., 2005; Miltenberger & Thiesse-Duffy, 1988) and abduction-prevention skills (Johnson et al., 2005). BST has also been

used extensively to teach social skills to typically developing children. For example, Hanley, Heal, Tiger, and Ingvarsson (2007) used BST to teach social skills to young children, including responding appropriately to name, complying with simple and multistep instructions, requesting attention, requesting assistance, framed requests to adults and peers, saying "thank you," acknowledging or complimenting others, sharing with peers, and comforting others in distress.

A common concern with social skills training programs involves the frequent use of artificial training contexts and the failure of the skills to generalize to natural settings (Bellini, Peters, Benner, & Hopf, 2007; Gresham, Sugai, & Horner, 2001; Sheridan, Hungelmann, & Maughan, 1999). Generalization of skills may be limited by a lack of correspondence between the training and target stimuli or differences in the demand characteristics of natural and contrived training environments (Sheridan et al., 1999; Stewart, Carr, & LeBlanc, 2007). Given that generalization may be hindered by contrived training environments, conducting social skills training in the natural environment may mitigate problems with social-skills generalization by implementing training with the relevant naturally occurring stimuli.

Brief in-situ training may be needed to promote generalization to natural environments or realistic situations following acquisition in analogue situations (Gatheridge et al., 2004; Johnson et al., 2005; Miltenberger et al., 1999; Miltenberger et al., 2004). Johnson et al. (2006) compared two BST programs for teaching abduction-prevention skills to school children: BST only and BST with in-situ training. Both programs were effective in teaching skills. Importantly, safety scores for the group that received in-situ training were higher than safety scores for the group that received BST alone at a three-month follow-up assessment, suggesting that in-situ training may also promote maintenance of acquired skills.

Prompting and Error Correction Procedures

An important consideration when teaching new skills is the use of response prompting procedures. A response prompt can include vocal, modeling, gesture, and physical-guidance prompts (Libby, Weiss, Bancroft, & Ahearn, 2008) and involves the behavior of another person that evokes a desired response in the presence of a discriminative stimulus (Miltenberger, 2008). Prompts are usually faded using either least-to-most (LTM) or most-to-least (MTL) prompting procedures. During LTM prompting, the teacher provides the learner a brief opportunity to respond independently before increasing the intrusiveness of the prompt. The teacher delivers increasingly more intrusive prompts until the learner completes the response (Demchak, 1990; Libby et al., 2008.). During MTL prompting, the teacher initially provides a more intrusive prompt (e.g., physically guidance) for the learner to engage in the correct response. The teacher decreases the intrusiveness of the prompts on subsequent trials as the learner responds correctly (Demchak, 1990; Libby et al., 2008). In a comparison of LTM and MTL prompting procedures to teach children solitary play skills, Libby et al. (2008) found that all participants acquired the target play skills using MTL prompting and that MTL prompting was associated with fewer errors than LTM prompting. However, several participants learned more quickly with LTM prompting, suggesting that MTL may prevent errors, but can sometimes slow acquisition.

When errors occur during skill acquisition, it is often necessary to implement an error-correction procedure to reduce the frequency of errors in the future (Rodgers & Iwata, 1991). During acquisition, error-correction procedures can be used to deliver feedback to learners and to increase the probability that the learners will respond correctly in the future (McGhan & Lerman, 2013). Although some error-correction procedures involve a statement that the response was incorrect or modeling the correct response, other error-correction procedures provide an

opportunity to practice the correct response. Active student responding and directed rehearsal error-correction procedures require the student to practice the correct response and have been effective in reducing errors and increasing the accuracy of future responses across a variety of different learners (Barbetta, Heron, & Heward, 1993; McGhan & Lerman, 2013; Worsdell et al., 2005). Active student responding involves requiring the learner to practice the correct response once following an error, while directed rehearsal requires the learner to practice the correct response multiple times contingent on an error (McGhan & Lerman, 2013).

Teaching Strategies

Active teaching is a teaching procedure that is centered on arranging controlled exposures to evocative situations while simultaneously teaching appropriate social skills (Hanley et al., 2007). In an active teaching model, evocative situations are contrived by teachers, school staff, or other children. These situations are described as evocative because they increase the value of social reinforcers, such as obtaining attention, accessing preferred tangibles from others, or escaping difficult academic tasks (Michael, 1993). Each evocative situation represents an opportunity for preschoolers to learn specific responses to obtain reinforcers (e.g., Hanley et al, 2007; Luczynski & Hanley, 2013). By teaching appropriate responses when an evocative situation occurs, teachers can reduce the likelihood that problem behavior will occur to access those same reinforcers. For example, if a teacher observes a child struggling to open a juice box, this situation serves as an opportunity for the teacher to provide prompts to have the child ask for help. If the child is able to contact the reinforcer (teacher assistance) following appropriate behavior (asking for help), the child is more likely to engage in socially appropriate behavior in the future to obtain teacher assistance. Failure to use active teaching strategies reduces opportunities for children to learn or use appropriate social skills when faced with potentially

difficult situations. Consequently, they may resort to problem behavior (e.g., hitting or yelling) to obtain preferred stimuli or desired adult attention instead of using more socially appropriate means of obtain reinforcers (Ingvarsson Hanley, & Welter, 2009; Luczynski & Hanley, 2013; McKerchar & Thompson, 2004; Reimers, Wacker, Cooper, Sasso, Berg, & Steege, 1993).

Preschool Life Skills

In response to the growing recognition of the importance of social skills development, especially during preschool and kindergarten, researchers have attempted to create comprehensive school programs that teach prosocial skills to young children in an effort to promote social skills and reduce problem behavior in the classroom (Hanley et al., 2007; Luczynski & Hanley, 2013). Much of the current research has attempted to evaluate procedures for teaching preschool life skills (PLS) in preschool classes with typically developing children. PLS programs have focused on teaching skills, including appropriately requesting teacher help or attention, tolerating delays or denials in the delivery of items or assistance, friendship skills, and functional communicative responses (Hanley et al., 2007; Luczynski & Hanley, 2013). Additional research aimed at decreasing preschooler problem behavior has examined ways to increase preschooler compliance by strengthening behavioral precursors to compliance (Hanley et al, 2007; Krause et al., 2012).

Hanley et al. (2007) implemented a classwide teaching program with 16 typically developing preschoolers to teach instruction following, functional communicative responses, delay tolerance, and friendship skills. Teaching procedures consisted of BST with instructions, modeling, role play and feedback. Children were exposed to contrived situations that targeted a specific skill (e.g., following instructions, tolerating delays imposed by teachers). Experimenters recorded instances of problem behavior and correct responses prior to and following teaching.

Following teaching, a 74% reduction in problem behavior and a four-fold increase in correct responses were observed.

Luczynski and Hanley (2013) extended the line of PLS research by teaching functional communication and self-control skills to six children at risk for school failure. Similar to Hanley et al. (2007), BST was used to teach the children to request teacher attention, teacher assistance, and preferred materials, and to tolerate delays and denials to requests. Unlike Hanley et al. (2007), who used a classwide format to teach the skills, Luczynski and Hanley (2013) used a modified version of the PLS program with small-group instructions with preschoolers nominated by their teachers as warranting more intensive teaching and programming. The small-group PLS teaching program was effective in teaching and maintaining the social skills, as well as effective in preventing problem behavior.

Response to Intervention

The PLS program could be implemented using the response-to-intervention (RTI) model that is commonly used in many elementary schools to tailor instruction (Gresham, 2004; Luczynski & Hanley, 2013). In the RTI model, the intensity of interventions is tiered and matches the severity of the presenting problem behavior or skill deficit, thereby increasing the efficiency and minimizing the intrusiveness of educational and behavioral interventions (Gresham, 2004; Luczynski & Hanley, 2013). A student's lack of response to an intervention is used as the basis for changing, modifying, or intensifying existing interventions in place (Gresham, 2004).

Universal interventions (Tier 1) are implemented with all students to help prevent the development of social or behavioral problems and increase prosocial behavior. Schools or educational programs that implement Tier 1 interventions develop and explicitly teach

behavioral expectations and social skills (Anderson & Borgmeier, 2010; Campbell & Anderson, 2011; Gresham, 2004). Skills targeted for instruction are often replacements for maladaptive behavior or are physically incompatible with inappropriate behavior (Carr & Durand, 1985; Dunlap & Fox, 1999). For example, at circle time, teachers may teach their students to "sit nicely" and define this behavior as "sitting with your legs crossed and your hands in your lap." Children who demonstrate this behavior may be less likely to physically touch or distract their peers during circle time or other instructional activities. Tier 1 interventions also include consequences for appropriate (e.g., tokens for appropriate behavior that are exchanged for a small item) and inappropriate behavior (e.g., timeout for inappropriate behavior; Anderson & Bormeier, 2010; Simonsen & Sugai, 2013; Simonsen, Sugai, & Negron, 2008). Hanley et al. (2007) used Tier 1 interventions, teaching skills at a classwide level to all students in a natural setting and using teacher praise to differentially reinforce prosocial behavior.

Selected interventions (Tier 2) focus on individuals who are not responsive to universal interventions and require more targeted interventions that are delivered in a small-group setting (Gresham, 2004). These students continue to receive Tier 1 intervention, but also receive more structure and guidance to meet behavioral expectations (Anderson & Borgmeier, 2010). Tier 2 interventions include explicit instruction of skills, structured prompts for appropriate behavior, opportunities for the student to practice the skills, and frequent feedback to the student (Anderson & Borgmeier, 2010). Tier 2 interventions are implemented similarly across groups of students who exhibit comparable behavior problems and are likely to benefit from a similar intervention. For example, Miltenberger et al. (2004) used BST during a Tier 2 intervention by using instructions, modeling, rehearsal, and feedback to teach firearm safety to a small group of young children.

Targeted interventions (Tier 3) focus on students who do not respond adequately to Tier 1 or Tier 2 interventions and require individualized instruction for skill deficits or interventions for severe problem behavior (Campbell & Anderson, 2011; Gresham, 2004). Tier 3 interventions often consist of antecedent strategies to prevent problem behavior, instructional strategies to teach desired behavior, and individualized consequences to decrease problem behavior and increase appropriate behavior (Anderson & Borgmeier, 2010). For example, Kraus et al. (2012) implemented a Tier 3 intervention with two preschoolers at risk for school failure by strengthening the behavioral precursors to compliance. Experimenters used modeling and differential reinforcement of target skills to increase precursor responses (student stopping ongoing activity, orienting towards the speaker, making eye contact, and saying "yes") prior to giving an instruction. Given that Tier 3 interventions often require individualized supports, these interventions often require relatively more resources to implement.

Given that the RTI model helps to address individualized client needs and goals to attenuate intervention delivery, this model may prove valuable when treating individuals with learning or developmental disabilities. To date, the majority of research involving the effectiveness of PLS programs has taken place in preschool classrooms with typically developing children. Little research has examined the effectiveness of these social skills training programs when implemented at Tier 1 and Tier 2 levels with children who have developmental disabilities.

Individuals with autism spectrum disorder (ASD) and intellectual disabilities experience significant deficits in social skills (Carter, Davis, Klin, & Volkmar, 2005; Guralnick, 2010; Guralnick, Connor, & Johnson, 2011; Smith & Matson, 2010; White, Keonig, & Scahill, 2007). Individuals with ASD and intellectual disabilities are more likely to develop problem behavior that may interfere with academic success, as well as require time-consuming, costly support

(Hanley et al, 2007; Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002; Olson & Hoza, 1993). Knowing that social skills deficits may increase with age, there are numerous potential benefits of early intervention for young children with ASD (Tantum, 2003; White et al., 2007).

Although the line of research assessing the effectiveness of PLS programs, originally developed by Hanley et al. (2007), and later extended by Luczynski and Hanley (2013), is promising, there are some limitations. First, to date, research has not examined the effects of this PLS program when implemented in a classroom with children with developmental disabilities. Although PLS programs have been successful in teaching social skills and reducing problem behavior in typically developing children (Hanley et al. 2007) and typically developing children referred for problem behavior (Luczynski & Hanley, 2013), the applicability and effectiveness of this PLS program in classrooms with children with ASD or other developmental disabilities is unknown.

Second, although Hanley et al. (2007) implemented a PLS program at a classwide (Tier 1) level and Luczynski and Hanley (2013) implemented their PLS program at a small-group (Tier 2) level, there is an absence of research concerned with the sequential application of these PLS interventions across the three tiers of the RTI method. Until the effects of each Tier of instruction are systematically evaluated to determine their effects on skill acquisition, it is unclear if children with developmental disabilities should begin social skills training on a Tier 1, Tier 2, or Tier 3 level for specific target social skills.

Third, relatively little research has evaluated the extent to which participants generalize skills with peers in their classrooms. Research on the generalization of school-based social-skills programs for children with developmental disabilities suggests poor generalization of skills

across participants and settings (Bellini et al., 2007). Thus, it is possible that target skills will not generalize to peer-peer interactions and will require specific peer-peer training to be effective.

The purpose of the present investigation was to extend the line of PLS research by assessing the effectiveness of the PLS program with preschool children with developmental disabilities. Participants systematically progressed from Tier 1 to Tier 2 to Tier 3 contingent on failure to meet the performance criterion for acquisition. The effectiveness of the three levels of the RTI model (Tier 1, Tier 2, Tier 3) in teaching preschool life skills (responding appropriately to one's name being called by an adult, requesting assistance, requesting attention, delay tolerance, and tolerating denied access to reinforcement) to children with developmental disabilities was evaluated. Furthermore, generalization probes of the target PLS skills were conducted for adults and peer interactions to determine the extent to which these skills generalized to interactions with adults and children in their preschool classrooms.

Method

Participants and Setting

Children were recruited from a local preschool that provided inclusive educational services for children with developmental disabilities. Eight children participated in the study (see Table 1 for names, ages, and diagnoses). Brian was able to follow one-step directions and communicated using one- and two-word phrases. Evan was also able to follow one-step directions and communicated using basic sign language and Proloquo®. Jeb was able to follow two-step directions and communicated using full sentences. Jon was able to follow step one-step directions and communicated using full sentences. Lacey was able to follow two-step directions and communicated using full sentences. Luke was able to follow two-step directions and communicated using two-and three-word phrases. Tina was able to follow two-step directions

and communicated using full sentences. Whitney was able to follow one-step directions and communicated using basic sign language. Whitney received training to use Proloquo® as part of her clinical services during the course of the study. Sessions were conducted within the classroom during ongoing activities or at a small table with two chairs, or in a therapy room at an on-campus university psychology clinic. Each classroom was staffed by a lead teacher with a Master's degree in Special Education and a teacher's assistant with a bachelor's degree. There were approximately 8 to 13 children in each classroom. The participants attended school for six hours a day from 8:30 am to 2:30 pm either two (Tuesday and Thursday), three (Monday, Wednesday, and Friday) or five days a week depending on their age and Individualized Education Plan (IEP). The main preschool classroom (30 m by 20 m) included carpeted areas, cubbies for storage of children's personal items, a play area with toys, and several child-sized tables and chairs. The pull-out area (5 m by 5 m) included one desk and two child-sized chairs. The university therapy room (15 m by 15 m) was carpeted, and contained two chairs and a play area with toys.

Data Collection, Interobserver Agreement, and Procedural Fidelity

Paper and pencil data collection was used to record occurrences of the dependent variables. *Problem behavior* was defined as any instances of aggression (hitting, pinching, grabbing, slapping, scratching, biting), screaming (any vocalization above conversational volume), or property destruction (sweeping materials off of surfaces, breaking materials or classroom stimuli, ripping/crumpling paper, or throwing materials a distance of 0.3 m or greater). *Responding appropriately to name* was defined as the participant stopping any ongoing competing behavior, orienting towards the speaker, and saying or signing "yes" or "ok" within 5 s of his or her name being called. *Requesting adult assistance or attention* was defined as the

participant recruiting help or attention by saying or "excuse me" or "help please" with an appropriate (i.e., conversational level) tone, or by signing "help please" or tapping the adult on the shoulder within 30 s of the presentation of the respective antecedent situation. *Delay tolerance* was defined as the participant saying or signing "okay" and waiting for 30 s for the adult-mediated item delivery, attention, or activity without making additional requests or engaging in problem behavior. *Denial tolerance* was defined as the participant accepting denied access to attention, assistance, or materials by saying or signing "okay" and refraining from problem behavior to obtain adult-mediated attention, assistance, or materials for 60 s. An independent response was defined as the occurrence of the target skill in the absence of a vocal, model, or physical prompt from the therapist. A prompted response was defined as the occurrence of the skill following a vocal, model, or physical prompt from the therapist.

Data were collected during generalization probes by recording if the target skill occurred independently given opportunities in the natural environment and were summarized as the percentage of correct, independent responses by dividing the total number of correct independent responses by the total number of opportunities to respond. The frequency of problem behavior was recorded during generalization probes.

Baseline and training sessions included eight trials. During each session opportunities were arranged for responding appropriately to name, requesting adult-mediated attention or assistance, delay tolerance, or denial tolerance similar to the procedures described by Hanley et al. (2007) and Luczynski and Hanley (2013). Only one skill was evaluated per session. During each trial, the data collector recorded the programmed situation, frequency of problem behavior, and if the correct social skill occurred correctly or incorrectly and independently or prompted.

The data were summarized as the percentage of correct, independent responses by dividing the total number of correct independent responses by the total number of trials in the session.

Undergraduate and graduate trainees were trained to collected data by the experimenter. Interobserver agreement (IOA) was calculated on a trial-by-trial basis. An agreement was defined as both observers recording the same response (correct or incorrect and independent or prompted) during each trial. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements. This fraction was converted to a percentage. For pre-baseline and post-mastery generalization probes, IOA was calculated on a mean interval-by-interval basis. Each 20-min observation was divided in four 5-min intervals. Observers recorded occurrences of behavior within each interval. For each interval, a proportion was calculated by dividing the smaller number of occurrences by the larger number of occurrences. IOA was calculated by summing the proportion of agreements and dividing by the number of intervals and then converting this number to a percentage. IOA was collected across 30 % of sessions, with a mean interobserver agreement of 97.3 % (range, 87.5%-100%)

The observer recorded procedural fidelity data either in situ or from video recordings. During baseline and training sessions, procedural fidelity was determined by measuring therapist performance on the following responses during each trial: arranging antecedent situation, arranging the beginning of the trial as prescribed, responding following a correct response according to the condition, implementing the correction procedures according to the condition following an incorrect response and following problem behavior, and collecting data accurately. Treatment fidelity scores were calculated by dividing the number of correct therapist responses by the total number of opportunities in a session. This fraction was then converted into a

percentage. Treatment integrity was collected across 20% of sessions, and therapists correctly responded during a mean of 98.8% (range, 85.4% -100%) of opportunities.

Experimental Design

The effectiveness of Tier 1, Tier 2, and Tier 3 on acquisition of social skills was evaluated using a concurrent multiple-baseline across-participants design. The implementation of the independent variable (Tier 1, Tier 2, and Tier 3 teaching procedures) was staggered across the skills for each participant.

Pre-Baseline and Post-Mastery Generalization Probes

Generalization probes were conducted in the main preschool classroom across five normally scheduled activities (free choice, circle time, meals, centers, and transitions). Free choice was a period in which the children had access to toys, books, and leisure items in the classroom. Circle time was a teacher-led activity during which children sat in a half circle, facing the lead teacher. The lead teacher engaged the children in conversation, lessons about the weather and day of the week, songs (typically about the alphabet, numbers, weather, etc.) and read stories aloud. During meals, groups of four children sat with an adult at a small table. The teacher assisted the children in washing their hands and preparing their meals. Centers consisted of children participating in various teacher-led activities such as floor-play, time on iPads, arts and crafts, block building, tracing, matching, and writing. Transitions involved children moving from one activity to another activity as they changed physical locations (e.g., from lunch in the main preschool classroom to recess).

During generalization probes, the therapist recorded either the occurrence or omission of a skill following naturally occurring opportunities for the participant to demonstrate the skill (e.g., requesting adult attention to play with a toy, responding appropriately when one's name is

called by a teacher). The therapist also recorded the occurrence of problem behavior. Generalization probes were conducted until a minimum of five opportunities to practice each skill with adults and peers are observed. If five opportunities are not observed after three 20-min probe sessions (60 min of observations), the therapist contrived opportunities for the skill to be practiced in the natural environment. The therapist instructed either adults or peers (depending on which opportunities had not been observed) to call a peer's name, withhold access to an item or assistance, or signal delayed or denied access to assistance or an item. For example, if the participant had not had an opportunity to respond to his name being called by a peer, the therapist contrived an opportunity by instructing a peer to call the participant's name.

Baseline

Baseline sessions consisted of eight trials to practice each skill. Similar to the procedures described by Hanley et al. (2007) and Luczynski and Hanley (2013), the therapist arranged specific antecedent situations. No instruction or teaching occurred prior to the sessions. The therapist did not deliver any prompts or implement error-correction procedures following incorrect responses across all skills, and the therapist refrained from commenting if problem behavior occurred.

Skill 1: Responding appropriately to name. The therapist arranged antecedent situations by allowing the participant to engage in a competing task or activity, such as eating snack, playing with a toy, or completing a group activity, for 2 min prior to the trial. A minimum of two trials per session were conducted across at least three different activities (play, work, and group activities). At the onset of the trial, the therapist called the participant's name in a clear, neutral tone and recorded the participant's subsequent response. The therapist refrained from including any questions, directives, or statements when calling the participant's name. If

the participant emitted the target skill, the therapist provided brief, neutral praise. If the participant did not emit the target skill, the therapist did not provide any prompts or error-correction procedures.

Skill 2: Requesting adult assistance. Antecedent situations for requesting assistance were contrived by withholding preferred items or assistance to obtain items that were necessary to begin or complete an activity. For example, the therapist placed a highly preferred edible or small tangible in a jar with a tight fitting lid in front of the participant that the participant was unable to open. The therapist would also place important materials or parts of an activity out of the child's reach, deliver instructions to complete a difficult task, or instruct the child to tie his or her shoes. Each antecedent situation was presented for a minimum of two trials within each session. If the participant correctly asked for assistance, the therapist provided brief, neutral praise and delivered assistance for the remainder of the 30-s trial. If the participant engaged in problem behavior, the therapist provided assistance for the remainder of the trial. If an incorrect response occurred or the participant did not respond, the therapist provided assistance following 30 s.

Skill 3: Requesting adult attention. Antecedent situations for requesting attention were contrived by removing, withholding, or diverting therapist attention during interactions with the participant. For example, the therapist would engage in a play activity, such as playing on a toy piano or pretending to talk on a toy cell phone, with the participant for 30 s. At the end of the 30 s, the therapist would cease play with the participant, remove some of the play materials, and orient slightly away from the participant while refraining from making eye contact. Antecedent situations would also be arranged by the therapist engaging in play with the student for 30 s and then diverting his or her attention to a nearby peer, or by gathering preferred play materials and

sitting next to the participant without initiating play. The trials began when the therapist removed attention from the participant, and each antecedent situation was presented for a minimum of two trials within the session. If the participant correctly asked for attention, the therapist would provide brief, neutral praise and deliver attention for the remainder of the 30-s trial. If the participant engaged in problem behavior, the therapist provided attention for the remainder of the 30-s trial. If an incorrect response occurred or the participant did not respond, the therapist provided attention following 30 s.

Skill 4: Delay tolerance. The therapist arranged antecedent situations for delay tolerance by having the participant wait for preferred items or activities. For example, the therapist would allow the participant to access a preferred toy for 60 s. After 60 s, the therapist would remove the toy and signal the delay by providing the instruction to "wait please." The therapist would also deliver a snack to the participant's nearby peers at snack time and tell the participant to "wait please," or the therapist would take a preferred toy from a participant while it was being played with and give it to a nearby peer. Each antecedent situation was presented for a minimum of two trials within each session. If the participant emitted the target skill, the therapist provided brief, neutral praise, delivered the item or activity after 30 s, and allowed access to the item for 30 s. If the participant engaged in problem behavior, the therapist provided access to the item or activity for the remainder of the 1-min trial. If the participant engaged in an incorrect response or did not respond, the therapist provided access to the item or activity after 30 s.

Skill 5: Denial tolerance. Antecedent situations for denial tolerance were contrived by withholding preferred stimuli. The therapist signaled denied access to the stimuli or assistance by saying "[stimulus/assistance] is unavailable" or "you cannot have [stimulus/assistance]." For example, the therapist would allow the participant to have 60 s of access to an iPad or a preferred

toy and, after the 60 s, state "you cannot have iPad" while handing the item to the peer or holding onto the item. If the participant emitted the correct response, the therapist provided brief, neutral praise at the end of the 1-min trial. Following problem behavior, the therapist provided access to the assistance or stimuli for the remainder of the 1-min trial. If the participant emitted an incorrect response or did not emit a response, the therapist refrained from commenting and ended the trial after 1 min.

Tier 1: Classwide Training

Classwide instruction (Tier 1) was conducted with groups of six children. During the teaching session (see Appendix for a description of teacher scripts used for teaching conditions) the therapist outlined the target skill, provided rationales about why the skill was important, and modeled the skill to the student using similar teaching scripts as described in Luczynski and Hanley (2013). Each student had an opportunity to practice the skill. If the student performed the skill correctly, the therapist provided descriptive praise and brief physical attention. If the participant made an error or engaged in problem behavior, the therapist used least-to-most (LTM) prompting (vocal prompt, model prompt, full-physical/vocal prompt) to have the student correctly perform the skill. Each teaching session lasted approximately 10 min, and only one skill was taught a day.

For training sessions, the therapist arranged antecedent situations as described in baseline for the target skill. Contingent on a correct independent response, the therapist provided descriptive praise, brief physical attention, and the adult-mediated reinforcer (e.g., assistance) and access to items (if applicable). If the participant responded incorrectly or engaged in problem behavior, the therapist used LTM prompting to evoke the correct response. Following a correct response after the model prompt, praise and the reinforcers specific to the skill (e.g., assistance,

attention, access to items) were delivered. A neutral statement and access to skill-specific reinforcers were delivered following a full physical/verbal prompt.

The therapist conducted a maximum of five training sessions (unless visual inspection indicated an increasing trend) to evaluate acquisition on each skill. Mastery was defined as independent, correct responses on at least 85% of trials across two consecutive sessions. If the participant reached mastery, the participant did not receive any additional training on that skill. If the participant did not meet mastery, the participant moved to Tier 2 for additional training.

Tier 2: Small-Group Training

Small-group instruction (Tier 2) was conducted with groups of three children. Each Tier 2 small-group instructional session was approximately 10 min. During the teaching session the therapist outlined the target skill, provided rationales about why the skill was important, and modeled the skill to the student using similar teaching scripts (refer to Appendix). Each student had an opportunity to practice the skill. If the participant correctly performed the skill, the therapist provided descriptive praise and brief physical attention. If an incorrect response or no response occurred, the therapist implemented an error-correction procedure consisting of active student responding. During the error-correction procedure, the therapist represented the antecedent situation, prompted the correct response by providing a vocal instruction (e.g., "say ____ and do _____"), physically guided the response, and then delivered neutral praise. The error-correction procedure was followed by a practice trial. During the practice trial, the therapist the represented the antecedent situation and provided the opportunity for the participant to practice the target response independently. If the participant correctly emitted the target skill during the practice trial, the therapist provided descriptive praise and access to the skill-specific reinforcers. Following an incorrect response or no response on the practice trial, the therapist

repeated the error-correction procedure and provided a neutral statement (e.g., “that’s asking for help”).

During training sessions, the therapist arranged antecedent situations as described in baseline for the skill. Contingent on a correct independent response, the therapist provided descriptive praise, brief physical attention, and skill-specific reinforcers (e.g., adult-mediated attention when targeting requesting attention or assistance when targeting requesting assistance). If the participant responded incorrectly or engaged in problem behavior, the therapist implemented the active student responding error-correction procedure.

Training for each target skill ended after five sessions, or when the participant reached mastery. If mastery of the target behavior was not achieved and correct responding was not trending upwards after the fifth session, the participant moved to Tier 3 for continued teaching and training of the target behavior

Tier 3: Individual Training

One-on-one instruction (Tier 3) was conducted with each participant individually. The therapist provided instruction about the target skill, modeled the target skill, and role played with the participant during the teaching sessions (refer to Appendix). Following a correct response, the therapist delivered descriptive praise, brief physical attention, adult-mediated skill-specific reinforcer (e.g., assistance, attention, or access to items), and a highly preferred edible or tangible (30-s access). Following no response or an incorrect response, the therapist implemented a directed-rehearsal error-correction procedure. The therapist represented the antecedent situation, provided a vocal instruction (e.g., “say ____ and do _____”), and physically guided the correct response, and then delivered neutral praise following the correct response. The therapist then repeated the error-correction procedure three times.

Following one-to-one teaching, the therapist conducted training sessions. The skills were taught using most-to-least (MTL) prompting with an embedded time-delay prompt. Prompts were faded based on participant performance. The prompt step increased (i.e., the prompt was faded to a less intrusive prompt) following one session with at least 85% accuracy. The prompt step decreased (i.e., the prompt level increased to a more intrusive prompt) following one session with three or more errors. At prompt step 1, the therapist immediately provided a full-physical/verbal prompt following the antecedent situation. At prompt step 2, the therapist provided a full-physical/verbal prompt after a 1-s delay. At prompt step 3, the therapist provided a full-physical/verbal prompt after a 2-s delay. At prompt step 4, the therapist provided a model/partial prompt after a 4-s delay. At prompt step 5, the participant was required to independently emit the target skill. Contingent on an incorrect response, the therapist implemented the directed-rehearsal error-correction procedure.

Modified responding to name (Jeb, Whitney, and Evan). Three participants, Jeb, Whitney, and Evan, did not meet the mastery criteria for responding to name after 10 sessions in Tier 3. The response criterion for a correct response for responding to name was modified to include stopping and orienting towards the speaker (the 'okay' was omitted as part of the requirement). The therapist following the procedures outlined in Tier 3 to teach the modified response.

Requesting assistance modification (Whitney and Evan). Two participants, Whitney and Evan, did not meet mastery for requesting assistance after 10 sessions in Tier 3. The response topography was modified with these two participants to require them to request help using assistive communicative technology (i.e., Proloquo®) rather than using a sign for help. A baseline requesting assistance probe with the Proloquo® was conducted. During the baseline

probe, the therapist did not delivery any programmed consequences followed the correct response using Proloquo® or following incorrect responses. The therapist provided assistance after 30 s regardless of responding. During the modified requesting assistance training sessions, the therapist taught the participants to touch a Proloquo® icon labeled "Help" in lieu of providing a vocal response or signing for help using the procedures outlined in Tier 3.

Requesting attention modification (Evan). Evan did not meet mastery for requesting attention after 10 sessions in Tier 3. A baseline requesting attention probe was conducted as described for requesting assistance, in which no programmed consequences followed the target response using Proloquo® or incorrect responses. During modified requesting attention sessions, the therapist taught Evan to touch a Proloquo® icon labeled "Excuse me" in lieu of providing a vocal response or patting the adult on the shoulder using the procedures outlined in Tier 3.

Delay tolerance modification (Jon). Jon did not meet mastery for delay tolerance in Tier 3. For Jon, the first modification involved the therapist delivering an additional preferred edible following the correct communicative response (saying "okay") in addition to the programmed edible delivery for a correct response at the end of the trial. For the second modification, the therapist wrote the word "OKAY" on a 7 cm by 12 cm note card and placed it in front of Jon as a visual prompt during the teaching procedures outlined in Tier 3. In addition, the therapist continued to deliver the extra edible following the correct communicative response. During the third modification, the therapist increased the size of the note card to 22 cm by 27 cm piece of paper with the word "OKAY" handwritten. The fourth modification for this skill involved a novel therapist arranging antecedent situations for delay tolerance and delivering the extra preferred edible following the correct communicative response.

Delay tolerance modification (Whitney and Evan). For Whitey and Evan, following baseline probes for delay tolerance, in which no programmed consequences followed the target responses using Proloquo®, the modified delay tolerance sessions began. During modified delay tolerance sessions for Whitney and Evan, the therapist used the training outlined in Tier 3 to teach them to emit the correct response by touching a Proloquo® icon labeled "Okay" instead of providing the vocal response or sign.

Denial tolerance modification (Jon, Whitney, and Evan). Jon, Whitney, and Evan did not meet mastery for denial tolerance in Tier 3. For Jon, the modification for this skill involved a novel therapist arranging antecedent situations for delay tolerance and the delivery of a preferred edible following the correct communicative response (saying "okay") in addition to the programmed edible delivery following 60 s without additional requests or problem behavior.

For Whitey and Evan, following baseline probes for denial tolerance, in which no programmed consequences followed the target responses using Proloquo®, the modified denial tolerance sessions began. During modified denial tolerance sessions for Whitney and Evan, the therapist used the training outlined in Tier 3 to teach them to emit the correct response by touching a Proloquo® icon labeled "Okay" instead of providing the vocal response or sign.

Results

Lacey's performance across baseline and training is displayed in Figure 1. Lacey engaged in low levels of correct responding during baseline across all skills. Lacey acquired four skills with Tier 1 instruction. Lacey mastered responding to name, delay tolerance, and denial tolerance with three training sessions and responding to attention in four sessions. The percentage of correct requests for assistance increased during Tier 1, but not to mastery level.

Lacey mastered requesting assistance with three sessions at Tier 2 training (refer to Figure 1, second panel).

Figure 2 shows Jeb's percentage of correct responding across baseline and training sessions. Jeb engaged in low levels of correct responses during baseline. Jeb mastered four skills with Tier 1 instruction, acquiring requesting assistance, requesting attention, tolerating delays, and tolerating denied requests in 8, 4, 6, and 2 sessions, respectively. Jeb had no correct responses to name during Tier 1 and Tier 2 training. He engaged in some correct responses for responding to name with Tier 3 training, but levels remained low across the phase. Responding to name was modified in Tier 3 to include only stopping and orienting towards the speaker (and the communicative response requirement was omitted). Following this modification, Jeb met mastery for responding to name in 2 sessions.

Figure 3 shows Luke's performance across baseline and training sessions. Luke had zero levels of correct responding for responding to name, requesting attention, and tolerating denied requests during baseline. Luke's performance for requesting assistance gradually increased during baseline and he mastered this skill in 9 sessions without training (refer to Figure 3, middle panel). Luke may have acquired the skill without explicit teaching because correct responses were reinforced with assistance during baseline. Luke engaged in variable levels of correct responding during baseline for delay tolerance. Luke met mastery for responding to name, requesting attention, delay tolerance, and denial tolerance during Tier 1 in 3, 3, 5, and 4 sessions, respectively.

Figure 4 shows Brian's performance across baseline and training sessions. Brian had low levels of correct responding for responding to name, requesting attention, and tolerating delays during baseline. Brian also engaged in variable levels of correct responding during baseline for

requesting assistance (Figure 4, second panel) and denial tolerance (bottom panel). Brian met mastery for delay tolerance and denial tolerance during Tier 1 in 6 and 3 sessions, respectively. The percentage of correct responses increased during Tier 2 for responding to name, requesting assistance, and requesting attention, and he mastered these skills in 3, 3, and 7 sessions, respectively.

Figure 5 shows Tina's performance across baseline and training sessions. Tina had low levels of correct responding for responding to name, requesting attention, and requesting attention during baseline. Tina met mastery for requesting assistance in Tier 1 in 3 sessions. The percentage of correct responses for responding to name also increased in Tier 1, but not to mastery levels. In Tier 2, she met mastery for responding to name in 4 sessions (refer to Figure 5, top panel). Tina discontinued the study before Tier 1 training could be implemented for requesting attention.

Figure 6 shows Jon's percentage of correct responding across baseline and training sessions. Jon engaged in correct responses at low levels during baseline and Tier 1 training across all skills. Jon mastered two skills with Tier 2 instruction, acquiring responding to name and requesting assistance in 5 sessions. He had zero levels of correct responding for requesting attention, delay tolerance, and denial tolerance during Tier 2 training. Jon mastered requesting attention in Tier 3 training in 10 sessions (refer to Figure 6, middle panel). During delay tolerance and denial tolerance, the experimenter anecdotally noted that Jon would frequently engage in echoic responding and repeat the discriminative stimulus (i.e., "wait" or "__ is unavailable") in lieu of the correct vocal response (i.e., "okay"). Several modifications were made to the Tier 3 training procedures for these skills (described in Method). Following these modifications, Jon met mastery for denial tolerance after 5 sessions. An additional probe session

was conducted after Jon met mastery with the novel therapist, in which the original therapist arranged antecedent situations for denial tolerance. After meeting mastery with the novel therapist, he was able to emit the target response at mastery level with the novel therapist. Jon did not meet mastery for delay tolerance with modifications despite some increased variability in his levels of responding. Training was discontinued on delay tolerance after 31 Tier 3 sessions.

Figure 7 summarizes Whitney's performance during baseline and training. Whitney had low levels of correct responding during baseline and Tier 1 for all target skills. There were low levels of responding in Tier 2 for four skills, and responding increased to moderate levels for delay tolerance. Whitney mastered requesting attention with Tier 3 training after 20 sessions. Whitney continued to engage in low levels of correct responses to her name during Tier 3. Similar to Jeb, modifications to response requirements were implemented. Whitney was required to stop the activity and orient towards the person calling her name. However, she was not required to sign 'yes.' Following modifications, levels of correct responding to name increased and Whitney met mastery in 9 sessions (Figure 7, top panel). Whitney engaged in low levels of correct responses during Tier 3 training for requesting attention, tolerating delays, and tolerating denials (refer to second, fourth, and bottom panels). The response topography was changed from sign to assistive technology using Proloquo® for these skills. A baseline probe was conducted with the Proloquo® and Whitney had no correct responses using the Proloquo® probe across skills. Tier 3 training was implemented with the use of the Proloquo®. Whitney acquired requesting assistance, tolerating delays, and tolerating denied requests with 5, 7, and 5 sessions, respectively.

Figure 8 summarizes Evan's performance during baseline and training. Evan had low levels of correct responding during baseline for all skills. He had low levels of correct

responding during Tier 1 and Tier 2 for all skills. Although Evan engaged in variable levels of correct responding in Tier 3 for responding to name and requesting attention, he did not meet mastery for any skills in Tier 3. Similar to Jeb and Whitney, modifications to response requirements were implemented for responding to name where Evan was required to stop the activity and orient towards the person calling his name. However, he was not required to sign 'yes.' Following modifications, levels of correct responding to name increased and Evan met mastery in two sessions (Figure 8, top panel). For requesting assistance, requesting attention, delay tolerance, and denial tolerance, the response topographies were changed from signs to assistive technology using Proloquo® for these skills. Baseline probes were conducted with Proloquo®. Evan had no correct responses during the Proloquo® probes for requesting assistance, requesting attention, and denial tolerance. He engaged in low levels of correct responding during the Proloquo® probe for delay tolerance. Tier 3 training was implemented with the use of the Proloquo®, and Evan mastered requesting assistance, requesting attention, tolerating delays, and tolerating denied requests in 6, 6, 5, and 3 sessions, respectively.

In summary, six participants met the mastery criteria for all five skills. One participant (Jon) met mastery for four of five skills, and one participant (Tina) discontinued the study after mastering two skills and prior to training for the third skill. Table 2 summarizes the number of participants who met mastery for each skill with each level of instruction. Two participants acquired responding to name at Tier 1, three participants mastered the skill at Tier 2, and three participants required Tier 3 training to acquire the skill. Two participants mastered requesting assistance at Tier 1, three participants acquired the skill at Tier 2, and two participants required Tier 3 training to acquire the skill. Three participants met mastery for requesting attention at Tier 1, one participant acquired the skill at Tier 2, and three participants required Tier 3 training. Four

participants mastered delay tolerance in Tier 1, no participants acquired the skill in Tier 2, and two participants required Tier 3 training to acquire the skill. Four participants acquired denial tolerance in Tier 1, none acquired in Tier 2, and three acquired denial tolerance in Tier 3.

Figure 9 outlines pre-baseline and post-mastery generalization probes for Lacey (top panel), Jeb (second panel), Luke (third panel), and Brian (bottom panel). Lacey, Luke, and Brian did not correctly response to name, request assistance, request attention, or response correctly when told to wait (delay) or when denied access with adults (left column) or with peers (right column). Jeb corrected waited (delay tolerance) on 20% of opportunities with adults, but did not engage in any other skills. All four participants had increases in at least one skill with adults during post-mastery probes. At post-mastery with adults, Lacey emitted the correct responses on 20% of opportunities for delay tolerance and 60% of opportunities for denial tolerance. At post-mastery with adults, Jeb emitted the correct response when told to wait at similar levels to baseline (20% of opportunities). However, Jeb showed increased correct responses for requesting assistance (40% of opportunities). Luke had increases in all skills during post-mastery probes with adults. Luke responded correctly to his name on 40% of opportunities, accurately asked for help on 60% opportunities, correctly requested attention on 40% of opportunities, and correctly responded on 80% of opportunities for delay tolerance and denial tolerance. During post-mastery probes with adults, Brian emitted the target response for responding to name on 40% of opportunities, and on 20% of opportunities for requesting assistance and requesting attention.

Lacey, Jeb, Luke, and Brian had fewer occurrences of skills during post-mastery probes with peers (Figure 9, right column). Lacey did not engage in any of the skills during post-mastery probes with peers. Jeb appropriately requested attention on 40% of opportunities. At

post-mastery, Luke tolerated delays on 40% of opportunities. Brian engaged in the correct response on 20% of opportunities for responding to name and tolerating delays with peers.

Figure 10 displays pre-baseline and post-mastery probes for Jon (top panel), Whitney (middle panel), and Evan (bottom panel) with adults (left column) and peers (right column). Jon, Whitney, and Evan did not engage in any correct responses during pre-baseline probes with adults or peers. Jon correctly requested assistance for an adult on 20% of opportunities during post-mastery probes. Jon did not generalize any skills with peers during post-mastery probes. Whitney and Evan did not engage in the correct responses with any skills with peers or adults at post-mastery.

Discussion

The present study examined the effectiveness of the PLS program using the RTI model with eight participants with developmental disabilities or at risk for a developmental delay. Overall, six participants met the mastery criteria for all five skills and one participant met mastery for four of five skills. The final participant met mastery for both skills she received training on prior to discontinuing the study.

The acquisition of skills varied across participants during Tier 1, Tier 2, and Tier 3 training. Three participants (Jeb, Lacey, and Luke) acquired the majority of skills in Tier 1. Luke only required Tier 1 instruction for mastery (one skill was mastered in baseline). Lacey required Tier 2 training for requesting assistance and Jeb required Tier 3 training for responding to name. Brian acquired all skills in either Tier 1 (delay and denial) or Tier 2 (name, assistance, and attention). Jon required Tier 2 instruction for two skills (name and assistance) and Tier 3 instruction for two skills (attention and denial). Two participants (Whitney and Evan) required Tier 3 instruction with modification to master all skills.

Hanley et al. (2007) implemented a classwide teaching program with 16 typically developing preschoolers to teach social skills using behavioral skills training (instructions, modeling, role play and feedback) and contriving opportunities to practice the skills in the classroom. The trained resulted in a 74% reduction in problem behavior and a four-fold increase in the target skills. Relatedly, Luczynski and Hanley (2013) extended the line of PLS research by teaching functional communication and self-control skills to six children at risk for school failure. The authors used behavioral skills training to teach participants social skills. However, the authors delivered the training using small-group instruction, as opposed to large-group instruction, with preschoolers identified by their teachers as requiring more intensive teaching and programming. This modified small-group PLS program was effective in teaching and maintaining social skills, and to prevent problem behavior in the classroom.

The results of the current study suggests that the PLS program is a viable intervention to teach children with developmental disabilities social skills including responding to one's name being called, requesting teacher assistance and attention, and tolerating delays and denied access to the delivery of reinforcers (assistance or materials). Consistent with the findings of Luczynski and Hanley (2013), students requiring more intrusive, individualized teaching strategies (Tier 2 and Tier 3) were able to acquire target skills using a modified PLS curriculum.

Poor generalization of skills across peers and adults was observed with all participants. Although Hanley et al. (2007) argued that the target skills would likely generalize due to the number of adults and peers that were used across a number of different evocative situations during training, generalization probes or follow-up measures never directly assessed generalization of target skills. Similarly, Luczynski and Hanley (2007) did not measure generalization of skills with novel teachers or classroom. Although unable to compare our results

with those of other PLS studies, our findings regarding generalization are consistent with existing literature on school-based social skills curricula for children with developmental disabilities (e.g., Bellini et al., 2007). Although accurate implementation of skills was more likely to occur during post-mastery generalization probes with six of eight participants, only one participant (Luke) responded with 80% accuracy on two skills (delay tolerance and denial tolerance) with adults. Levels of responding during post-mastery probes suggest a relation between levels of performance and the training necessary for participants to acquire skills. Participants who required Tier 3 instruction to master a skill engaged in the lowest levels of correct performance during post-mastery probes (refer to Figure 10). Conversely, Luke, Jeb, Brian, and Lacey acquired the majority of the target skills in either Tier 1 or Tier 2. These participants had greater generalization of skills at post-mastery. Of the seven participants who completed generalization probes, only Luke showed increases in all skills with adults during post-mastery generalization probes.

Broadly, our participants can be grouped into two subsets: those who acquired the majority of skills with Tier 1 and Tier 2 instruction and those who required individualized Tier 3 instructions to acquire the majority of skills. Brian, Jeb, Lacey, Luke, and Tina communicated vocally and acquired the majority of target skills in Tier 1 and Tier 2. Evan and Whitney communicated using alternative modalities (sign language, Proloquo®), and struggled to acquire skills across tiers until modifications were made during Tier 3 training that enabled them to use assistive communication devices to emit the target skills. Although Jon was able to communicate vocally, he also frequently engaged in echoic responding. This may explain why he was able to acquire some skills in Tier 2 (i.e., responding to name, requesting assistance) but required Tier 3 training for other skills. Furthermore, Jon, Evan, and Whitney were more likely to have difficulty

following two-step directions than Brian, Jeb, Lacey, Luke, and Tina. Future research should examine prerequisite skills that predict learning at Tier 1 or Tier 2 rather than individualized Tier 3 training. It may be that learners with more advanced verbal repertoires and that are able to consistently follow two-step directives require less intrusive instruction to acquire social skills.

Future research should evaluate learners' ability to follow group instructions and active participant choral responding during group instruction. Students' abilities to follow group instructions may have implications for skill acquisition as a result of classwide or small-group teaching strategies. Furthermore, choral responding during group instruction may provide a rough assessment of students' communicative skills that influence skill acquisition and performance. If future research can identify prerequisite skills associated with acquisition for different training strategies, clinicians could teach PLS skills effectively while also minimizing the intrusiveness of their interventions. Future research should also investigate PLS skills that predict acquisition of other PLS skills. For example, in the current study all participants who acquired delay tolerance also mastered denial tolerance in the same Tier in which delay tolerance was acquired, suggesting that these skills may require very similar prerequisite skills.

The effectiveness of communicative technology in teaching academic, communication, and leisure skills to learners with developmental delays and communication deficits is well supported (for a review, see Kagohara et al., 2013). It is probable that Evan and Whitney would have acquired the target skills in fewer sessions if they had access to communication devices earlier during instruction. However, there are drawbacks to using communicative devices to facilitate communication relative to using sign language. One of the main limitations is that these devices are not always easily accessed. Until learners are taught to consistently carry their communicative devices and to retrieve them when needed, the responsibility lies on teachers to

ensure the devices are readily available to the learners. This might be difficult in classrooms with high student to adult ratios. In addition, communicative devices require learners to have a certain level of technical competence and fine motor skills, and the devices may become damaged or malfunction (Kagohara et al., 2013). Pre-training assessment of learners' prerequisite communication skills, fine motor skills, fluency with sign language and learning history with communicative technology may inform training strategies and help operationalize acceptable target responses prior to implementation of the PLS program. Ideally, teaching strategies would be tailored to fit the learner's prerequisite skills and learning history before training begins. Future research should help to develop efficient assessment strategies and look at differences in acquisition and maintenance across response topographies (e.g., augmentative communication devices vs. sign) for nonvocal learners.

The overall low levels of performance during naturally occurring opportunities in the classroom (post-mastery generalization probes) indicates that additional steps should be taken to promote generalization. Anecdotally, the experimenter noted that participants had limited opportunities during pre-baseline and post-mastery observations to practice the skills during naturally occurring interactions with teachers and peers in the classroom. If teachers only provide few opportunities to practice skills, children are unlikely to learn or maintain skills in the classroom. This observation may highlight a need for additional teacher training on incidental teaching and active teaching strategies to provide opportunities to teach and maintain functional social skills. The limited practice opportunities may also reflect proactive teaching strategies used by the teachers to minimize the potential for problem behavior in the classroom (e.g., Jolivette, Stichter, Sibilsky, Scott, & Ridgley, 2002). Regardless, additional teacher training would likely help promote generalization and maintenance of skills in the classroom.

Additional programming considerations during training may promote generalization. For example, incorporating common classroom stimuli during teaching and training (e.g., Sheridan, Hungelmann, & Maughan, 1999) may improve generalization. Ideally, classroom stimuli embedded into antecedent situations during training would consist of familiar materials that would be encountered in preschool classrooms. For example, a participant who displays frequent problem behavior involving denied access to a preferred musical instrument or puzzle would likely benefit from PLS teaching and training that incorporates those specific stimuli. In the current study, a wide variety of classroom materials and toys were used in antecedent situations across target skills. Some of the items, such as the iPad, were highly preferred by the majority of participants. However, other stimuli were used to help arrange a salient antecedent situation (e.g., a mason jar to withhold reinforcement to edible stimuli) that the participant would be less likely to encounter in the classroom. Future research might include pre-baseline data collection to inform more individualized varied, naturalistic stimuli to use during training and evaluate if this improves generalization.

In-situ training may be needed to promote generalization of skills to realistic classroom situations following acquisition in contrived situations (e.g., Miltenberger et al., 2004). PLS teaching and training in the context of naturally occurring social interactions in the classroom, as opposed to analogue situations outside of normal classroom programming, may increase the relevance of the trained responses and increase generalization of acquired social skills for students (Stewart et al., 2007). Additionally, training teachers to contrive antecedent situations and teach relevant social skills during ongoing classroom activities, as opposed to training teachers using contrived role-plays or other analogue methods, may increase these teachers' active teaching skills. Given the particularly poor generalization of target skills towards peers,

incorporating opportunities to practice the skills during training with both children and adults, may help promote generalization towards peers. Although peers were involved in several antecedent preparations for certain skills, the communicative responses were not directed to peers.

Finally, it is important to select responses that are meaningful in social settings and are likely to contact natural contingencies (e.g., McConnell, 1987). When thinking about ways to increase generalization, teaching learners to show response variability is desirable because this increases the likelihood that they will contact reinforcement in the natural environment. However, not all learners may be good candidates to initially learn multiple, varied ways to emit social and communicative skills. For example, learners with greater verbal skills may be able to reliably recruit teacher assistance in a variety of ways, whereas a learner with a more limited verbal repertoire may have difficulties acquiring multiple responses and may not possess the prerequisite skills necessary for improvisation or response variability.

One limitation of the current study is that the target responses were modified for Jeb, Evan, and Whitney. For these learners, the response definitions for responding to name (Jeb, Evan, and Whitney), requesting assistance (Evan and Whitney), requesting attention (Evan), delay tolerance (Evan and Whitney), and denial tolerance (Evan and Whitney) were modified so that the correct terminal criterion was different from the response criterion originally applied during the pre-baseline generalization probes. For example, by allowing Evan and Whitney to use Proloquo® to acquire the target skill of denial tolerance, we cannot directly compare skills at pre-baseline and post-mastery. In other words, although these participants met mastery for the modified target responses, the criteria by which their responses were evaluated at post-mastery were not the same criteria by which the participants' responses were evaluated with when they

met mastery. That being said, the modified skills did not occur during post-mastery probes, suggesting that it was unlikely the participants would have engaged in these responses during pre-baseline probes.

In sum, eight children diagnosed with developmental disabilities or at risk for developmental delays were able to acquire social skills, including responding appropriately to one's name being called, recruiting adult-mediated assistance and attention, and tolerating delays and denied access in the delivery of adult-mediated tangibles or assistance. In general, poor generalization of skills was observed to adults and peers, suggesting that future research examine procedures for increasing generalization of these skills in naturally occurring classroom situations. Such research, along with the development of assessment-based procedures for predicting efficient instructional procedures for these learners, will advance the PLS curricula and contribute to the nomological network of effective social skills training programs for learners with developmental disabilities and delays.

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Appendix

Description of teaching scripts:

Responding appropriately to name

Instructions: Therapist says, "When a teacher calls your name, it is important that you look at them. It's also important that you say 'yes' so that the teacher knows you are listening. So when a teacher calls your name, you stop what you are doing, look at the teacher and say "yes."

Modeling: The therapist simultaneously models the skills as they are being explained.

Role Play and Feedback: Following the instructions and modeling, the teacher says "Let's practice." The teacher role plays with the participant. The therapist neutrally states the name of the learner. Contingent on a correct response, the teacher delivers descriptive praise (and a highly preferred item in Tier 3). Contingent on no response or an incorrect response, the teacher uses a least-to-most (vocal prompt, model prompt, full-physical/vocal prompt) prompting (Tier 1) or implements an error-correction procedure (active student responding at Tier 2 or directed rehearsal at Tier 3).

Requesting teacher assistance

Instructions: Therapist says, "It's important to tell adults what you need. Sometimes, adults don't know what you want, so you have to ask for it. If you need help from an adult, you need to tell them. When you want help from a teacher, say 'Help me' using a nice, quiet inside voice."

Modeling: The therapist simultaneously models the skills as they are being explained.

Role Play and Feedback: Following the instructions and modeling, the teacher says "Let's practice." The teacher role plays with the participant, contriving the antecedent situation for opening a tight jar as described in training for recruiting assistance. Contingent on a correct response, the teacher delivers descriptive praise (and a highly preferred item in Tier 3).

Contingent on no response or an incorrect response, the teacher uses a least-to-most (vocal prompt, model prompt, full-physical/vocal prompt) prompting (Tier 1) or implements an error-correction procedure (active student responding at Tier 2 or directed rehearsal at Tier 3).

Requesting teacher attention

Instructions: Therapist says, "It's important to tell adults when you want them to give you attention. Sometimes, adults don't know you want attention, so you have to ask for it. If you want attention from an adult, you need to tell them. When you want attention from a teacher, say 'excuse me' using a nice, quiet inside voice, or pat the adult on the shoulder."

Modeling: The therapist simultaneously models the skills as they are being explained.

Role Play and Feedback: Following the instructions and modeling, the teacher says "Let's practice." The teacher then role plays with the participant, using the antecedent situation for diverting attention away from the participant as outlined in training for requesting attention. Contingent on a correct response, the teacher delivers descriptive praise (and a highly preferred item in Tier 3). Contingent on no response or an incorrect response, the teacher uses a least-to-most prompting (Tier 1) or implements an error-correction procedure (active student responding at Tier 2 or directed rehearsal at Tier 3).

Delay tolerance

Instructions: Therapist says, "Sometimes, when we want something or ask for something, we have to wait to get it. It's important to wait nicely when we ask for something or need something. When a teacher says 'wait please' or 'in a few minutes' say 'Okay" in a nice, inside voice and wait quietly with nice hands or return to playing with your other materials. Do not keep asking once a teacher has said 'wait please' or 'in a few minutes'"

Modeling: The teacher models the skill after delivering the instructions.

Role Play and Feedback: Following the instructions and modeling, the therapist says "let's practice." The teacher role plays with the participant, using the antecedent situation for removing a preferred toy as outlined in training for tolerating delayed access. Contingent on a correct response, the teacher delivers descriptive praise (and a highly preferred item in Tier 3). Contingent on no response or an incorrect response, the teacher uses a least-to-most (vocal prompt, model prompt, full-physical/vocal prompt) prompting (Tier 1) or an error-correction procedure (active student responding at Tier 2 or directed rehearsal at Tier 3).

Denial tolerance

Instructions: Therapist says, "Sometimes, when we want something or ask for something, we cannot get it. It's important to be nice when we ask for something or need something and it is not available. When a teacher says something is 'unavailable' or 'you cannot have it' say 'Okay' in a nice, inside voice with nice hands and return to playing with your other materials. Do not keep asking once a teacher has said 'unavailable' or 'you cannot have it.'"

Modeling: The teacher models the skill after delivering the instructions.

Role Play and Feedback: Following the instructions and modeling, the therapist says "let's practice." The teacher role plays with the participant, using the antecedent situation for withholding access to a preferred toy or electronic item as outlined during training for denied access. Contingent on correct responses, the teacher delivers descriptive praise (and a highly preferred item in Tier 3). Contingent on no response or an incorrect response, the teacher uses a least-to-most (vocal prompt, model prompt, full-physical/vocal prompt) prompting (Tier 1) or implements an error-correction procedure (active student responding at Tier 2 or directed rehearsal at Tier 3).

Table 1.

Participant Demographics

Name	Sex	Age (Years)	Diagnosis
Brian	Male	5	Down syndrome
Evan	Male	6	ASD
Jeb	Male	5	ASD
Jon	Male	6	ASD
Lacey	Female	5	At risk for developmental delay
Luke	Male	5	ASD
Tina	Female	4	At risk for developmental delay
Whitney	Female	6	Down syndrome

Note. ASD = autism spectrum disorder

Table 2.

Frequency of Target Skill Acquisition by Tier

Skill	Tier 1	Tier 2	Tier 3
Name	2	3	3
Assistance	2	3	2
Attention	3	1	3
Delay	4	0	2
Denial	4	0	3

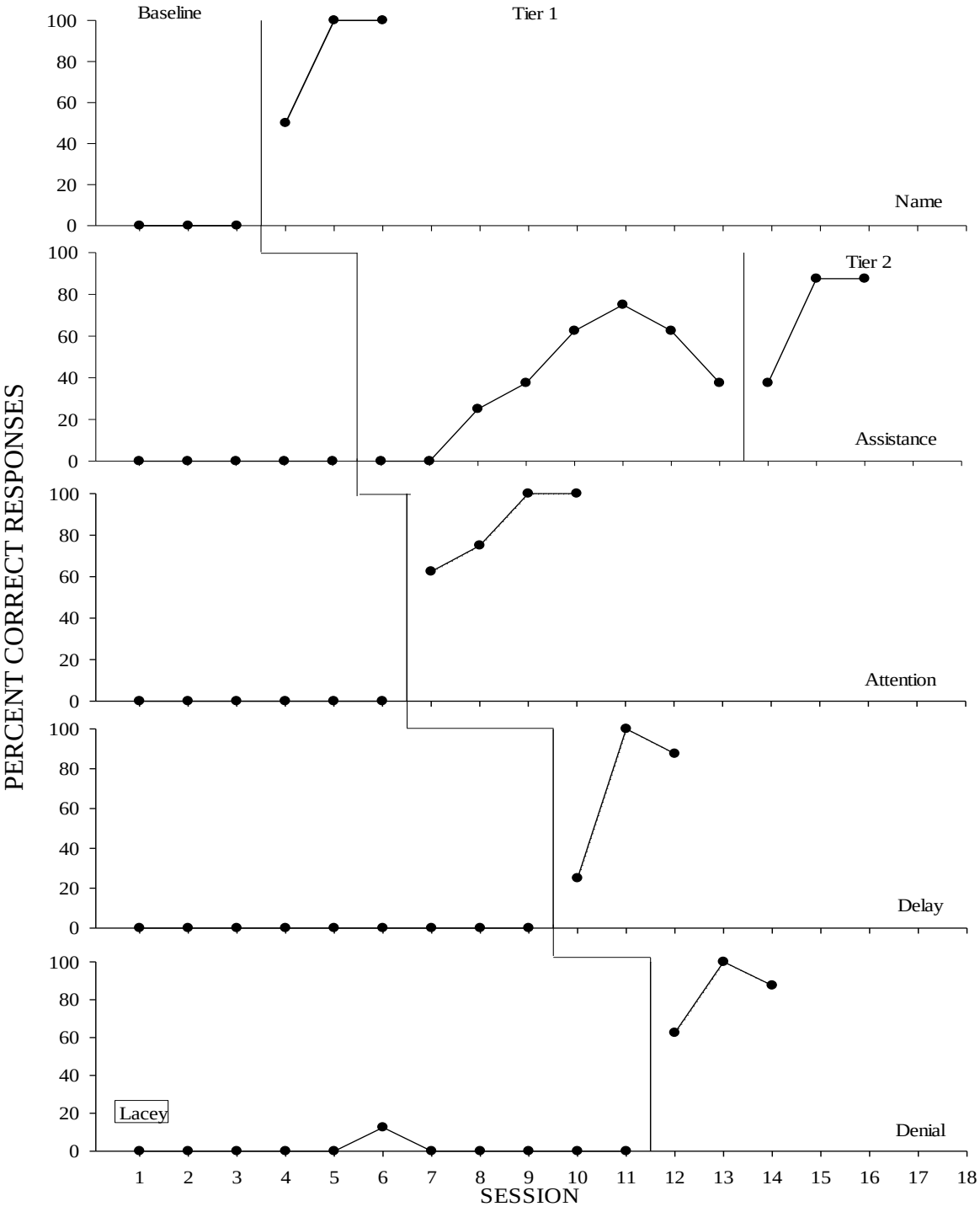

Figure 1. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Lacey.

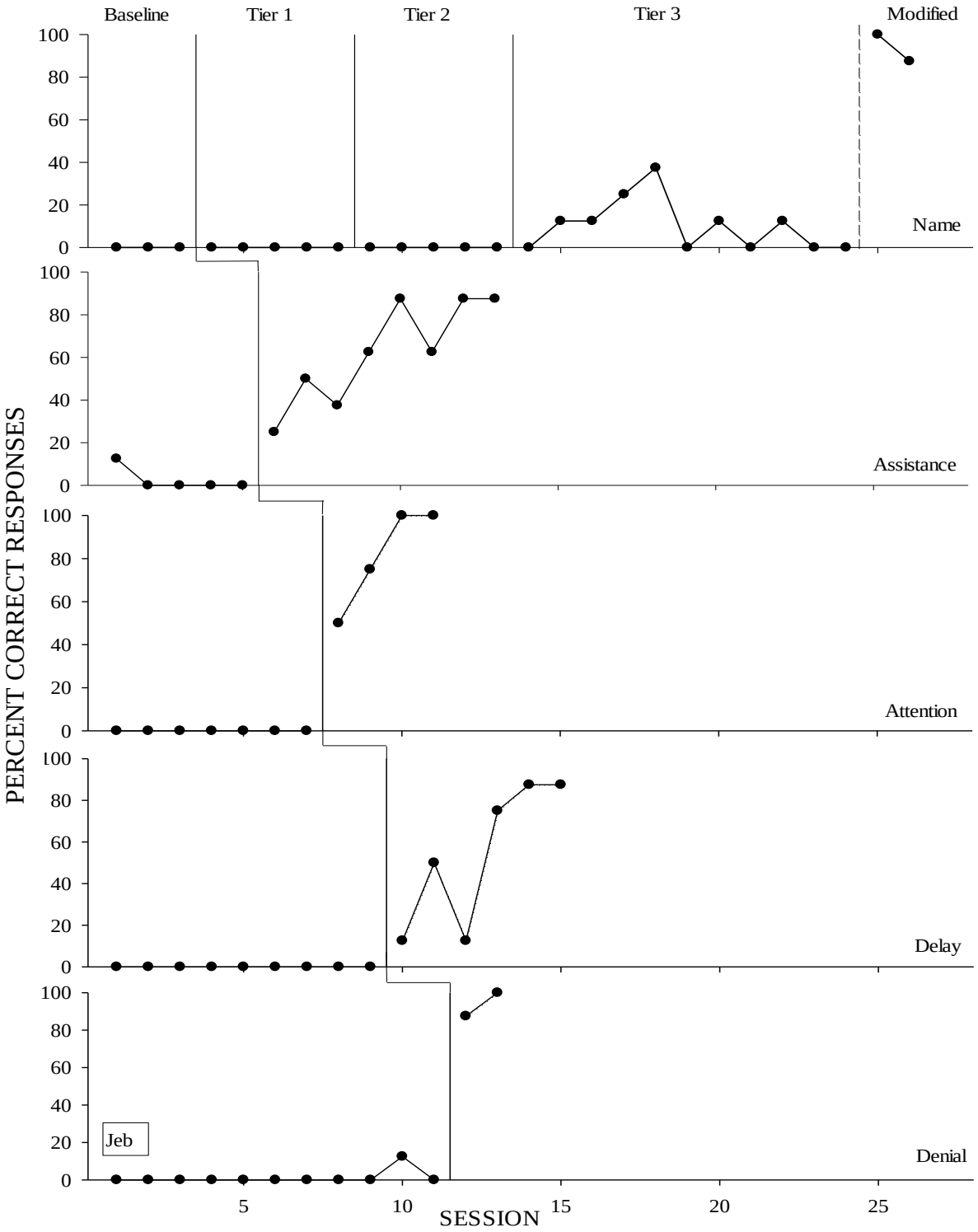

Figure 2. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Jeb.

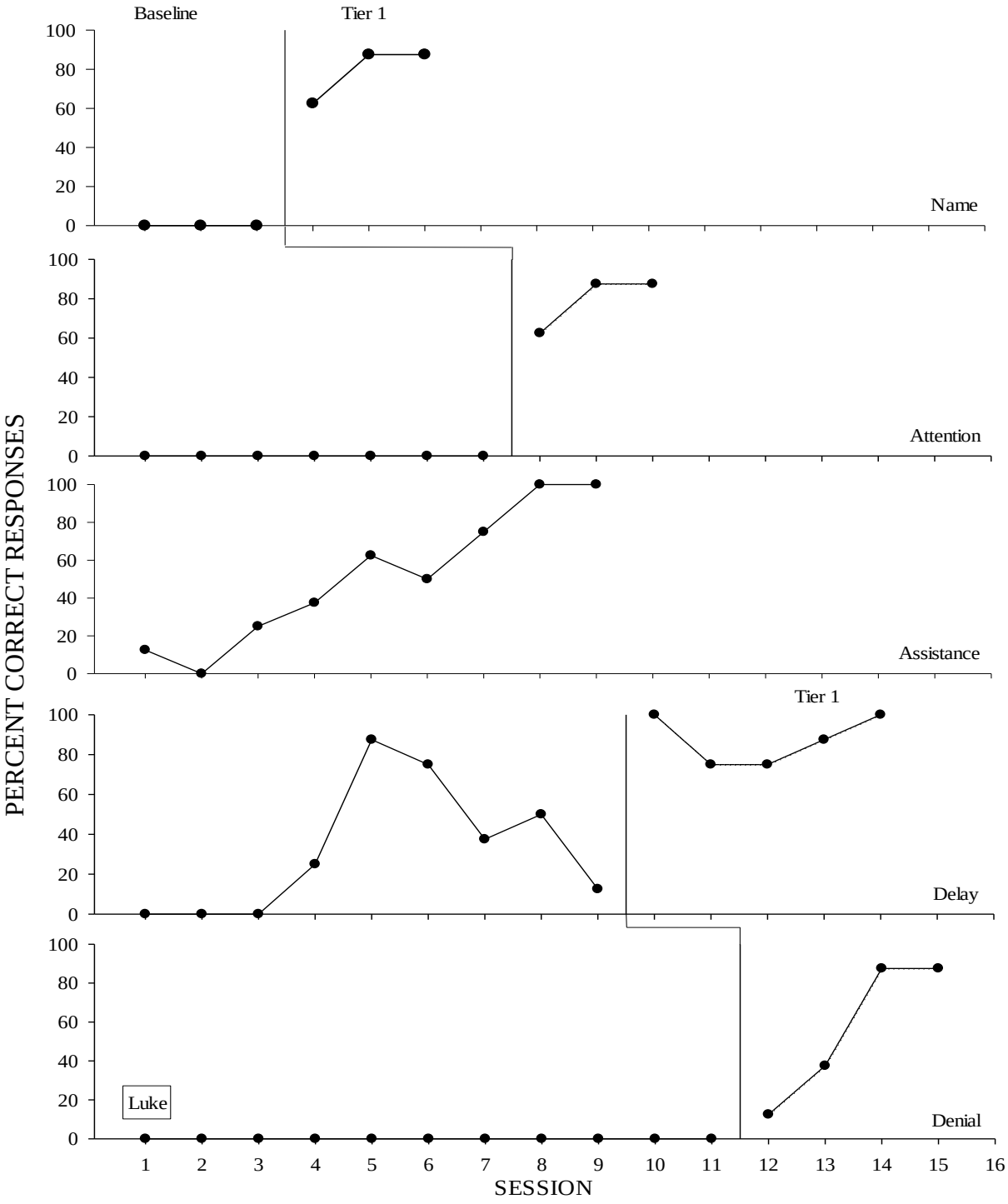

Figure 3. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Luke.

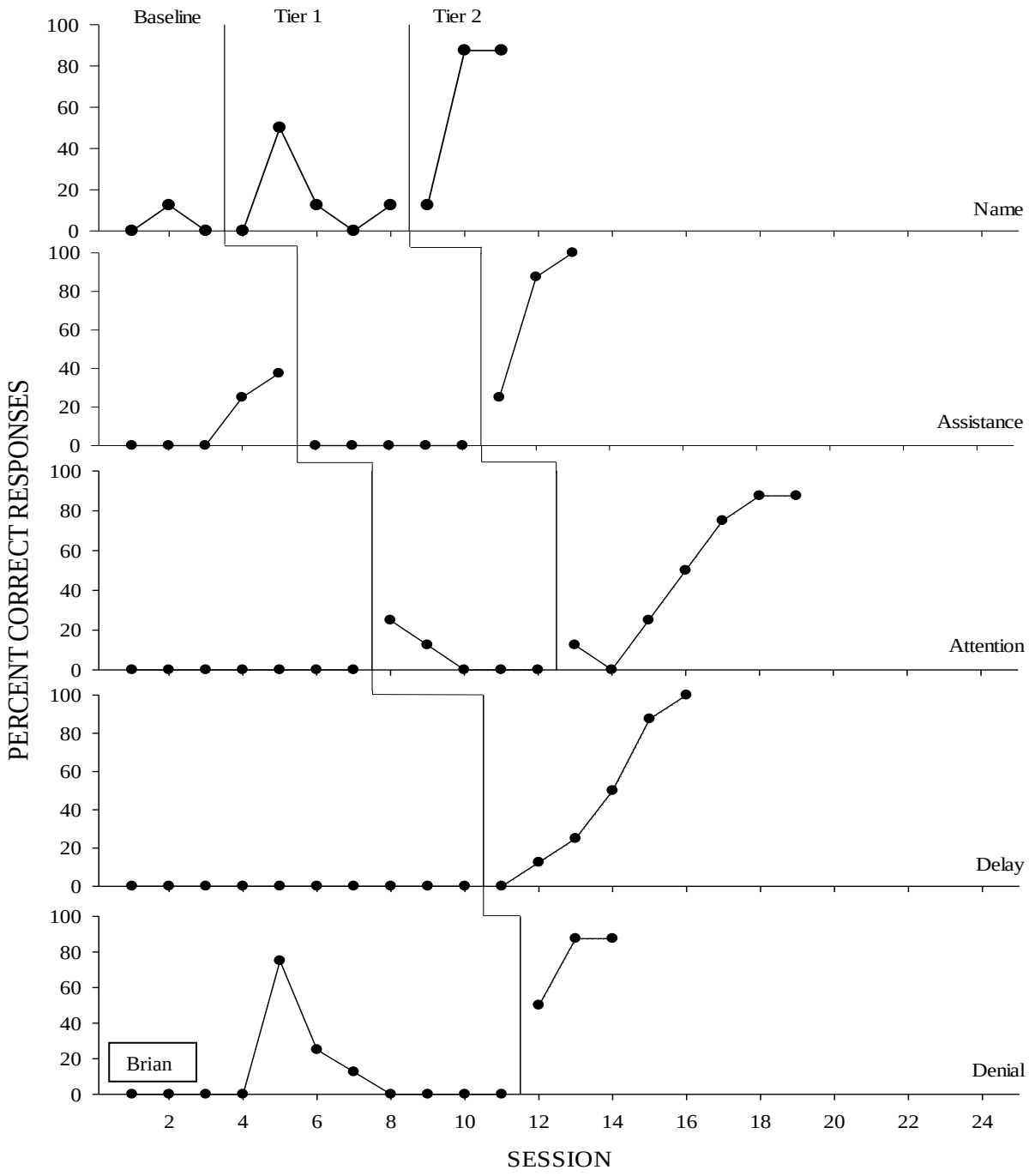

Figure 4. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Brian.

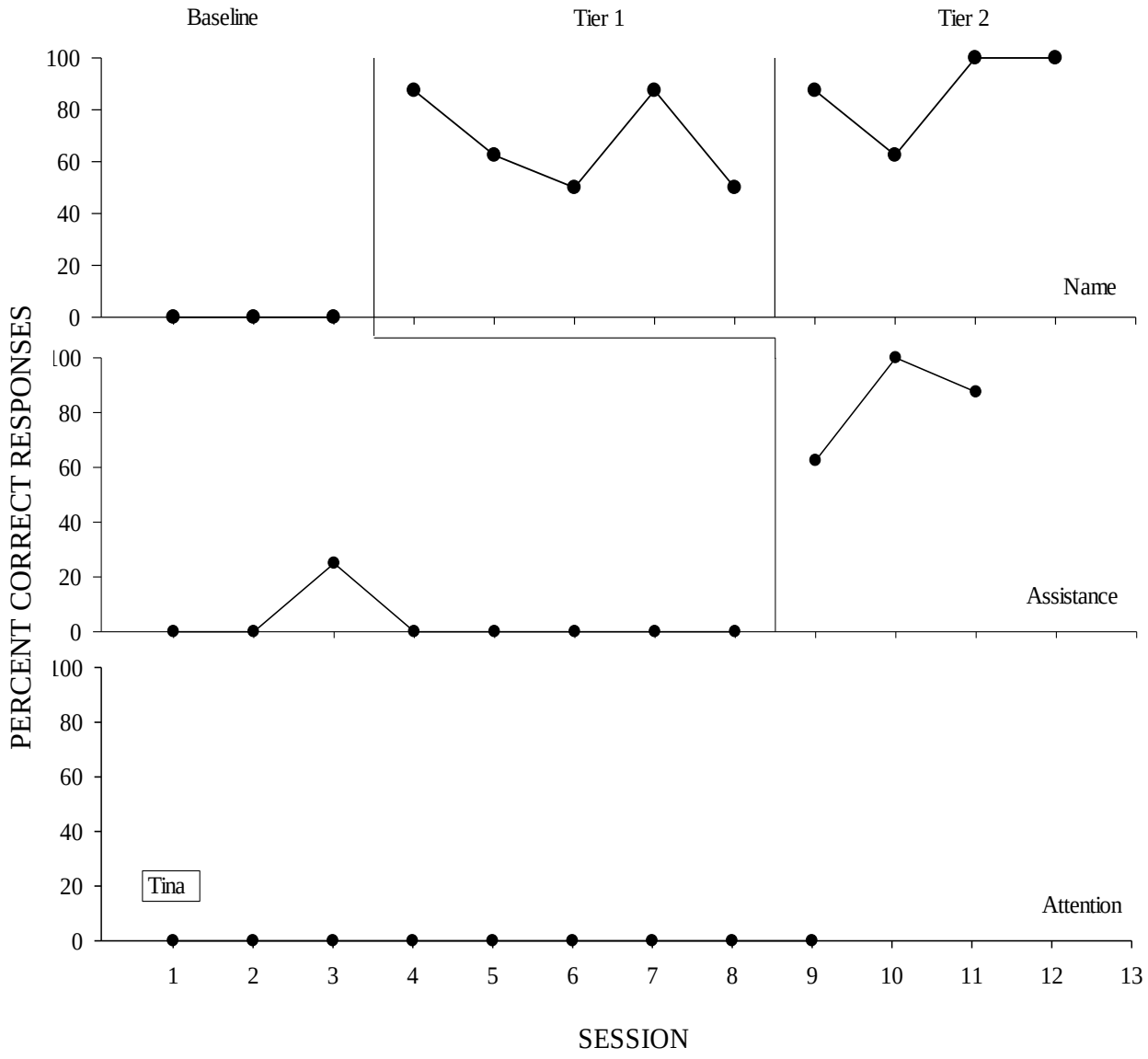

Figure 5. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), and requesting attention (third panel) for Tina.

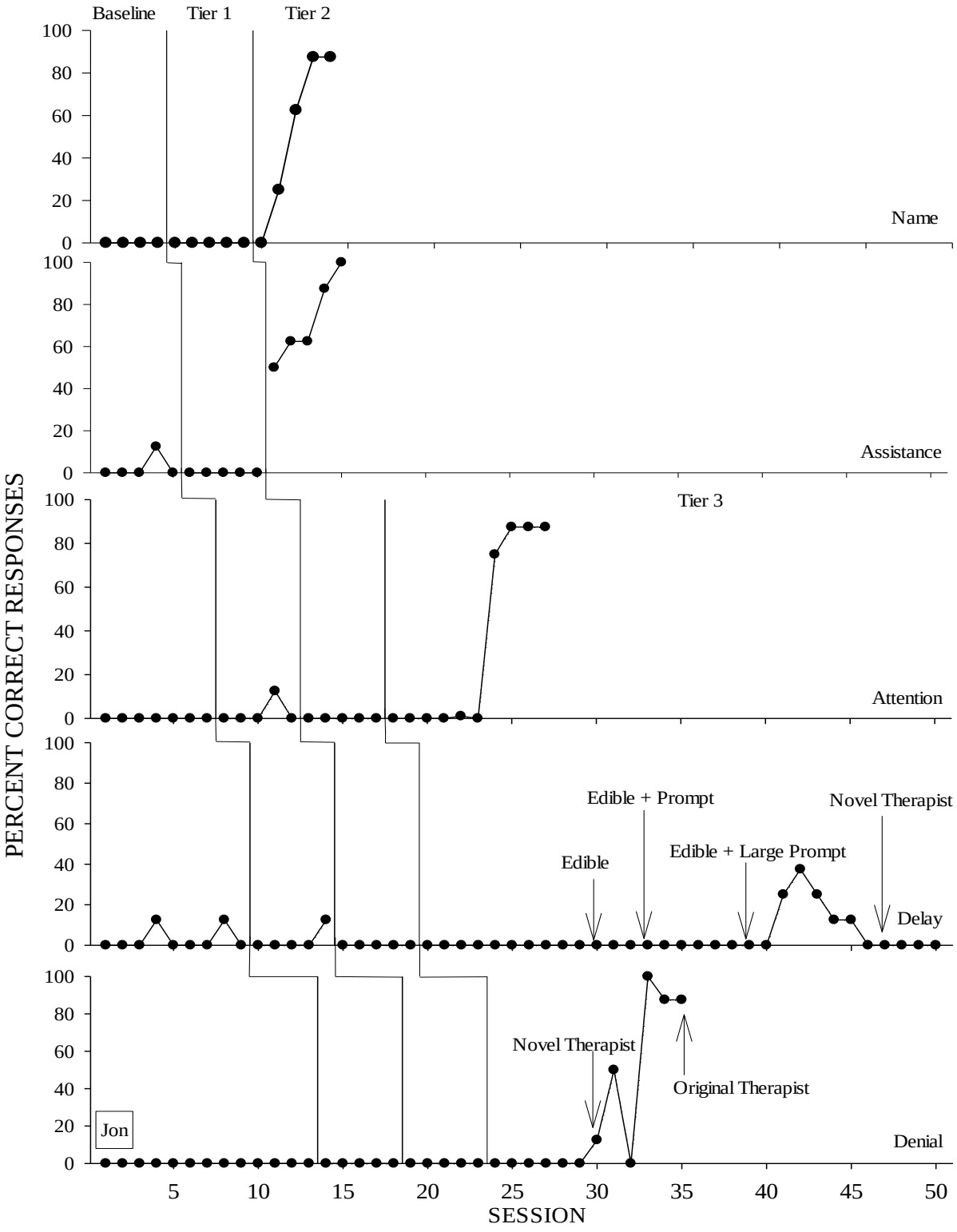

Figure 6. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Jon.

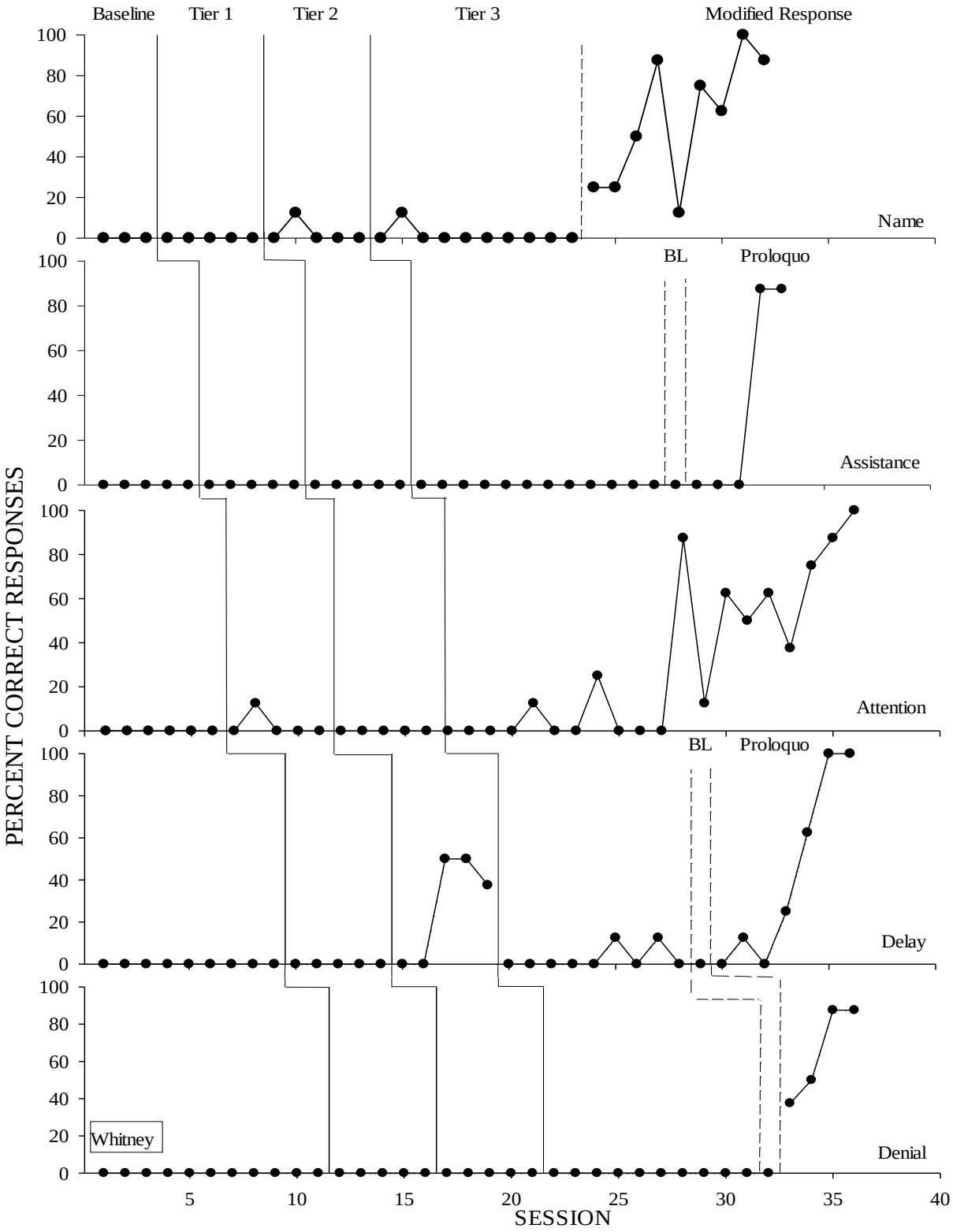

Figure 7. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Whitney.

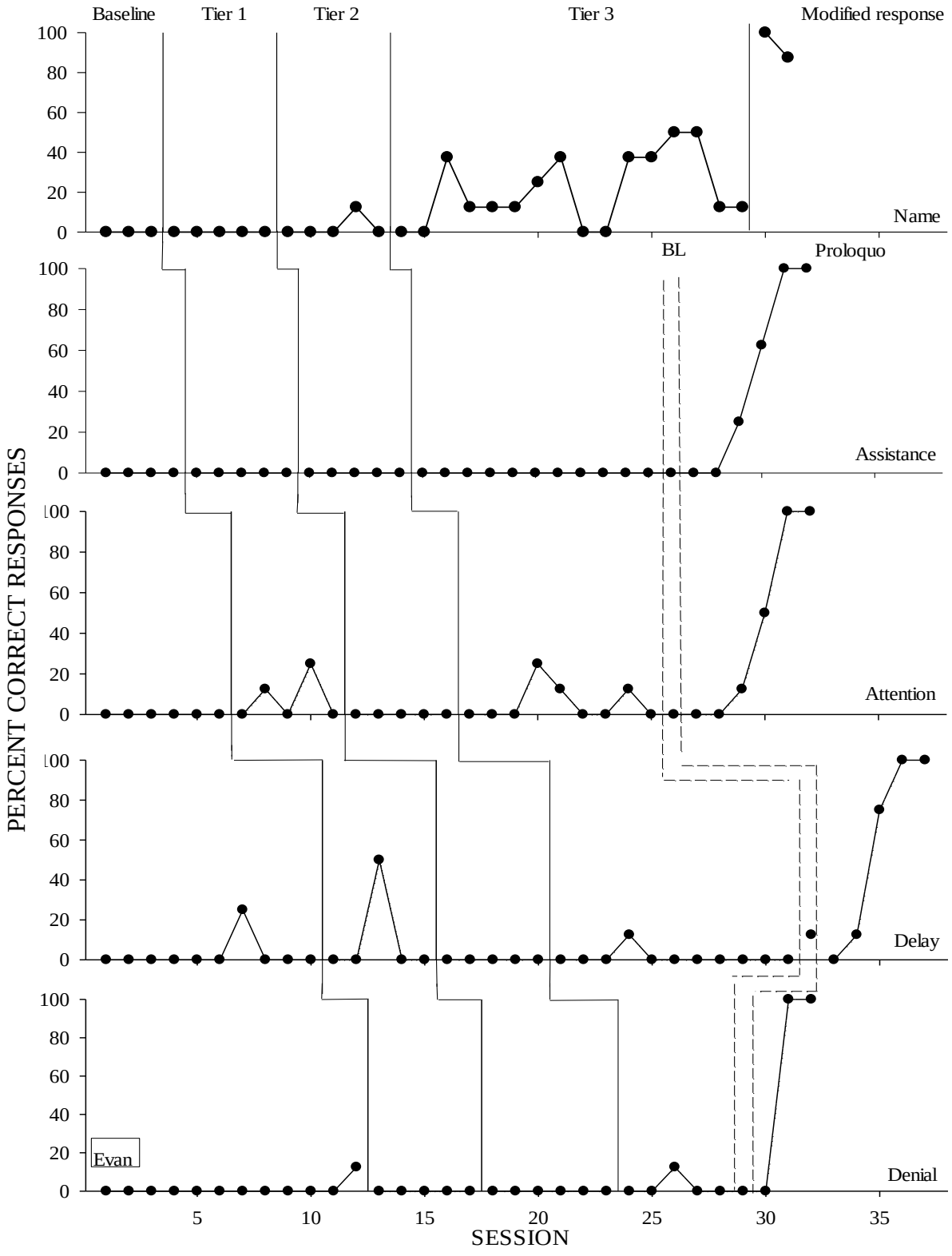

Figure 8. Percentage of correct responses across responding to name (top panel), requesting assistance (second panel), requesting attention (third panel), delay tolerance (fourth panel), and denial tolerance (bottom panel) during baseline and training sessions for Evan.

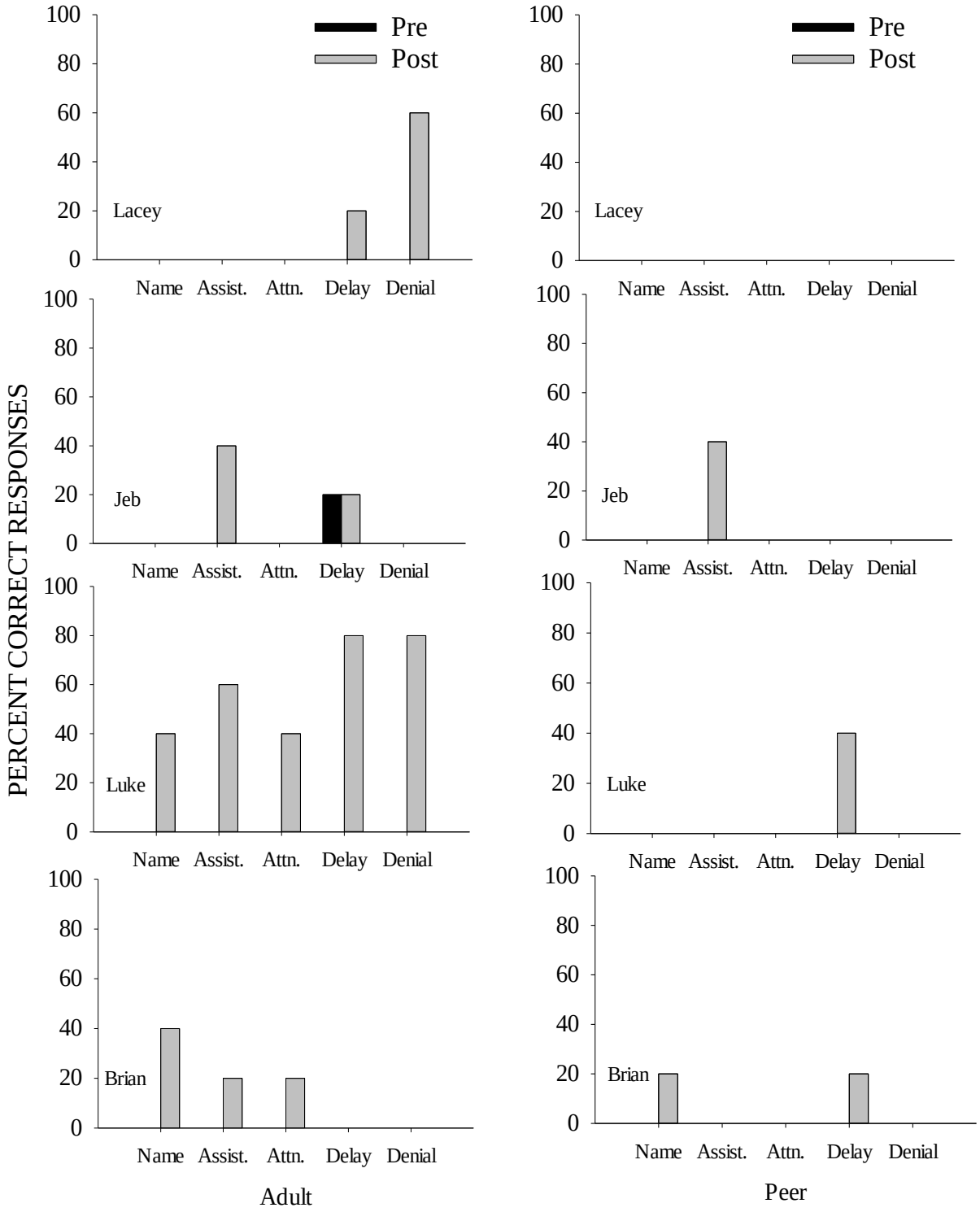

Figure 9. Percentage of correct responses of target skills across pre-baseline and post-mastery probes with peers (left column) and adults (right column).

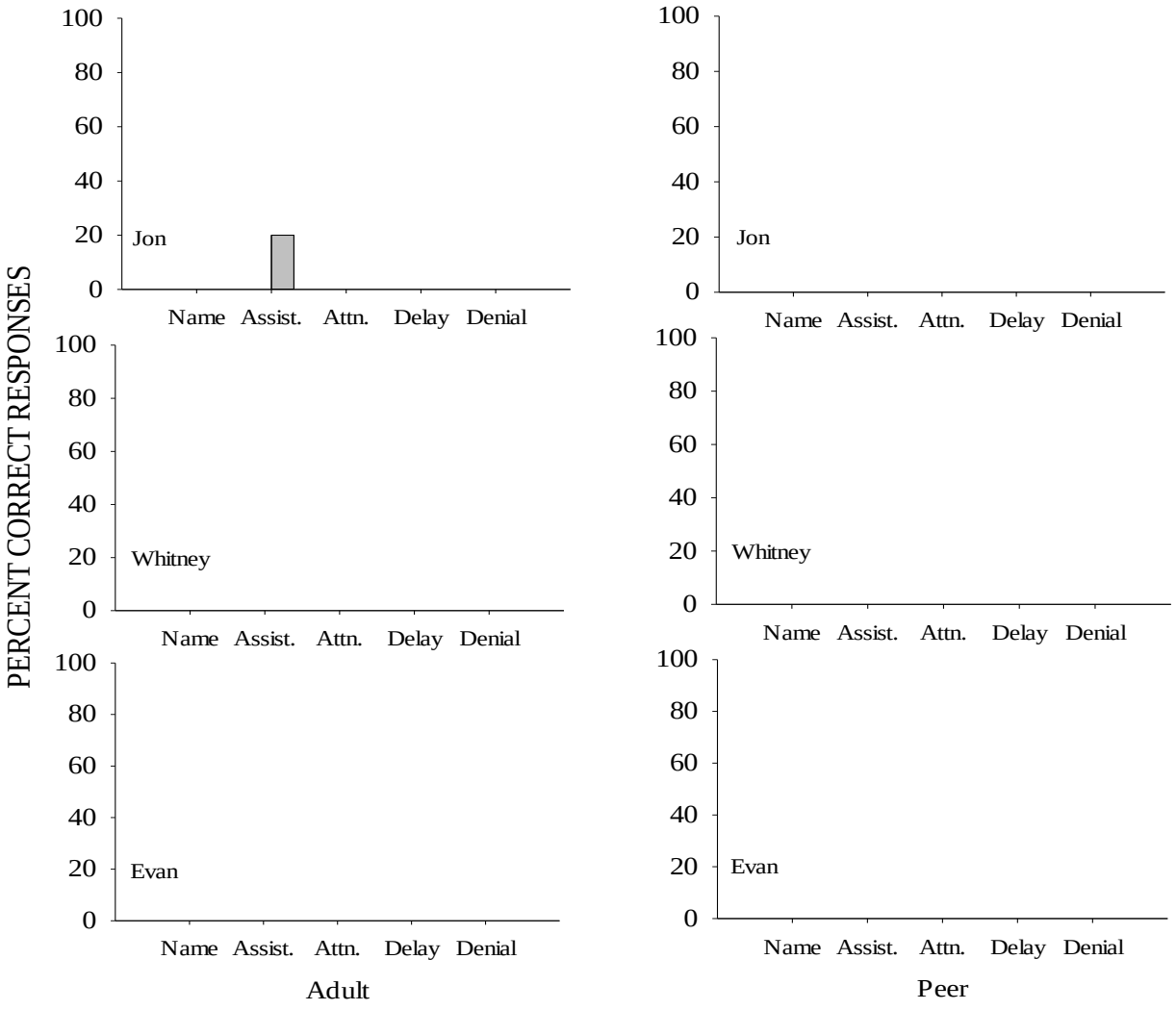

Figure 10. Percentage of correct responses of target skills across pre-baseline and post-mastery probes with peers (left column) and adults (right column) for Jon, Whitney, and Evan.