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ORIGINAL PAPER

Effects of a Modified Milieu Therapy Intervention on the Social Communicative Behaviors of Young Children with Autism Spectrum Disorders

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Abstract The purpose of the current study was to evaluate the effectiveness of combining milieu therapy and functional communication training (FCT)] to replace aberrant behavior with functional communicative skills in 3 male preschool or elementary aged children with Autism Spectrum Disorders (ASD). Study activities were conducted in the natural environments of the participants and parents acted as change agents. A concurrent multiple baseline design across participants was used to evaluate the effectiveness of the modified milieu therapy intervention. Results indicate that aberrant behavior decreased concurrent with an increase in total percentage of communication responses (PCR). The children maintained communication and low rates of aberrant behavior, and generalized their communication from the home to the classroom. A discussion of limitations and future research directions is included.

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Introduction

The severity of communication deficits of children with Autism Spectrum Disorders (ASD) is a more significant predictor of outcome than any other factor, including features specific to diagnosis (Lord and Risi 1998; Georgiades et al. 2007). Communication problems typically are compounded by significant impairments in social interaction, a highly restricted area of activities and interests, and engagement in high levels of aberrant behaviors toward others or themselves that interfere with their learning, such as screaming, hitting, and biting (Sigafoos 2000; Sigafoos et al. 2006). These problems increase parental stress (Koegel et al. 1992) and create substantial obstacles for individuals responsible for their education and care (Durand and Merges 2001).

Several researchers have responded to the aforementioned issues by examining the relationship between aberrant behaviors and communication abilities of children with ASD (e.g., see Bott et al. 1997; Chung et al. 1995; Sigafoos 2000; Schroeder et al. 1978). When children lack the appropriate communication skills to communicate, they may use aberrant behaviors for communication purposes (Sigafoos 2000).

To address both the communication and behavioral needs of children with ASD, researchers have investigated several interventions (Durand and Carr 1987; Kaiser 1993). Two of the most prominent strategies in the literature that are applicable to children with ASD and address the areas of aberrant behavior and communication are: (a) functional communication training (FCT), and (b) milieu therapy.

Functional Communication Training

Functional communication training (FCT) is one intervention strategy that has been used to address both the communication and aberrant behavioral needs of children with ASD (Carr and Durand 1985; Durand and Merges 2001; Wacker et al. 1990). FCT involves assessing the function (i.e., outcome, consequence) of a behavior (e.g., attention, escape, tangible, or sensory) through analogue assessment methodology referred to as functional analysis, and then replacing the aberrant behavior by teaching a communicative response that serves the same function (Durand and Carr 1987; see Mancil 2006 for a detailed description of the procedures).

A number of researchers have demonstrated the positive effects of this intervention with children with ASD and children with other developmental disabilities. Researchers have provided a plethora of evidence demonstrating that FCT has a significant impact on aberrant behavior (Durand and Carr 1992; Wacker et al. 2005).

Despite these positive findings, FCT research with children with ASD has not examined the generality of this intervention to natural settings. The majority of FCT research studies with children with ASD have been conducted in clinical settings without sufficiently analyzing generalization to other people and settings and predominantly limiting change agents to clinicians and researchers (Mancil 2006). Further, parents and teachers seldom have been included as the change agent. In a recent review only two studies were found that used a teacher (Wacker et al. 1990) or a parent (Wacker et al. 2005) as a change agent (Mancil 2006). In contrast, other behavioral intervention strategies focusing on communication skills, such as milieu therapy, have expanded research into the natural environment (e.g., home and school) with natural change agents (e.g., parents and teachers).

Milieu Therapy

Milieu therapy is another behavioral intervention with a plethora of studies demonstrating that it has been effectively used with children with developmental disabilities and/or communication disorders (e.g., Hester et al. 1995; Yoder and Warren 2002) and children with ASD (e.g., Hancock and Kaiser 2002). In contrast to FCT, milieu therapy focuses on teaching children new communication skills and behaviors within their natural environments (Kaiser 1993). The natural environment may refer to any setting, including the home, school, or an inclusive educational setting where the child typically would spend time (Schwartz 2003).

Researchers have used four basic milieu procedures [i.e., (a) modeling desired responses and correcting responses, (b) providing a mand (a vocal operant maintained by a reinforcer that is evoked by the discriminative stimuli for that reinforcer; Skinner 1957) and then modeling/correcting if needed, (c) time delay, and (d) incidental teaching (see Warren and Gazdag 1990 for a detailed description of the procedures] in the natural environment to demonstrate significant increases in children's communication and language skills (Hancock and Kaiser 2002). Researchers have accomplished this by focusing research with parents and teachers as natural change agents within the natural environment. Teaching communication skills in natural environments has many advantages including: (a) increases in vocabulary (Yoder et al. 1995), (b) generalization of communication skills (Hancock and Kaiser 2002), (c) maintenance of communication skills (Spradlin and Siegel 1982), and (d) unprompted use of language (Yoder and Warren 2002). Milieu therapy is a behavioral practice that has been demonstrated to successfully increase communication skills in children with ASD. In contrast to the FCT literature reviewed, the focus of milieu therapy has been on teaching children new skills and behaviors within their natural environments (e.g., home and school). Despite these positive findings, milieu therapy research has not evaluated milieu therapy's effects on aberrant behaviors. Research consumers do not know if improvements in aberrant behavior occurred, which may affect decisions of consumers who are looking for comprehensive interventions. Second, there is a paucity of research involving children with ASD. The few milieu therapy research studies that have included children with ASD were not designed specifically for the ASD population; instead, they were designed for any individual with communication deficits.

When considering the strengths and limitations described in the FCT and milieu therapy literature, future research should address concerns to extend the literature of both areas of research. A logical extension of the FCT research is to extend this literature by examining the following: (a) the effectiveness of FCT strategies in natural environments, (b) the generality of FCT across people (adults and peers) and settings (home, school, community), and (c) the maintenance of skills acquired through FCT across time. As discussed previously, few FCT research studies have been conducted in natural environments. Further, researchers have not investigated the generalization or maintenance of acquired skills sufficiently. In addition, researchers have not examined the use of parents and teachers as natural change agents sufficiently.

Similarly, there are logical extensions of the milieu therapy research. Analysis of the following: (a) the connection to behavioral problems, and (b) the design of studies specifically for children with ASD would extend the current research base. As described previously, milieu

therapy researchers have not systematically analyzed the relation between acquisition of communication skills and aberrant behavior. For example, one question for future researchers to consider is whether aberrant behaviors continue to decrease across settings as the child's communication repertoire increases? The field cannot conclude what influence if any that milieu therapy has on children's aberrant behavior, particularly for children with ASD. Also, studies have not been designed for children with ASD. Rather, the studies have been designed for children with language delays, which may or may not include children with ASD.

One logical extension of the literature is to combine the strengths in FCT and milieu therapy. Each approach has strengths that would support the future research directions for the other approach (e.g., milieu therapy is in natural environments and FCT decreases aberrant behavior). Combining both areas of research may (a) increase the response variation (i.e., more words and more complex words) of children's communicative skills, (b) provide an analysis of the relation between aberrant behaviors and communication, (c) facilitate generalization and maintenance of communicative skills in natural environments that also replace aberrant behavior, and (d) demonstrate that these skills can be taught by natural change agents.

Therefore, the purpose of the current study was to evaluate the effectiveness of combining the strengths of two effective strategies [i.e., milieu therapy and functional communication training (FCT)] to replace aberrant behavior with functional communicative skills in the individual's natural environments with parents as change agents. The following research questions were addressed:

1. Does the implementation of a modified milieu therapy intervention increase communication responses and decrease dependence on prompts in children with ASD in a natural setting?
2. Do newly acquired communication skills in children with ASD generalize to an untrained setting?
3. Do newly acquired communication skills in children with ASD maintain over time?
4. Does the implementation of a modified milieu therapy intervention result in a decrease of aberrant behaviors in children with ASD in a natural setting?

Method

Participants

Three male preschool or elementary aged children with ASD participated in the study. They ranged in age from 4 years and 1 month to 7 years and 11 months (see Table 1 for information about each participant). They were recruited with the help of a local agency for individuals with ASD.

The target children had a diagnosis of ASD obtained independently from a physician, licensed psychologist, or diagnostic center. In addition, the Social Communication Questionnaire (SCQ; Rutter et al. 2003) and the Autism Diagnostic Interview-Revised (ADI-R; Lord et al. 1999) were administered to obtain additional standardized scores indicating a diagnosis of autism. According to teacher and parent interviews, their socio-communicative skills included the ability to initiate and respond through gestures and verbal language (2–3 word utterances). Parents and teachers noted that each participant had to be prompted to communicate the majority of time and had low rates of social initiations to peers and adults. The participants' mothers had various levels of education and research study experience. Scott's mother was trained in applied behavior analysis (ABA) and had participated in other studies; whereas, the other two mothers had neither ABA training or participated in studies prior to the current investigation. In addition, Scott's mother and David's mother had a Bachelors degree, while Zeb's mother had a high school diploma. Similarly, each participant's teacher had differing degrees of education, expertise, and teaching experience (see Table 2 for information about each participant's teacher).

Settings, Change Agents, and Materials

Study activities were conducted in the natural environments of the participants (i.e., home and school). All assessment data were collected in the home of each participant (e.g., living room or other area where communication typically occurred). Training of the child participants and parents occurred in the home of each respective participant. Additionally, generalization data were collected in the participants' classrooms during the baseline, intervention, and maintenance phases in

Table 1 Participant characteristics

			ADI-R		Participant	Topography of behavior	Function of behavior
Participant	Age	Diagnosis	S–C–R	SCQ	MA		
Scott	7–11	Autism	26–22–10	25	49 months	Hit, pinch	Tangible
David	4–1	Autism	26–14–10	24	29 months	Hit, bite self	Tangible
Zeb	4–10	Autism	26–16–10	27	32 months	Tantrum	Tangible

Note: Age in years-months; MA = mental age; S–C–R = Reciprocal social interaction, communication, repetitive behaviors

Table 2 Teachers' survey results

Participant	# of students	Other studies	Education	ABA trained	Experience
Scott's teacher	5	No	Bachelors	Yes	6 years
David's teacher	9	Yes	Masters	No	12 years
Zeb's teacher	6	No	Masters	No	15 years

the home setting. The location of the study within the home and classroom were selected by the parents and teachers and represented locations where the communication skills typically occurred (e.g., playground, snack time). In addition, the maintenance phase occurred in the home and classroom in the same location as the previous phases.

The first author conducted the pre-intervention/assessment phases. Parents served as the change agents for the baseline, intervention, and maintenance phases. During each of the phases, picture cards (created with Board Maker™), preferred items, training videos, a digital video camera, a laptop computer, and data collection sheets were used.

Dependent Measures and Data Collection

The percentage of communication responses (PCR) and rate of aberrant behavior served as the primary dependent measures for the study. In addition, data were collected on prompts and spontaneous verbalizations. The specific definitions used to operationally define each behavior are described in Table 3 and have been adapted from previous researchers (Lalli et al. 1995; Wacker et al. 2005).

Sessions across all phases were videotaped using a Panasonic mini-DV digital camcorder and subsequently coded using real time data collection sheets. The data were transferred to an ibook G4 laptop computer for data analysis using imovie and Quicktime Pro software. Each session was conducted for 5 min.

Table 3 Operational definitions

Behavior	Operational definition
Aberrant behavior	Varied and were adjusted based on child's target behavior (Table 1)
Unprompted CR	Handing picture card to trainer without prompt
Prompted CR	Handing picture card to trainer following a prompt
Verbal prompt	Consisted of a verbal cue, (i.e., "Tell me what you want"
Verbal/Gestural prompt	Verbal prompt combined with holding the hand out, palm up
Physical prompt	Hand over hand exchange of picture card

Note: CR = communication response

During each session, the first author recorded the frequency of aberrant behaviors, frequency of prompted and unprompted communication responses, latency to respond to prompts, frequency of types of prompts, and diversity and number of unprompted verbalizations. The frequency of the aberrant behavior was recorded in real time (i.e., every aberrant behavior was recorded). Responses per minute were calculated by taking the frequency of aberrant behaviors during the session and dividing by the total amount of time of the session (5 min).

Latency data were collected on the time between the adult taking the preferred item from the target child and the target child requesting the item spontaneously. The average latency to respond per session was calculated by adding the latency to respond with unprompted communication during the five-minute session and dividing by the total number of unprompted communication responses.

Experimental Design

A concurrent multiple baseline design across participants was used to evaluate the effectiveness of the modified milieu therapy intervention on decreasing aberrant behaviors and increasing communication behavior. While parents implemented the intervention in the home, the first author videotaped the child in the classroom to determine if skills generalized to the classroom and teacher. Effects of multiple baseline designs were demonstrated by introducing the intervention to different participants at different times (Kazdin 1982).

Experimental Procedures

All experimental sessions in each phase were 5 min in duration. On average, sessions were conducted 2–3 days per week and took 3–4 weeks for each participant to complete all phases of the study. Four phases were conducted (a) pre-intervention/assessment (functional analysis and preference assessment), (b) baseline, (c) intervention, and (d) maintenance. Additionally, generalization was collected throughout the study.

Pre-intervention/Assessment Phase

Two assessments were conducted: (a) preference assessment, and (b) functional analysis.

Preference Assessment

A preference assessment was conducted based on procedures described by Roane et al. (1998). First, parent interviews were conducted to provide insight into target children's interests and behavioral functions. Item interests obtained in the caregiver interview were used for the

preference assessment. From this list of items, the top seven were chosen for the preference assessment. This set of seven items was arranged in a circle in the specified location, chosen by the parent, at the home. The first author walked the child to the center of the circle, which was equidistance from all items. The child was told to choose a toy. Each target child was allowed to choose any item he wanted to interact with, including multiple items. For a period of 5 min, the observer recorded the duration the target child played with each item. The item the target child played with for the longest duration was used as the first item of interest in the intervention phase.

After the first preference assessment was conducted, the item the target child engaged with for the longest time period was removed. Following this, another preference assessment was conducted minus the original preferred item. This was repeated until three items were identified, which were chosen as the items used to teach each communication mand to the target child. The first assessment determined the first item to use for the mand and the next two preference assessments determined the subsequent items to use for mand training.

Functional Analysis

The functional analysis was conducted to determine the function of the aberrant behavior. As stated, only children who displayed a tangible function were chosen for inclusion in this study. Tangible functions were chosen because of the inherent design of the intervention techniques, such as incidental teaching (i.e., to request items), and to avoid exposing a child to aversive stimuli that elicits escape behavior. A functional analysis was conducted in the participants' home settings using the procedures outlined by Iwata et al. (1982/1994) with the addition of a tangible condition.

The functional analysis (FA) was conducted by manipulating consequences such as escape from demands, contingent attention, and contingent tangible items to determine the function of the behavior. To identify a primary function, the relative effects of contingent reinforcement were compared to the other conditions (i.e., tangible, free play, escape). After completing the FA, a tangible function was identified for each participant.

Baseline and Intervention Phases

The baseline and intervention phases consisted of baseline, training, and the intervention.

Baseline

Prior to beginning baseline, the first author interviewed parents and teachers and conducted direct observations in the home and classroom in locations training occurred. During the interviews, the first author asked the parents and teachers to identify routines during which the target children typically had access to the preferred items. After obtaining the aforementioned data, baseline observations occurred during typical home and classroom routines, which were identified and held constant for each target child. Baseline consisted of direct observation of all dependent measures. During baseline, the target child was given access to the first preferred item for 30 s. The parent then removed the item and interacted with the first preferred item for 30 s. After interacting with the preferred item, the parent returned the item to the target child for another 30 s access period. This interaction cycle continued for the 5 min session. During this time, the target child had access (i.e., card was on the floor next to the target child) to the picture card of the first preferred item. These procedures were repeated throughout each 5 min session.

Training

Before initiating the intervention, parents were taught the procedures for teaching their child to communicate using the modified milieu therapy intervention. This skill was taught through viewing videos of the experimenter conducting an intervention with a child with autism and through role-play training sessions. Parents first read the training manual. The first author clarified any questions about coding definitions. Then, the first author and parents viewed videos and identified and recorded intervention procedures. They used paper and pencil to record and classify (e.g., verbal, physical) each prompt given to the child in the video. In addition, the first author and parents wrote each response from the child and recorded whether the response was prompted or unprompted, classifying the prompt. This was done until the parents achieved 90% interobserver agreement (IOA) with the first author. Finally, parents role-played the intervention procedures with the first author. The parent practiced taking an item and playing with the item, and giving verbal, verbal/gestural, and physical prompts with the first author until they were able to perform the skills correctly 10 consecutive trials.

For purposes of generalization, in contrast, teachers were taught a single skill. They were taught to place highly preferred items in view, but out of reach of the child. Additionally, the teachers were instructed to give the highly preferred items to the child when the child gave them a picture card. The teachers practiced these skills through role-play with the first author until they were able to complete this skill successfully as evaluated and defined by parents and teachers performing the procedures correctly 10 consecutive trials.

Intervention

Following baseline and completion of adult training, the intervention began (see Fig. 1 for visual of the intervention procedures). The intervention phase consisted of three conditions (i.e., each tangible item was a new condition). The intervention sessions initially occurred in an area of the home predetermined in the interviews during the pre-intervention/assessment phase. However, if the child initiated communication and then began to play in other locations (e.g., bedroom floor, kitchen table), the parent followed the child and conducted the intervention in the new location.

During the intervention, a time delay of 5 s was used prior to prompting the child for the tangible items. If the child asked for the item at any time, the child was allowed access to the preferred item for 30 s and then the first author prompted the parent to take the item and play with the item. An access time of 30 s was used because this time period has been identified as enough time to keep a child's interest but not satiate (O'Neill and Sweetland-Baker 2001).

The intervention began by allowing the child access to the preferred item for 30 s and then performing a two-step modeling procedure. The first step of the modeling procedure consisted of the first author giving the parent a visual prompt (i.e., index card with "Provide Model" written on it), the parent then said, "I want the ___", gave the picture card to the child, and then took the preferred item. The parent then played with the item of interest in the home for 30 s without immediately providing another prompt. If the child did not use the picture card, the second step of the modeling procedure consisted of the first author providing a visual prompt (i.e., index card with the words "Physical prompt" written on it) for the parent to provide a physical prompt (i.e., hand over hand assistance) and then allow access to the preferred item for 30 s. This two-step model procedure was done with each target child and was not recorded as communication responses.

After the two-step modeling procedure, the first author provided a visual prompt (i.e., index card with "Take Toy" written on it); the parent took the item and played with the item of interest in the home without immediately providing a verbal mand. If the child did not ask for the item within the defined time delay for the tangible item, the first author provided a visual prompt (i.e., index card with the words "Verbal prompt" written on it) indicating to the parent to provide a verbal prompt. The parent would then say, "Tell me what you want." If the child did not initiate communication within the 5 s time delay for the tangible item, the first author provided a visual prompt (i.e., index card with the words "Verbal/gestural" written on it) for the parent to provide a combined verbal/gestural prompt. If the child still did not respond within the 5 s time delay, the first author provided a visual prompt (i.e., index card with the words "Physical prompt" written on it) for the parent to provide a physical prompt (i.e., hand over hand assistance) and then allow access to the preferred item for 30 s.

This condition for the intervention phase was continued two to three times a week until the latency of the child's response occurred consistently within the allotted 5 s time delay for the tangible item and decreased levels of aberrant behaviors were indicated. When the child displayed the communicative response following the mand for the first item consistently within 5 s, for at least 75% of the prompts, and at least 20% of the communication responses in the last three sessions were unprompted, the same procedures were followed to teach two additional mands for preferred items. In each new condition of the intervention phase (i.e., condition two and three), the child had access to the new card indicating a new item and the card(s) from the previous condition(s) of the intervention phase.

Maintenance Phase

The purpose of the maintenance phase was to determine if unprompted communication trained in the home maintained over time. Two weeks following the conclusion of

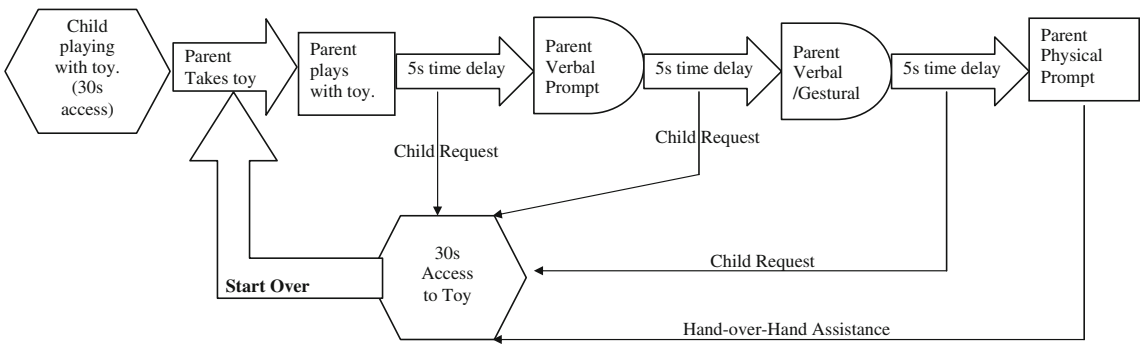

Fig. 1 Intervention procedures for parents to follow with their children

Table 4 Maintenance session items

Participant	Session 1	Session 2	Session 3	Session 4	Session 5
Scott	Ball	Computer	Toy story	Computer	Ball
David	Swing	Train	Toy story	Toy story	Swing
Zeb	Swing	Computer	Toy story	Computer	Swing

the intervention phase, the first author and graduate assistant videotaped sessions in the home until a stable trend in data was observed. During these sessions, the first author did not provide any prompts to the parents. Parents continued to provide the intervention as previously implemented during the last condition of the intervention phase without any assistance from the first author. During this phase, the target child had access to all three picture cards. In addition, the parent randomly interacted with each preferred item across sessions. Each preferred item was interacted with for at least one entire session (see Table 4).

Generalization

The purpose of the generalization probes was to determine if and when communication trained in the home environment generalized to the classroom environment. Generalization data were collected simultaneously while the intervention phase of the study was being implemented. The data were collected during typical classroom routines and activities as identified through the pre-assessment interviews (e.g., snack, playtime, center time). The routines targeted depended on the item of interest and when the item was typically available to the target child. For example, if the preferred item was a toy car that the target child would play with during playtime and center time, then data were collected during those periods. During these routines, the target child had access to the picture cards. When data stabilized in each phase at home, at least three generalization probes were conducted in the classroom (Kennedy 2005).

The first author videotaped generalization sessions in the classroom that corresponded to sessions in each child's home. After a few sessions in the home setting, generalization data were collected in the classroom for at least a four to one ratio. That is, for every four sessions in the home, at least one generalization data session was conducted.

During the generalization sessions, the teachers did not provide any prompts. Each target child's respective preferred items were in view, but not accessible without requesting the item. As aforementioned, each target child had access to the picture cards that indicated his respective preferred items. The picture cards accessible to each target child mirrored those accessible in the corresponding condition of the intervention phase. If the target child requested the preferred item using the picture card, he was given 30 s access to the item.

Interobserver Agreement

Interobserver agreement (IOA) was calculated for 50–100% of all sessions across all study phases. For all measures (e.g., communication responses, prompts), total agreement was calculated (Kennedy 2005). It was determined by calculating the scores for theses sessions and counting the number of agreements between the two observers divided by the number of agreements plus disagreements multiplied by 100 (Kennedy 2005). The mean IOA across all study phases was 94%, 96%, and 94% for Scott, David, and Zeb, respectively. In addition, kappas were calculated for the measures across phases for each participant (see Table 5).

Treatment Integrity

Treatment integrity data were gathered by viewing the videotapes from the baseline, intervention, maintenance, and generalization sessions. Data were gathered during baseline to ensure that the modified milieu therapy intervention was not being implemented. Data collectors viewed the videos and recorded any adult prompts provided by the parents and teachers (i.e., recorded any prompts because the parents and teachers were instructed to make no prompts). In addition, data were gathered on the intervention in the home setting to ensure that the experimental procedures were implemented consistently across participants. Data also were gathered during the maintenance phase to ensure that the experimental procedures were implemented consistently across participants. Finally, data were gathered during generalization sessions to ensure that the teachers were following instructions and the modified milieu therapy intervention was not being implemented in the classroom.

Table 5 Interobserver agreement across phases

Phase	Aberrant behavior			Communication response		
	Scott	David	Zeb	Scott	David	Zeb
Baseline	.94	.86	1.0	.95	1.0	1.0
Condition 1	.86	.89	.98	.87	.92	.89
Condition 2	.88	.78	.84	.93	.89	.84
Condition 3	.79	.87	.91	.88	.98	.90
Maintenance	.93	.82	.96	.78	.85	.87
Generalization	.92	.95	.90	.91	.86	.93

Note. Kappa measures for each student, phase, and measure.

Social Validity

Social validity data were collected on the intervention and outcomes. Caregivers and teachers were asked to complete rating scales concerning the invasiveness and friendliness of the procedures to determine the social validity of the process. In addition, videotape analyses by one expert in the field of ASD were used to determine therapeutic outcomes of the participants' social-communicative behaviors. The expert was chosen from the local University and had several years experience working with children with ASD and their parents and teachers. The expert was asked to view 10-min video clips of randomly selected footage of the participants during the baseline and intervention sessions. The expert completed a Likert scale to indicate the degree of appropriate social-communicative behavior displayed by the participant on the video clips.

Results

Preference Assessment

The three participants' preferences had similarities and differences. The results of the three preference assessments for all three participants are found in Table 6.

Functional Analysis

Functional analyses were conducted for all three participants to determine functions of their aberrant behaviors (see Fig. 2). Scott's results indicate that Scott's aggressive behavior was maintained by access to tangible items of interest. Similarly, David's results indicated that his SIB was maintained by access to tangible items of interest. In addition, Zeb's results indicate that his tantrum behavior was maintained by access to tangible items of interest.

Intervention Results

As indicated in Figs. 3–4, Scott, David, and Zeb were not communicating and engaged in high rates of aberrant behavior. After the implementation of the intervention, their aberrant behavior decreased concurrent with an increase in total percentage of communication responses (PCR). In addition, their unprompted PCR increased across conditions. They maintained communication and low rates of aberrant behavior. Further, they generalized their communication from the home to the classroom.

During the implementation of the first intervention condition (condition 1), Scott showed a gain of 37% from baseline (M = 0%) to intervention (M = 64%, range 40–86%) in total percentage of communication responses

Table 6 Preference assessment choices

Participant	Condition 1 Item	Condition 2 Item	Condition 3 Item
Scott	Ball (5 min)	Computer (3 min 45 s)	Toy Story (4 min 46 s)
David	Train (4 min 3 s)	Toy Story (3 min 48 s)	Swing (3 min 11 s)
Zeb	Computer (5 min)	Swing (3 min 4 s)	Toy Story (5 min)

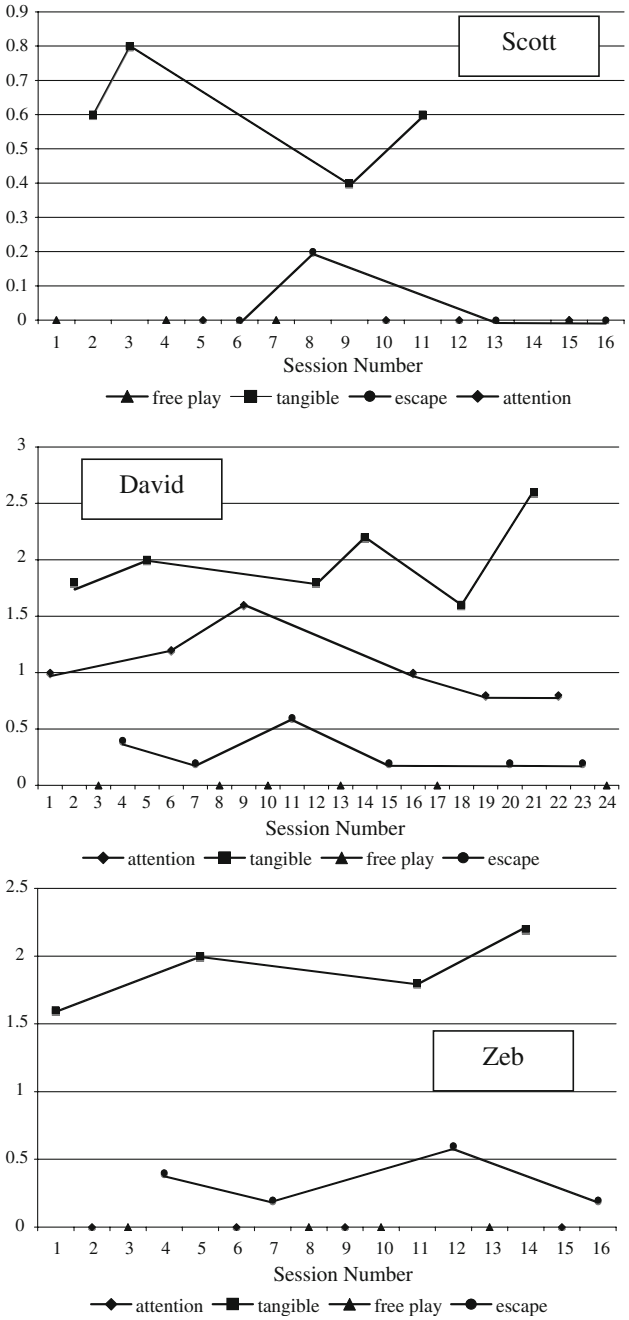

Fig. 2 Participants' rate of aberrant behavior per min during the functional analysis

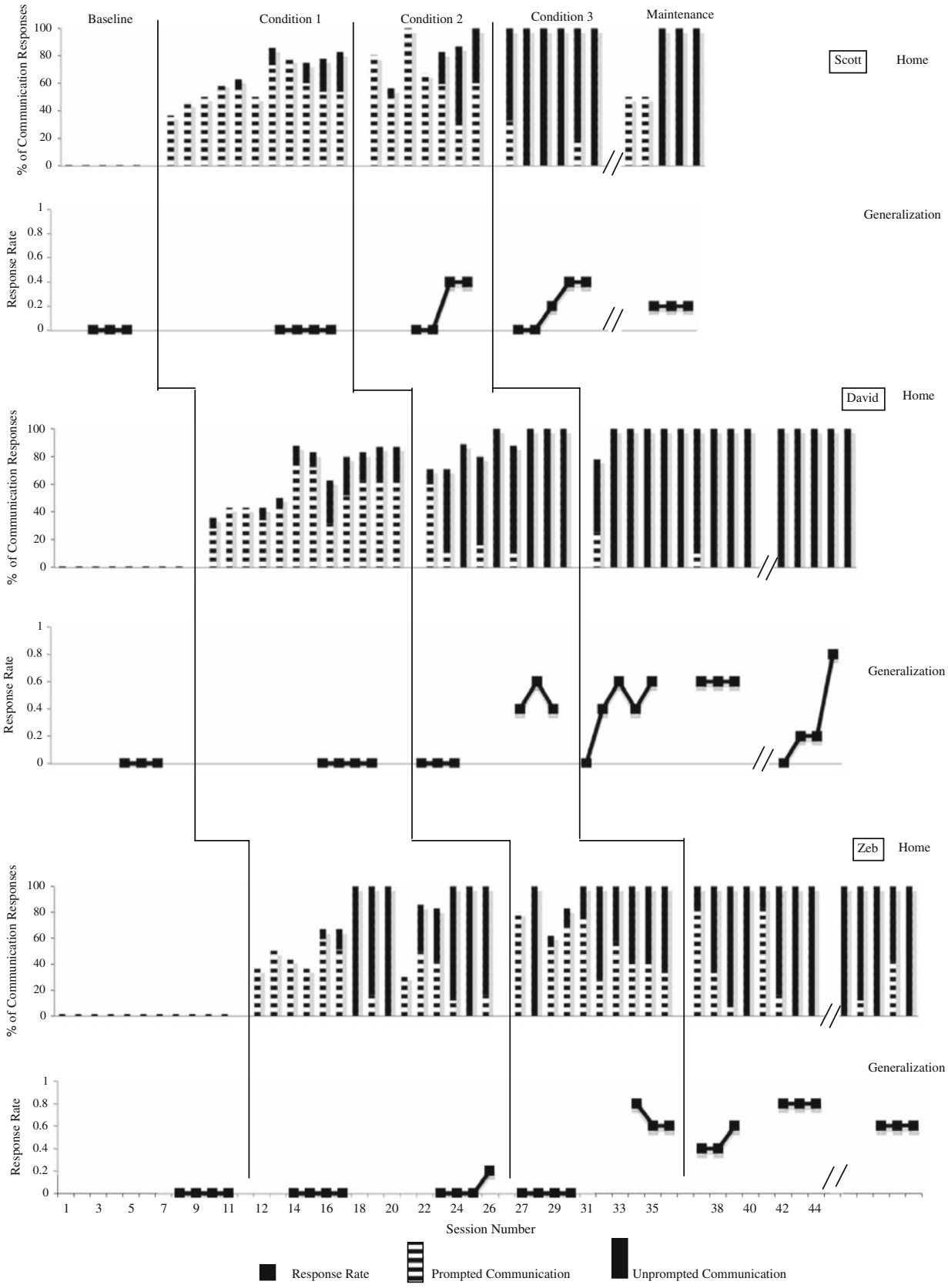

Fig. 3 Communication response percentages and rates across conditions

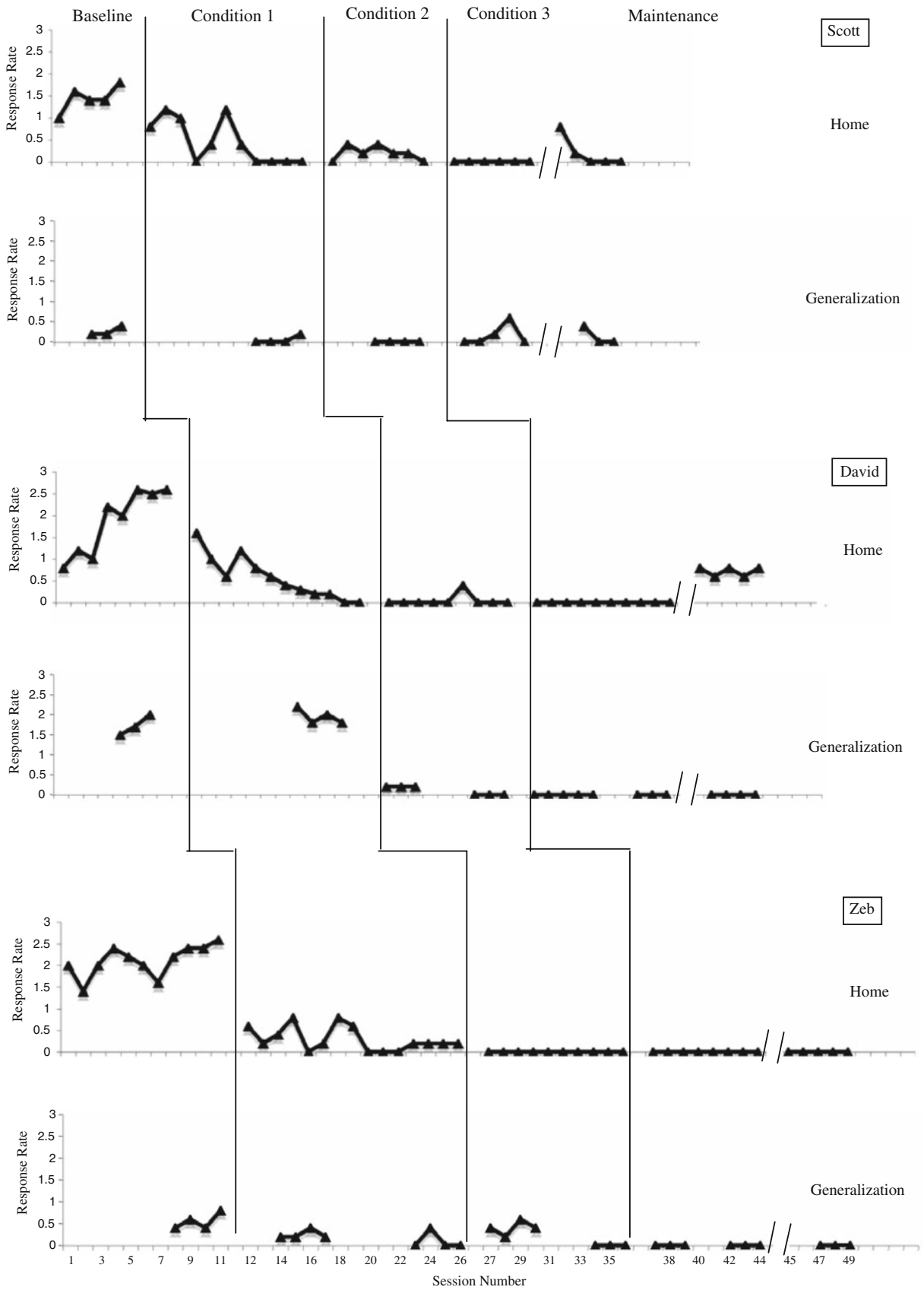

Fig. 4 Rate of aberrant behavior across conditions

(PCR). His prompted PCR averaged 56% while his unprompted PCR averaged 8%. Concurrently, he showed a decrease in aberrant behavior from baseline [M = 1.44 responses per minute (RPM)] to intervention (M = 0.45 RPM). Across condition 2, Scott's total PCR averaged 82% (range of 56–100%). After further analysis, it was noted that his prompted PCR averaged 64% while his unprompted PCR averaged 18%. His rate of aberrant behavior decreased further to an average of 0.2RPM (0–0.4RPM). In addition, his communication began generalizing during condition 2 with 0.40 RPM (0.4–0.4). Scott also had low rates of aberrant behavior in the generalization setting (M = 0.3 RPM, 0.2–0.6 RPM). During condition 3, Scott's total PCR increased further to an average of 100%. He also began to have more unprompted responses with an average of 9% prompted and 91% unprompted. In addition, his aberrant behavior decreased to zero. Once again, Scott generalized communication to the classroom (M = 0.2 RPM, 0–0.4 RPM) and displayed no aberrant behavior. Further, Scott maintained high levels of PCR (M = 80%, 50–100%) and low rates of aberrant behavior (M = 0.2RPM, 0–0.8 RPM) two weeks after conclusion of the intervention in the home. In addition, Scott maintained communication in the generalization setting (i.e., classroom; M = 0.2 RPM, 0.2–0.2 RPM) and exhibited low rates of aberrant behavior (M = 0.13 RPM, range 0–0.4 RPM).

During the implementation of the first intervention condition (condition 1), David showed a gain of 36% from baseline (M = 0%) to intervention (M = 68%, range 43%–88%) in total percentage of communication responses (PCR). His prompted PCR averaged 50% while his unprompted PCR averaged 15%. Concurrently, he showed a decrease in aberrant behavior from baseline [M = 1.86 responses per minute (RPM)] to intervention (M = 0.56 RPM). Across condition 2, David's total PCR averaged 89% (range of 71–100%). After further analysis, it was noted that his prompted PCR averaged 11% while his unprompted PCR averaged 78%. His rate of aberrant behavior decreased further to an average of 0.04RPM (0–0.4RPM). In addition, his communication began generalizing during condition 2 with 0.23 RPM (0.–0.6). David also had low rates of aberrant behavior in the generalization setting (M = 0.1 RPM, 0–0.2 RPM). During condition 3, David's total PCR increased further to an average of 98% (78–100%). He also began to have more unprompted responses with an average of 3% prompted and 95% unprompted. In addition, his aberrant behavior decreased to zero. Once again, David generalized communication to the classroom (M = 0.48 RPM, 0–0.6 RPM) and displayed no aberrant behavior. Further, David maintained high levels of PCR (M = 100%) and low rates of aberrant behavior (M = 0.72, 0.6–0.8 RPM), compared with baseline levels, two weeks after conclusion of the intervention. In addition, David maintained communication in the generalization setting (i.e., classroom; M = 0.3 RPM, 0–0.8 RPM) and exhibited no aberrant behavior.

During the implementation of the first intervention condition (condition 1), Zeb showed a gain of 37% from baseline (M = 0%) to intervention (M = 70%, range 31%–100%) in total percentage of communication responses (PCR). His prompted PCR averaged 30% while his unprompted PCR averaged 44%. Concurrently, he showed a decrease in aberrant behavior from baseline [M = 2.11 responses per minute (RPM)] to intervention (M = 0.56 RPM). Across condition 2, Zeb's total PCR averaged 93% (range of 63–100%). After further analysis, it was noted that his prompted PCR averaged 47% while his unprompted PCR averaged 45%. His rate of aberrant behavior decreased further to zero. In addition, his communication began generalizing during condition 2 with 0.29 RPM (0.–0.6). David also had low rates of aberrant behavior in the generalization setting (M = 0 RPM). During condition 3, Zeb's total PCR increased further to an average of 94% (28%–72%). He also began to have more unprompted responses with an average of 28% prompted and 72% unprompted. In addition, his aberrant behavior remained at zero. Once again, Zeb generalized communication to the classroom (M = 0.63 RPM, 0.4–0.8 RPM) and displayed no aberrant behavior. Further, Zeb maintained high levels of PCR (M = 100%) and low rates of aberrant behavior (M = 0 RPM) two weeks after conclusion of the intervention. In addition, Zeb maintained communication in the generalization setting (i.e., classroom; M = 0.6 RPM, range 0.6–0.6 RPM) and exhibited no aberrant behavior.

Treatment Integrity

Treatment integrity was collected for all phases of the study and during all treatment sessions (i.e., baseline, intervention, maintenance, and generalization sessions). Treatment integrity data for baseline, intervention, maintenance, and generalization sessions include: (a) percentage of correct procedural prompts (i.e., verbal, verbal/gestural/, or removal), (b) correct implementation of the time delay procedure, and (c) the percentage of times the requested item was given to participant for the correct time (i.e., 30 s access contingent on communication response) when item was requested. Treatment integrity for each procedure was calculated by marking a "yes" if it was done correctly and a "no" if it was done incorrectly. The total correct procedures were divided by the total number of procedures. Across phases, treatment integrity averaged 92.4% with a range of 73% to 100%.

Social Validity

The participants' parents, teachers, and an expert in the field of ASD completed Likert-type rating scales to determine the social validity of the intervention process and outcomes, respectively. The parents and teachers all indicated that the participants increased communication and decreased aberrant behavior. In addition, they noted that they would do the intervention in the future. Further, after viewing the video of the children in the home and classroom setting for the baseline, intervention, and maintenance phases, the expert noted that the participants all communicated more appropriately, decreased their levels of aberrant behavior, communicated more frequently, and improved overall functioning in communication.

Discussion

The study sought to determine the effectiveness of a modified milieu therapy intervention on increasing communication skills, decreasing dependence on prompts, and decreasing aberrant behaviors in young children with ASD in natural settings. Overall, target children's percentage of communication response increased, leveled, and remained stable at or above 75% across the intervention conditions. In addition, this was maintained at follow-up sessions conducted two weeks after the conclusion of the last intervention condition. Further, communication skills generalized to the classroom setting (i.e., generalization setting) in conditions 2 and 3 for Scott and David and conditions 1, 2, and 3 for Zeb. However, the communication response rates for generalization were the highest in condition 3 and maintenance sessions for each participant.

The participants' dependence on prompts decreased across all three intervention conditions, with less prompts being required for condition 3 or maintenance sessions. During condition 3 and maintenance sessions, 80% or greater of the participants communication responses did not require a physical, verbal/gestural, or verbal prompt. Each participant responded on average between 3 and 4 s across all three intervention conditions; however, this measure was slightly variable.

Similar to the percentage of communication response levels, aberrant behavior rate decreased, leveled, and remained low across conditions and maintained at 0 RPM by condition 3. In addition, aberrant behavior rate remained at zero during maintenance sessions for each participant except David, whose rate remained well below baseline levels. Further, aberrant behavior rates for each participant during generalization probes leveled and stabilized at zero.

Treatment integrity data revealed that the intervention was conducted with a high level of integrity within and across participants. Finally, social validity data demonstrated that the teachers, parents, and an expert in the field of ASD found the study to be beneficial to the participants.

The results are promising, but must be considered with caution in light of a few limitations. As with many single subject research studies, the small sample size limits the external validity of this study (Kazdin 1982). In addition, since the study only included young children with ASD whose aberrant behavior was maintained by a tangible function, one cannot be certain that the findings would extend to older children with other behavioral functions (e.g., attention or escape). Milieu therapy alone also may have yielded similar results with the inclusion of aberrant behavior measures; however, this was not examined in the present study. Further, due to the nature of the intervention, the number and type of prompts varied across phases. Particularly, no prompts were given during the baseline phase of the study. However, by the end of each condition of the intervention phase, the use of unprompted communication for at least 20% of sessions were required for each participant to move to the next condition. Further, the providing of prompts to elicit communicative responses was chosen as a part of the intervention to prevent the escalation of aberrant behaviors and increase the ethical treatment of the intervention for the children. In addition, the procedures for the system of prompts were consistent across conditions within the intervention phase and resulted in completely fading the use of prompts by the end of condition 3. Further, parents noted that they did not use the procedures with the preferred items outside of the intervention sessions. However, a formal rating system or observations were not used to measure the nonuse of procedures. Thus, it is possible that parents varied in procedure practice outside of the intervention sessions. A final limitation involves the rating of videotapes by experts. The experts only rated video of children who participated in the study, so there is not way to know if other children would have improved similarly without the prescribed intervention.

Nevertheless, the findings have a number of positive instructional implications for young children with ASD and their families. One of the purposes of this study was to examine the relationship between communicative responses learned in one setting (i.e., home) and the generalization of these responses to a second setting (i.e., school). As discussed in the results section, for the majority of the participants, generalization of communicative responses began to occur in condition 2, with the exception of Zeb, who requested the item only once during condition 1. However, Zeb did begin to respond in condition 2,

which has occurred in previous studies involving generalization of communication responses (Dyches et al. 2002).

Researchers have suggested that generalization that does not occur immediately may increase over time when more exemplars have been presented. Griffiths and Craighead (1972) and Stokes and Baer (1977) referred to this phenomenon as *training sufficient exemplars* (i.e., training multiple examples of a new skill). For example, Griffiths and Craighead (1972) provided training in two settings, and then observed generalization to a third untrained setting where the skill of articulation did generalize.

In addition, Stokes and Baer (1977) purported that introducing individuals to natural contingencies may increase the chance of generalization. For instance, a child asking for a preferred tangible item that he or she would have access to in the natural setting and then receiving the item requested would be a natural contingency. Charlop et al. (1985) demonstrated this by teaching children with autism to request an item in a training setting and then observing generalization to a separate setting.

In addition to generalizing skills, participants generally maintained high levels of communication and low levels of aberrant behavior during maintenance sessions, with the exception of David. Similar to the other two participants, David maintained high levels of communication, but he also engaged in aberrant behavior during maintenance sessions.

There are several possible explanations that may be applied to David's occurrence of problem behaviors during the maintenance condition, all related to potential setting events. One plausible explanation may have been the occurrence of a temporally distant setting event for David just prior to the maintenance phase of the study (i.e., change of routine and out of town visit with his family). Additionally, David's parents noted that his sleep patterns were interrupted (i.e., sleep deprived during sessions) during this out of town trip and continued to pose a problem since returning home. Each of these potential setting events is related to personal contexts (McGill et al. 2005). Personal contexts refer to events such as when someone has been sleep deprived, ill, or had a change in routine. According to McGill and colleagues, setting events in personal contexts, particularly the disturbance of sleep, are more likely to contribute to the occurrence of problem behaviors than others such as physical setting or day of the week.

Future Research

This study demonstrated positive effects of the intervention on the social communicative behaviors of young children with ASD. The results along with the limitations of the current study provide implications for future research. First, the study's findings should be replicated with a larger group of individuals with ASD, systematically accounting for diverse characteristics (e.g., language level). These analyses may provide additional information for individuals along the autism continuum with different diagnoses, age, and ability level. This may assist researchers in identifying ASD subgroups that are the most responsive to the intervention. For example, children with ASD who have social characteristics that are aloof (i.e., have an absence of speech and poor social interaction, but seem to enjoy others) may respond better than children who are socially passive (i.e., avoid eye contact and other social stimuli such as touching). Further, children with ASD who have an average I.Q. and/or are considered high functioning may demonstrate better responses to the intervention.

Second, the utility of the intervention with various trainers should be explored. Researchers could examine whether similar results would occur when fathers, teachers, or peers implement the intervention in comparison to mothers who were the implementers in the current study. In addition, researchers should explore generalization with peers. Researchers may want to determine if similar results would occur following training with an adult or if training would need to occur with one peer before generalizing to another peer. Further, training may need to occur with multiple peers before the communication responses generalize to other peers.

Third, the effects of using different items should be examined. For example, researchers could examine the effectiveness of using items identified later in the sequence of preferences as the first items trained. Some researchers have found using preferences identified in subsequent preference assessments to have similar effects as the first preferences (Ciccone et al. 2006). Further, DeLeon et al. (2000) found that rotating sets of toys had a better effect on outcomes than using a single set of toys.

Fourth, researchers should examine generalization further. Researchers should examine generalization to peers and siblings. For example, researchers should examine if communication skills generalize to peers after training with an adult or if training should occur first with one peer to increase the chance of generalization to another peer. Also, researchers could examine generalization to other items across settings, both preferred and non-preferred items.

Finally, researchers should examine additional outcomes of the modified milieu therapy intervention such as possible effects on the mother's use of language. For example, the experimenter and the expert, both, observed that the mothers began to speak more with participants, similar to how they may interact with typically developing children. The mothers began using speech that focused on "richly" describing objects. They talked about the colors, shapes, and other properties of the items. This could possibly have an effect on the overall outcomes with communication (Hart and Risley 1999). Further, researchers should

examine the effects, if any, the intervention has on the amounts of eye gaze, social smiling, and/or otherwise improve the deficits typically associated with ASD. For example, the increase in communication may result in improvement in joint attention skills. Further, the reciprocity of communication learned may transfer to other areas such as playing with peers.

In summary, the present study contributes to research and practice because it adds to the FCT and milieu therapy literature by demonstrating that a combined intervention decreases aberrant behavior, increases unprompted communication, and promotes generalization to untrained settings and persons. This contributes to practice because the study demonstrates the utility of the intervention with individuals who have limited training (e.g., parents). In conclusion, the implementation of the modified milieu therapy intervention by parents in the natural setting led to an increase in unprompted communication, clinically significant decreases in aberrant behavior, generalization to untrained settings and persons, and maintenance of these effects.

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