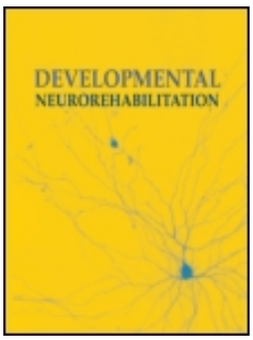

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Staff training effective in increasing learning opportunities for school-aged children with autism spectrum disorders

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Abstract
Objective: This study examined the effectiveness of instruction and video feedback on staff's ABA skills during one-to-one play situations and initiations of children with autism spectrum disorder (ASD).
Methods: Data were collected within a multiple baseline design across 5 dyads. A continuous 20 s interval recording system was used to record motivation, creating opportunities, prompting and reinforcement of staff and child initiations. Training included instruction, consisting of instructions, video examples and role-plays. After this, a 4-h delayed video feedback condition started.
Results: Three staff members created significantly more learning opportunities during post-instruction and a significant increase occurred during video feedback for one staff member. Initiatives increased significantly in two children during post-instruction. During follow-up, three children showed unprompted initiatives. The mean percentage of spontaneous initiations increased during follow-up.
Conclusion: The findings provide support for training staff in a clinical setting to create learning opportunities, which also may result in concomittant improvement in child initiations.

Keywords: *Autism*, *learning opportunities*, *staff training*, *children*

Introduction

The number of young children being diagnosed with autism spectrum disorders (ASD) has increased substantially in recent years [1, 2]. Services are generally insufficient to cope with the growing demand for treatment and the pervasiveness of the social and communicative deficits [3]. One way of addressing this problem is to develop treatment approaches that focus on establishing generalized changes in social communication skills of children with ASD.

Currently, researchers recognise ABA as the most prominent treatment approach available for children with ASD. Many studies and recent meta-analyses provide evidence on the effectiveness of analogue ABA interventions on improving social communication skills in children with ASD [4–6]. Substantial gains in IQ, language and academic improvements as well as improvements in social and adaptive behaviours have been obtained as a result of ABA [4–7].

Although analogue teaching is effective, it targets every behaviour separately and may therefore be time-consuming and cost-inefficient [4]. Moreover, stimulus generalization (generalization of treatment effects to other settings or caregivers) is not automatically accomplished [8]. Analogue teaching may thus be inefficient, and as a result, a Pivotal Response Treatment® has been developed for children with ASD. PRT® is a naturalistic approach focusing on children's communication skills and targeting pivotal areas.

Pivotal areas are areas that are central to a wide range of a child's functioning, and when prompted, they are believed to produce improvements in many non-targeted behaviours [9, 10]. Koegel et al. [11] identified five pivotal areas: motivation, self-initiations of communication, responsiveness to multiple cues, empathy and self-management. Research has shown that children with ASD learn social communication skills such as utterances and question asking as a result of PRT® [12–14]. Harper et al. [13] demonstrated that implementing PRT® within a school setting of children with ASD lead to an increase in their social initiations. Moreover, Koegel et al. [15] showed that the presence of

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initiations during baseline predict favourable long-term outcomes, such as adaptive skills and community functioning. Children with ASD who increased social initiations as a result of PRT® improved their adaptive behaviours and social functioning [15] and a reduction of disruptive and inappropriate behaviours occurred [16].

PRT® is a naturalistic approach that aims to improve children's social initiations by creating learning opportunities in their natural environment [17]. Positive effects of PRT® on self-initiations of communication in children with ASD have been shown for both parent and teacher training programmes [14, 18]. However, studies on effectiveness of training direct-care staff in PRT® are lacking yet. Direct care staff are the main caregivers for children with ASD who are admitted to a facility. Therefore, it is important that staff are trained in PRT®, because children spend most time of the day with staff.

Several studies have shown that behavioural staff training programmes are effective in improving ABA skills (e.g. prompting, modelling, error correction and reinforcement) by staff [4, 19]. Results of these studies have pointed out that feedback is essential for durable implementation of skills learned [20, 21]. Especially video feedback is effective in improving ABA skills in staff as well as in improving adaptive behaviours in children with ASD [22]. Moreover, studies have shown that the effectiveness of feedback is dependent on the timing of the feedback [23]. Unfortunately, it is not always possible to provide feedback immediately following treatment sessions or to provide on-the-job feedback. Since this is a struggle for many clinical settings, it is important to investigate if feedback delivered not optimally, i.e. in a delayed format, is also effective in improving ABA skills of direct care staff in a clinical setting. Therefore, the present study will investigate the effects of providing 4-h delayed video feedback on the ABA skills (i.e. child motivation, creating opportunities, prompting, and reinforcing child initiatives) of direct care staff. More specifically, we will investigate whether (a) staff training based on PRT® and 4-h delayed video feedback are effective in increasing staff's ABA skills during one-to-one play situations and (b) concurrent improvements occur in children's self-initiations of communication.

Method

Setting and participants

The study was conducted at the day treatment facility of a psychiatric clinic for individuals with high-functioning ASD. The day treatment facility aims to stimulate the children's cognitive, social and communicative development. Children between 6 and 14 years old attend this facility for two days a week. Both group training and individual training are provided to work on goals according to their treatment plan.

Table I. Age, diagnosis and sum score of the SCQ of children at baseline.

Child	Age (y.m)	Diagnosis	Sum score SCQ	Total IQ
1	11.2	PDD-NOS	19*	121
2	12.4	PDD-NOS	15*	xx
3	10.8	PDD-NOS	18*	109
4	10.3	PDD-NOS (MCDD)	16*	114
5	11.0	Asperger	13	105

Notes: *Above cut-off score (≥15) for ASD. xx = not testable.

Participants were five direct-care staff members and five children with ASD. All staff members were female, with a mean age in years of 25 (range: 19–29 years) at the beginning of the study. Their mean work experience at the day treatment setting was 2.7 years (range: 8 months–7 years). Each staff member worked at least two days a week at the day treatment setting. The staff members had no experience with ABA interventions prior to this study. All children, four boys and one girl, had an ASD diagnosis established by a licensed psychiatrist according to DSM-IV criteria [24]. Sum scores of the Social Communication Questionnaire (SCQ [25]; Dutch translation [26]) of the children at baseline are presented in Table I. Scores on the SCQ were used as affirmation of ASD. Although child 5 did not reach the cut-off score for ASD, he was included in the study because he had an ASD diagnosis. The WISC-III-NL [27] was used to measure total IQ. All children had the skills needed for participation in the present study. They were able to answer a question and ask questions about topics of their specific interest.

Staff members received a letter with information about the training and the aim of this study. In order to obtain informed consent, the parents of the children received an information letter together with a consent form. All parents consented with both the participation of the child in the study and videotaping the children's sessions. This study was approved by the Ethics Committee of the Faculty of Social Sciences of the Radboud University Nijmegen.

For the purpose of this study, each staff member was assigned to one child, thereby forming 5 dyads. Behaviours of both staff member and child were videotaped during one-to-one play sessions.

Sessions

One-to-one play sessions were conducted in a therapy room at the day treatment facility. The second author prepared the therapy room by

arranging the seating positions; staff member and child were seated around the corner of a table, both facing the camera. Four games were displayed on a table in the room, from which the child could choose. The recording of the sessions started once the dyad entered the room and the staff member discussed with the child which game to play. Each session lasted approximately 20 min, of which 15 min were recorded. Only staff, child and second author were present during sessions.

During each session, staff and child played a game of the child's preference. Staff was instructed to motivate the child to initiate interactions during the sessions. There was no predetermined number of trials.

Recording

Sessions were videotaped for 15 min. The first 5 min of each session were not used for registration to allow participants to get familiar with apparatus and presence of the second author.

A continuous 20 s interval recording system (establishing 30 intervals per session) was used to collect data on both staff behaviour and child behaviour. A plus (+) was recorded if a behaviour was present during an interval, a minus (−) was recorded if a behaviour was absent during an interval. In order to motivate the child to initiate an interaction, four main categories of staff ABA skills were distinguished: (a) following child motivation, (b) creating an opportunity, (c) prompting and (d) reinforcing. The following child behaviours were recorded: (a) child initiative after a created opportunity by staff, (b) prompted child initiative after a prompt by staff and (c) spontaneous child initiative without an opportunity or prompt of staff.

When staff applied an ABA skill during an interval, but the (prompted) initiative of the child and/or reinforcement by staff were not completed within that interval, recording was completed in the next interval.

Response definitions

The observation categories were defined as follows:

Motivation. In order to motivate the child the staff had to follow the interest of the child and keep his/her attention. The staff member followed the child's interest by (a) providing two or more options, (b) allowing the child to reject or accept an activity, (c) asking the child what s/he would like to do, (d) following the child when s/he takes an initiative (verbal or non-verbal) in choosing an activity or object or (e) engaging in the activity that the child has chosen. Child attention was defined by the child looking at the staff member or the activity for at least two consecutive seconds.

Creating an opportunity. The staff member created an opportunity by (a) shared control, i.e. the staff member had control over an object the child desires. To receive the object, the child needed to ask for it (b) within sight, out of reach, i.e. the staff member placed an object within the child's sight, but out of reach. To receive the object, the child needed to ask for it, (c) out of sight, i.e. the staff member placed an object out of the child's sight. To receive the object, the child needed to ask for it, and (d) routine break, i.e. the staff member did something that did not fit in the ordinary routine of the activity (e.g. throwing the dice while it is the child's turn to throw the dice). The child needed to confront the staff member with this routine break in order to play the game according to the rules.

Prompting. The staff member had to prompt the child if the child did not initiate a question or remark within 5 s after a created opportunity. Four types of prompts were recorded: (a) waiting prompt. The staff member did not take any action or initiative for at least 3 s (e.g. when staff and child can start playing the game). Because the staff member did not take the initiative, the child is prompted to take the initiative (e.g. in order to start playing the game), (b) open-question prompt. The staff member asked the child an open-question (e.g. what could you ask me now?) in order to initiate a question, (c) completing prompt. The staff member partially modelled the sentence or question that the child should initiate. The child is prompted to complete the sentence, (d) telling prompt. The staff member modelled the sentence or question that the child should initiate. The child is prompted to repeat the sentence.

Contingent and natural reinforcement. A reinforcement directly followed the initiative of the child. The reinforcement had to follow within 2 s after the child's initiative and should have been the first behaviour of the staff member that followed the initiative. The reinforcement had to be a natural consequence of the initiative of the child.

Child initiative. A correct initiative consisted of (a) the use of normal vocal loudness, (b) body and facial orientation toward the staff member and/or primary activity, and (c) functional or task-directed and purposeful content. The verbal initiation did not need to be phonetically correct and did not need to constitute a complete combination of words. When the child produced an initiative within 5 s after a created opportunity by staff, this was recorded as a correct child initiative.

Prompted child initiative. When the child showed a correct initiative (see definition above) within 5 s after a prompt by staff, this was recorded as a correct prompted child initiative.

Spontaneous child initiative. When the child showed a correct initiative (see definition above) that did not follow a question or remark from the staff member within 5 s, or when the child started talking about a new subject, this was recorded as a correct spontaneous child initiative.

Dependent variables

Staff measures. The following sequence of behaviours should have occurred to record a correct 'learning opportunity': (a) motivation, (b) creating an opportunity, (c) child initiative and (d) contingent and natural reinforcement. When creating an opportunity did not result in a child initiative, a prompt was provided by the staff. The following sequences of behaviours should have occurred to record a correct 'prompted learning opportunity': (a) motivation, (b) creating an opportunity, (c) prompting, (d) prompted child initiative and (e) contingent and natural reinforcement.

For each staff member, the percentage of learning opportunities was calculated by dividing the number of intervals with a correct learning opportunity by the total number of intervals, multiplied by 100. The number of intervals with a correct prompted learning opportunity was divided by the total number of intervals, multiplied by 100, to calculate the percentage prompted learning opportunities. When a learning opportunity occurred over two intervals, only the interval was counted in which the learning opportunity ended. The percentage of learning opportunities and the percentage prompted learning opportunities were added up to calculate the percentage of overall learning opportunities.

Child measures. The number of intervals with a correct child initiative was divided by the number of intervals with a created opportunity and multiplied by 100, which provided the percentage of child initiatives (i.e., where the child was not prompted before taking the initiative).

The number of intervals with correct spontaneous child initiatives was divided by the total number of intervals and multiplied by 100, which gave the percentage of spontaneous child initiatives.

Reliability of recording

The second author (i.e. primary observer) trained an independent, secondary observer in recording. First, the secondary observer received instruction on the recording system and the observation categories. Then, both the primary and the secondary observer simultaneously yet independently recorded videos from dyads who did not participate in the present study. Instructions and recording were rehearsed until a Cohen's kappa of at least 0.6 was established between the primary and the secondary observer.

The primary and secondary observer simultaneously yet independently recorded 33% of all sessions, evenly divided across participants and conditions. Interrater reliability was assessed on an interval-by-interval basis and calculated by dividing the number of agreements by the number of agreements and disagreements, multiplied by 100. Cohen's Kappa was also calculated on an interval-by-interval basis. Reliability was assessed for each category as well as across all observation categories.

Two indexes affect the magnitude of Cohen's Kappa: bias and prevalence [28]. Each observation category can be scored positive (+) or negative (−). If the number of positive categories (+) and the number of negative categories (−) within an observation category are equally divided, kappa values are easily interpreted. But if there are substantially less positive (+) and substantially more negative (−) categories the kappa statistic should be interpreted with caution. This so-called prevalence effect results in a decrease in kappa values [29]. To take account of the prevalence effect in the observation categories, prevalence-adjusted and bias-adjusted kappa (PABAK) were also calculated on an interval-by-interval basis.

Mean overall percentage of agreement (i.e. across all observation categories) was 96 (range: 92–99). Mean overall Cohen's Kappa and PABAK were 0.86 (range: 0.72–0.98) and 0.93 (range: 0.84–0.99), respectively, indicating excellent agreement between the two observers [30]. See Table II for the interrater reliability of recording for each category. According to the criteria of Cicchetti [30] all categories have excellent agreement.

Table II. Interrater reliability of recording.

Interrater reliability			
Category	Percentage of agreement Mean (SD)	Cohen's Kappa Mean (SD)	PABAK Mean (SD)
Motivation	99 (1.43)	1.00 (0.00)	0.99 (0.03)
Creating opportunity	99 (1.91)	0.68 (0.40)	0.97 (0.04)
Prompting	99 (1.01)	0.47 (0.44)	0.98 (0.02)
CN reinforcement	88 (5.79)	0.53 (0.20)	0.75 (0.12)
Child initiative	97 (3.57)	0.52 (0.40)	0.94 (0.07)
P child initiative	98 (1.60)	0.34 (0.43)	0.97 (0.33)
S child initiative	88 (6.76)	0.51 (0.24)	0.76 (0.14)

Notes: SD = standard deviation, CN reinforcement = Contingent and natural reinforcement, P child initiative = prompted child initiative, S child initiative = spontaneous child initiative.

Design

Data were collected within a multiple baseline ABACA design (A = baseline, B = instruction and C = feedback). The dyads were randomly allocated to different baseline lengths, ranging from 3 to 7 sessions during 5 weeks. The instruction lasted 3–4 weeks, the post-instruction lasted 3 weeks and the feedback lasted 3 weeks. Follow-up data were collected 2 weeks following completion of the feedback condition, and lasted 3 weeks.

Procedure

Pre-baseline. Staff were instructed to read the treatment manual. There were no sessions.

Baseline. Each dyad conducted one-to-one play sessions once or twice a week. Short conversations with the staff member before and after the session controlled for increased attention from the second author during the feedback condition (see below).

Instruction. The staff instruction was conducted by a trainer, i.e. the psychologist of the day treatment facility and consisted of two 8-h group instruction days. The second instruction day took place two weeks following the first instruction day. The trainer, second author, i.e. researcher, and all direct-care staff were present during both instruction days. No sessions were conducted during the instruction days.

First instruction day. The first day of instruction consisted of introduction, instruction, video examples and scripted role-play. During instruction, principles of ABA and the five pivotal areas were explained by the trainer. Most attention was devoted to the explanation of the ABA skills, that is creating opportunities, prompting, and contingent and natural reinforcement. During the instruction, staff members individually filled in three worksheets regarding the communicative goal of the child, motivation and creating opportunities during play with the child. Also, two videos were shown in which the trainer, in a play session with a child of the day treatment facility, created learning opportunities. Every time a learning opportunity was created, the video was paused and the trainer discussed the ABA skills utilized with the staff members.

Each staff member took part in four scripted role-play practices in which two staff members alternated in playing the role of staff or child. During the four scripted role plays, staff were instructed to practice creating an opportunity (with or without prompting) and providing contingent and natural reinforcement.

As home assignment for the second instruction day, participants were instructed to videotape a 10-min play session with a child during which they implemented all the ABA skills.

Second instruction day. The second instruction day took place 2 weeks following the first instruction day. No sessions were conducted between the first and second instruction day. The second instruction day also consisted of an introduction, instructions, video examples and scripted role-plays. Participants showed the videotaped 10-min play session of the home assignment and the trainer discussed with all the staff members, which learning opportunities were correctly and which were incorrectly created. The trainer outlined the ABA skills necessary for creating a learning opportunity. At the end of the second instruction day each staff member conducted a 10-min probe with a colleague staff member who acted as a child. During these probes, one-to-one play sessions with the child were simulated. These probes were videotaped and recorded using the recording instrument. Each staff member was instructed to create at least eight learning opportunities during 8 min [17]. Four staff members met this criterion during the first probe, the staff member of dyad 5 met the criterion during the second probe.

The secondary observer independently recorded 40% of the sessions to establish reliability of the recording of the probes. Mean percentage of agreement was 95 (range: 94–97), Cohen's Kappa was 0.84 (range: 0.81–0.87) and PABAK was 0.90 (range: 0.88–0.93), indicating excellent interrater reliability [30].

Post-instruction. Sessions during the post-instruction condition were similar to the sessions during baseline. Each dyad conducted a weekly session during three consecutive weeks. Staff members were instructed to create as many learning opportunities as possible. Immediately after she met the criterion during the second probe the staff member of dyad 5 was absent for five weeks due to illness. She started the post-instruction sessions 5 weeks after the second probe.

Video feedback. Each dyad conducted a weekly session during three consecutive weeks. Each time a session was conducted, the researcher watched the videotape of the session and recorded the categories using the continuous 20 s interval recording observation instrument (see *Recording*). She then selected four video clips showing correct learning opportunities and three video clips showing incorrect learning opportunities.

Four hours after the play session video feedback was provided in the same therapy room where the session was conducted, and lasted approximately 15 min. The video feedback followed a four-step script [21, 31] consisting of (a) showing a correct video clip, (b) praising the staff member for this correct implementation, (c) showing an incorrect video clip and (d) asking the staff member how a

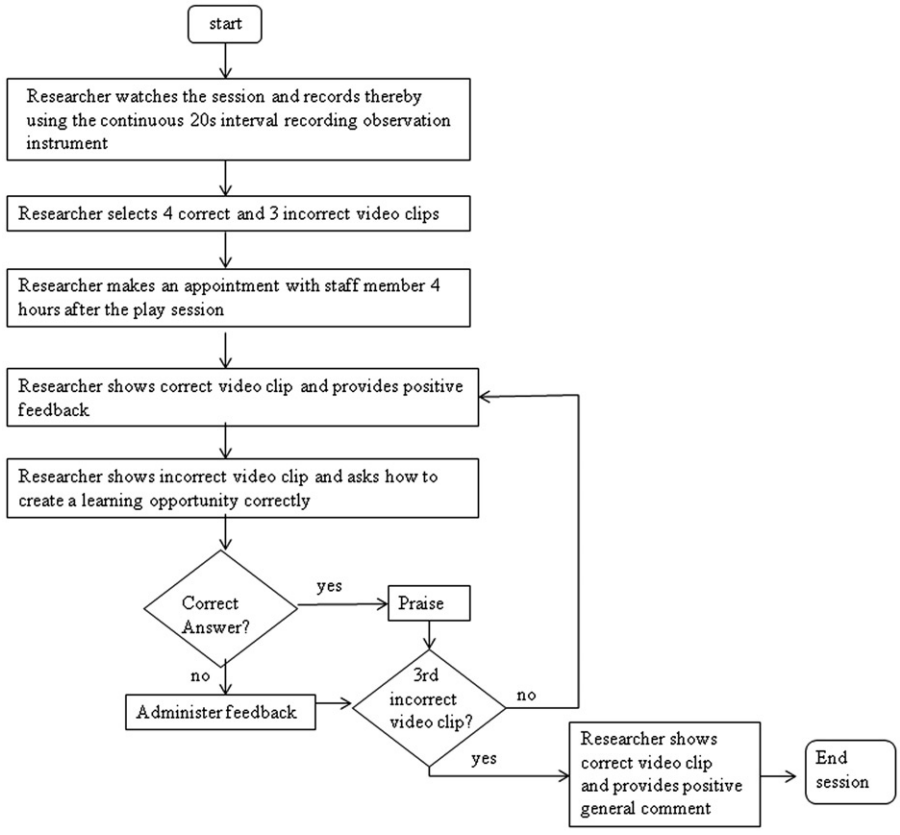

Figure 1 Flowchart of the video feedback procedure.

correct learning opportunity could have been created. When the staff member gave a correct answer, this was praised. When the staff member failed to give a correct answer, feedback was administered on how to implement ABA skills. The four-step feedback script was rehearsed three times. Finally, the researcher showed the fourth correct videoclip, praised the staff member for this correct implementation and gave a positive general comment on her performance during the session. For the flowchart of the steps in effect during video feedback condition (Figure 1).

Follow-up. This condition was in effect two weeks following completion of the video feedback condition and sessions were similar to those during baseline. Each dyad conducted a weekly session during three consecutive weeks. Staff members were instructed to create as many learning opportunities as possible. Staff received no feedback after the sessions.

Procedural fidelity of video feedback

All video feedback sessions were videotaped. To assess the degree to which the researcher provided the video feedback according to the steps in the flowchart, the first author completed a checklist outlining the steps of the flowchart. A + was recorded if the step was correctly executed by the researcher. In order to record + for feedback and praise, the feedback and praise should include a description of the staff member's performance. Procedural fidelity was calculated by dividing the number of correctly executed steps by the number of correctly executed steps and number of incorrectly executed steps, multiplied by 100. The first author randomly selected 33% of the video feedback sessions and completed the checklist. Procedural fidelity results showed that the video feedback flowchart was followed with 97% accuracy (range: 89–100%).

Social validity

During follow-up, data were collected to assess social validity of both instruction days as well as of the video feedback sessions. Staff members filled in a questionnaire consisting of 20 statements (e.g. 'The role-plays were informative') that were rated on a five-point Likert-type scale ranging from 1 (not at all) to 5 (very much). The questionnaire measured the (a) satisfaction and (b) effectiveness of the two training days and video feedback sessions.

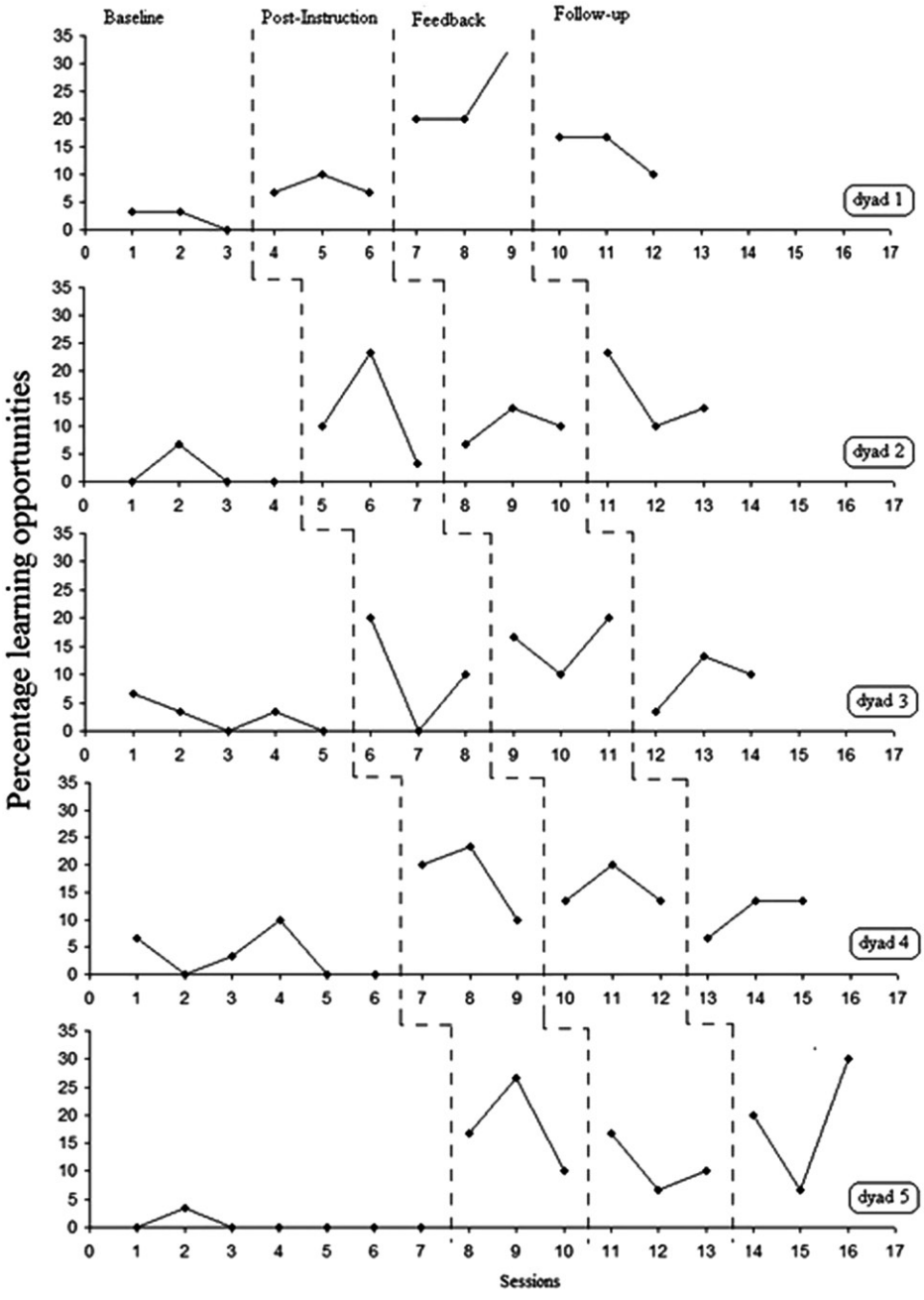

Figure 2 Percentage of learning opportunities by staff across conditions.

Statistical analyses

The percentage of learning opportunities, the percentage of child initiatives and the percentage of spontaneous child initiatives were calculated. Then, data were analysed by calculating TAU_{novlap} and the corresponding significance level. TAU_{novlap} is a non-parametric technique for measuring non-overlapping data between two phases. It is based on all pairwise data comparisons made in a time-forward direction [32]. Using WinPepi software [33] effect sizes were calculated by combining individual TAU_{novlap} of all staff members for the comparison of baseline and post-instruction, providing the effect size for the two instruction days. For the comparison of post-instruction and video feedback individual TAU_{novlap} were combined providing the effect size for the video feedback intervention [34]. Finally, the mean percentage of child initiatives across conditions was calculated.

Results

Staff performance

Figure 2 shows the percentage of learning opportunities by staff across conditions.

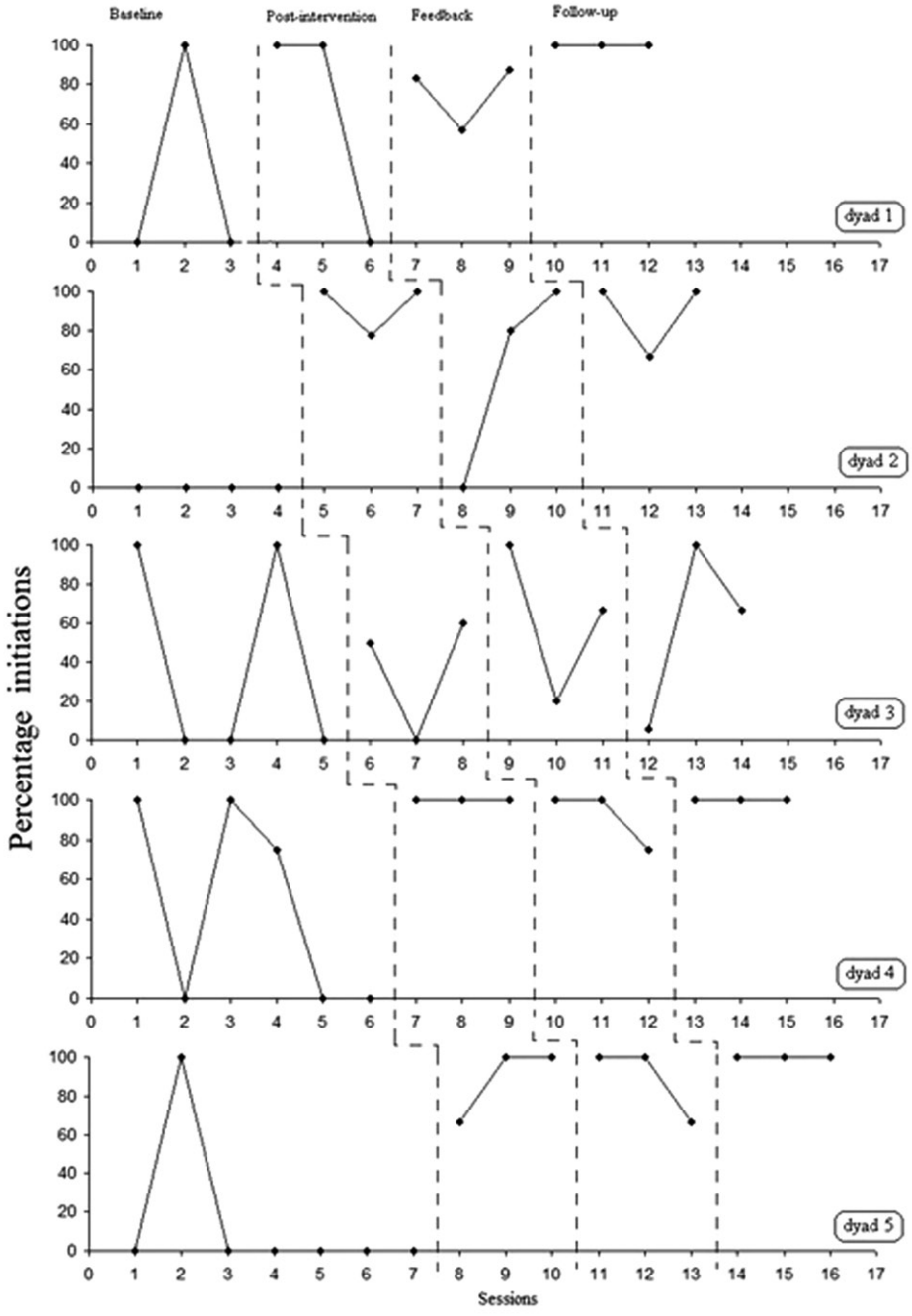

Figure 3 Percentage of initiatives by children across conditions.

The staff members of dyad 1, 4 and 5 created significantly more learning opportunities during post-instruction compared to baseline ($TAU_{novlap} = 1$, $p < 0.05$; $TAU_{novlap} = 0.944$, $p < 0.05$; $TAU_{novlap} = 1$, $p < 0.01$). There were no significant changes in the percentage of learning opportunities for the staff members of dyad 2 and 3.

A significant increase also occurred during video feedback compared to post-instruction for the staff member of dyad 1 ($TAU_{novlap} = 1$, $p < 0.05$). The other staff members maintained the same level as accomplished in post-instruction. During follow-up, the percentage of learning opportunities for the staff member of dyad 1 decreased significantly compared to video feedback ($TAU_{novlap} = -1$, $p < 0.05$). No significant changes occurred for the staff members of dyad 2–5 during follow-up compared to video feedback. Figure 2 shows that the staff members of dyad 1, 2 and 5 maintained the same level of learning opportunities as accomplished in post-instruction.

Child performance

Figure 3 shows the percentage of child initiatives after an opportunity created by staff

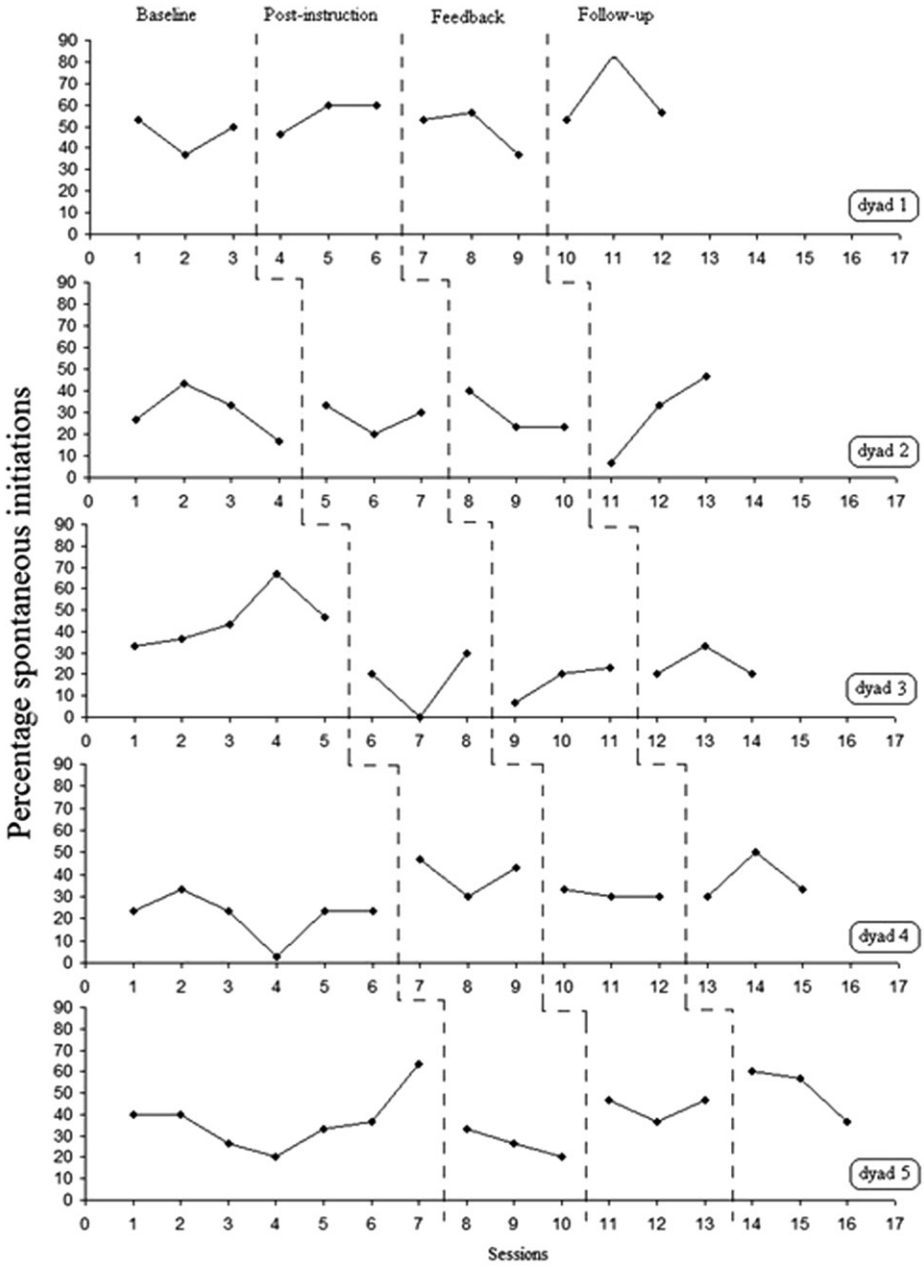

Figure 4 Percentage of spontaneous initiatives by children across conditions.

across conditions. The percentage of initiatives during baseline should be interpreted with caution due to the low number of created opportunities. The percentage initiatives for the children of dyad 2 and 5 increased significantly from baseline to post-instruction ($TAU_{novlap} = 1$, $p < 0.02$ and $TAU_{novlap} = 0.81$, $p < 0.02$, respectively). No significant changes in percentage of initiatives were found during post-instruction compared to baseline for the children of dyad 1, 3 and 4.

There were no significant changes in the percentage of initiatives from post-instruction to video feedback for the children of the 5 dyads. The child of dyad 1 showed a significant increase in the percentage of initiatives, from video feedback to follow-up ($TAU_{novlap} = 1$, $p < 0.05$). No significant changes in the percentage of initiatives were found for this condition for the children of the other dyads. Noteworthy, during follow-up the children of dyad 1, 4 and 5 never needed to be prompted after staff created an opportunity.

Figure 4 shows the percentage of spontaneous initiatives by children across conditions. No significant changes, except for the child of dyad 5, occurred in the percentage spontaneous initiatives. The spontaneous initiatives increased significantly

Table III. Mean percentage of child initiatives across conditions.

	Types of initiatives	
	Spontaneous initiatives (%)	Initiatives after created opportunities (%)
Baseline	34.8	84.4
Post-instruction	33.3	74.4
Video feedback	33.8	75.8
Follow-up	41.3	89.3

for the child of dyad 5 in the feedback condition compared to post-instruction ($TAU_{novlap} = 1$, $p < 0.04$).

Staff performance

Combined TAU_{novlap} of all staff members for the comparison of baseline and post-instruction provided an effect size of 0.85 (95% CI: 0.48–1.23), indicating a large effect. The effect size for the comparison of post-instruction and video feedback was 0.11 (95% CI: −0.25 – 0.48), indicating a small effect.

Child performance

Table III represents the mean percentage of child initiatives across conditions. As can be seen in the table, the mean percentage of spontaneous child initiatives remains constant across baseline, post-instruction and video feedback condition. During follow-up, the percentage of spontaneous initiatives increased. Although the percentage of initiatives during follow-up was higher than the percentage of iniatives during feedback, this increase was not statistically significant.

Social validity

Staff rated the two instruction days as higly effective (mean = 4.0; range 4.0–4.0) and as satisfactory (mean = 3.4; range 2.0–4.0). Regarding the different components used in the two staff instruction days, instructions, scripted role plays and the video examples were rated as the most effective, with means of 4.4, 4 and 4.3, respectively. With a mean of 3.5, the homework assignment 'videotaping a PRT® session' was rated as least effective. The video feedback was rated 4.3 (range 4.0–5.0) on effectiveness and 4.1(range 3.5–5.0) on satisfaction. After the video feedback, staff found that they were better able to implement the ABA skills (mean = 4.2, range 4.0–5.0). Moreover, straff tried to implement the ABA skills as much as possible during the day at the day treatment facility (mean = 4.0, range 4.0–4.0).

Discussion

In the present study, five staff members of a day treatment facility for school-aged children with ASD were taught to create learning opportunities during one-to-one play sessions. Findings suggest that instruction and 4-h delayed individual video feedback is beneficial in increasing staff's ABA skills (i.e. child motivation, creating opportunities, prompting and reinforcement). Three of the five staff members increased their ABA skills significantly as a result of instruction. Further, a significant increase in child initiatives after a created opportunity by staff was observed in two of the five children in the post-instruction condition. Video feedback resulted in a further significant increase in learning opportunities for one staff member. During follow-up, three of the five children took initiatives without being prompted. Moreover, the mean percentage of spontaneous initiations increased during follow-up.

The results of this study extend the PRT® literature [e.g. 10, 11, 13] by demonstrating that staff members of a day treatment facility may successfully be taught to create learning opportunities for children with ASD. Until now, studies have focussed only on teaching ABA skills to paraprofessionals and peers within a school setting [13, 22] and to parents in the home setting [14]. The majority of studies focus on increasing functional verbal utterances of young children with ASD, such as increasing child verbalizations of not fluidly verbal children aged 2–6 years [14], or increasing initiations in interaction in children aged 3–9 years [13, 22]. The present study adds to the growing literature supporting the use of PRT® to increase initiations in older children with ASD (i.e. between 10 and 12 years of age).

In a systematic review, Rispoli et al. [19] evaluated the certainty of evidence and quality of studies in the staff training literature. Only 12 studies met the criteria for inclusion in this systematic review. Out of these 12 studies, seven were classified as conclusive according to the following criteria: (a) the study included an experimental design, (b) the inter-observer agreement was adequate, (c) the dependent variables were operationally defined and (d) the procedures were described in detail for replication purposes. We believe that the present study meets these criteria. First, a multiple baseline design across dyads was used. Second, the study reported excellent inter-observer agreement and treatment fidelity. Third, definitions for dependent staff (i.e. a correct (prompted) learning opportunity) and child

measures (i.e. child initiatives) were provided. Finally, we provided a detailed description of the participants, setting, data collection and procedures.

Even though research has identified feedback as one of the most effective means of training staff, only a few studies evaluated feedback in isolation [19]. Rispoli et al. [19] recommend to study the use of feedback as individual training procedure. We evaluated the effectiveness of instruction and feedback separately. Instruction revealed a large effect size (i.e. 0.85) whereas feedback revealed a small effect size (i.e. 0.11). However, the effect size of the video feedback should be interpreted with caution as there may be a sequence effect in that the magnitude of the increase relative to the instruction condition was lowered due to the large effect of instruction alone.

The use of video during feedback has several advantages [22]. One advantage is its efficiency and flexibility in that the supervisor does not need to be present during the session. In addition, a video can provide greater detail and it enables trainers to reflect on their correct and incorrect behaviour [22]. The use of video feedback is common in the PRT® literature. For instance, Robinson [22] used modelling and video feedback to teach four paraprofessionals to implement PRT® in an inclusive school setting. In a parent group training, Minjarez et al. [14] reviewed home videos weekly and provided feedback on the implementation of PRT®.

The relatively low effect size of video feedback may also be explained by the delay in the feedback. A delay in the provision of feedback may lower its effectiveness though few studies have explored this issue. For example, O'Reilly et al. [23] assessed immediate and delayed supervisor feedback procedures in the acquisition of teaching skills by two preservice teachers. Immediate supervisor feedback consisted of on-the-job feedback and modelling during a session and discussing the performance immediately after the session. Immediate supervisor feedback was more effective than 1–3 days delayed supervisor feedback. Immediate feedback or on-the-job feedback is thus optimal, but often problematic in clinical settings due to practical constraints. Both Robinson [22] and Minjarez et al. [14] used delayed feedback. Robinson provided video feedback on the same day as the session, whereas Minjarez et al. provided video feedback once a week (i.e. 1–7 days delay). In both studies, the results show that feedback resulted in an improvement in ABA skills of the participants. In contrast to our study, Robinson [22] provided three modelling sessions with the child prior to video feedback. After the modelling sessions, video feedback started. All paraprofessionals demonstrated an immediate improvement in implementing PRT® techniques during the feedback condition [22].

In the PRT® literature, effectiveness of PRT® is computed globally, that is across all skills or techniques. This is usually done by dividing the number of correct implemented skills by the total number of correct plus incorrect implemented skills and multiplied by 100% [14, 22]. Using a global calculation can result in an inflated outcome or higher percentage of learning opportunities. A learning opportunity consists of correctly implementing a sequence of four ABA skills, that is following motivation, creating an opportunity, prompting and reinforcement. The computation of a correct learning opportunity should reflect this assumption. That is why we computed exactly by scoring the correct implementation of the sequence of these ABA skills. Only a complete and correctly implemented sequence of the ABA skills yielded a correct learning opportunity. In our study, sequences of four ABA skills in thirty 20-s intervals were observed, resulting in a total of 120 intervals. Applying the global computation would have produced higher levels of learning opportunities. For instance, if a staff member implemented one ABA skill incorrectly during 8 intervals (and 112 intervals of correctly implemented ABA skills), using the global computation would have yielded 93.33% (112 correct intervals divided by 120 intervals multiplied by 100%) correct learning opportunities. Assuming the incorrectly implemented ABA skills were in eight different sequences (and the other 22 sequences were correctly implemented), using the exact computation would have yielded 73.33% (22 correct sequences divided by thirty 20-s intervals multiplied by 100%) correct learning opportunities. Since implementing a correct learning opportunity requires a sequence of ABA skills, this sequence should be taken into account when calculating percentage of learning opportunities. Therefore, we recommend using the exact computation of correctly implemented learning opportunities instead of using the global computation.

A shortcoming of the present study is the way in which the criterion was assessed in the probes. Staff members were assessed during a single probe using role-play during which another staff member acted as a child with ASD during the probe. To what extent staff capable is of simulating characteristics of the clients, is unknown. Therefore, it is uncertain whether the staff member would have obtained the criterion with the child.

Another limitation of the study is the lack of data on stimulus generalization. The review of Rispoli et al. [19] shows that out of 12 studies only three studies addressed stimulus generalization. During future studies, it is recommended to assess whether instruction and/or delayed video feedback results in stimulus generalization.

Despite the above limitations, the findings of the present study are promising. They provide support for training staff in a clinical setting to create learning opportunities, resulting in concomittant gains in child initiations. Since the demand for treatment is growing, it is important to train staff in clinical settings to create learning opportunities for children with ASD.

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