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ORIGINAL PAPER

A Comparison of Video Feedback and In Vivo Self-Monitoring on the Social Interactions of an Adolescent with Asperger Syndrome

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Abstract Difficulties with social interactions and restrictive and repetitive interest patterns or behaviors are common among individuals with Asperger syndrome. These difficulties often pose barriers to establishing and maintaining social relationships. In the current study, 2 different interventions were compared that focused on improving the social interactions of a 14-year-old adolescent with Asperger syndrome. A reversal design was used to compare the effectiveness of video feedback and in vivo self-monitoring on inappropriate and appropriate social interactions during activities with a teacher. The procedures were replicated during activities with peers, and generalization was assessed during activities with the adolescent's mother. Although video feedback resulted in slight reductions in inappropriate behavior, larger reductions occurred during in vivo self-monitoring. Treatment acceptability data indicated high participant satisfaction with both interventions; however, the in vivo self-monitoring was rated as slightly preferred.

Keywords Asperger syndrome · Autism · Video feedback · Self-monitoring

Introduction

Difficulty with social interactions is a core characteristic of individuals with autism spectrum disorders (APA 2000; Kanner 1943). These social challenges are heterogeneous and can take a variety of forms (Kasari et al. 2006; Travis et al. 2001). For high-functioning children and adolescents with autism who are able to communicate vocally, social deficits often include failure to respond in a topically relevant manner to interactional bids by others, limited turn-taking during conversation, and a restricted

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range of conversational topics (Jones and Schwartz 2009; Marans et al. 2005; Rubin and Lennon 2004). Social difficulties of this nature generally persist into adolescence and adulthood and are very difficult to remediate (Church et al. 2000; Jones and Schwartz 2009).

One effective strategy for improving social skills of individuals with autism is self-management (e.g., Koegel et al. 1992; Lee et al. 2007). Self-management is a strategy in which individuals are taught to control or regulate their behavior in some way. Most self-management interventions involve two or more of the following strategies (Mitchem et al. 2001): self-monitoring (i.e., determining whether a target behavior occurred, recording occurrences of a target behavior), self-evaluation (e.g., determining the appropriateness of a behavior, deciding whether a goal was met), and self-reinforcement (i.e., rewarding oneself).

Self-management interventions have been used successfully to improve a variety of social skills. For example, in a study by Morrison et al. (2001) four students with autism, age 11–13, self-monitored their initiations and responses during game playing with nondisabled peers. The self-monitoring intervention resulted in improvements in social interactions (initiations and responses) as evidenced by increases in mean level between baseline and intervention phases, and generalization across settings was observed for some of the participants. Similarly, Koegel et al. (1992) taught four children with autism, age 6–11, to use a wrist counter to self-monitor responses to questions posed by others. Intervention was implemented across a variety of settings (i.e., clinic, community, home, and school) and resulted in increases in responding by all of the participants.

A recent meta-analysis by Lee et al. (2007) offers further support for the overall effectiveness of self-management with individuals with autism. In a search of research published prior to October, 2004, 11 studies (including 34 participants) were identified that met inclusion criteria. The studies primarily used single-subject methodologies. The effectiveness of the self-management interventions was evaluated using the percentage of nonoverlapping data points (PND; Scruggs and Mastropieri 1998; Scruggs et al. 1987). The overall mean PND across the studies was 81.9%, which, according to Scruggs and Mastropieri, indicates that self-management is an effective intervention for improving socially appropriate behaviors.

An alternative technique to self-management, also used to improve social skills of children with autism, is video modeling (Dowrick 1983). Video modeling involves viewing videos in which a peer or an adult models desirable behavior (e.g., Clare et al. 2000; Dowrick 1999). The videotapes are generally edited such that inappropriate or undesirable behavior is omitted, which advances in technology have made quite feasible. Video modeling has been shown to increase a variety of skills, including social skills. For instance, Charlop and Milstein (1989) improved the conversational skills of three boys with autism, age 6–7, using video modeling and Charlop et al. (2009) improved variation in conversation of two boys with autism, age 8 and 9.

Video feedback is a variation of video modeling. This technique involves videotaping individuals and having them review the videotape while self-evaluating the appropriateness of their behavior (e.g., Kern-Dunlap et al. 1992; Kern et al.

1995). An advantage of video feedback is that individuals can observe themselves on video in naturally occurring contexts. In addition, when applied to social skills, it provides the opportunity to intervene on social behavior without interrupting ongoing interactions, as would occur when providing in vivo feedback. Further, some individuals report watching themselves on video to be intriguing and enjoyable (Holmbeck and Lavigne 1992).

A few recent studies have evaluated video-based approaches alone and in combination with other types of interventions for social skill instruction. Maione and Mirenda (2006) implemented video modeling with a 5-year-old boy with autism. The intervention was implemented across three activities (Play Doh, Chevron Cars, and Caillou's Tree House) while the participant was engaged with his peers. Improvements in initiations and responses were observed during all three activities; however, gains were modest during two of the activities (Play Doh and Chevron Cars). When feedback was added to video modeling, greater improvements were observed in those two activities. Finally, because of day-to-day variability of interactions, in vivo visual and verbal prompting was added during the Chevron Cars activity, which resulted in yet greater improvements. The authors noted that the participant's lack of intervention responsiveness to the video modeling and feedback during the Chevron Cars activity may have been attributable to his perseverative behavior with the cars. These outcomes suggest that participant characteristics and activities may interact to influence the effectiveness of video interventions and additional or alternative components may be needed for optimal effectiveness.

In another study, Apple et al. (2005) conducted two experiments, the first with two 5-year-old boys with high-functioning autism/Asperger syndrome. Study 1 evaluated the effects of video modeling on providing and responding to compliments. Video modeling was effective for increasing responding, but did not increase initiations. A subsequent phase was implemented in which reinforcement and reminders were added to the video modeling. Tangible reinforcement was provided when a participant made four compliments, and reminders of the number needed for reinforcement were given during the play session. This phase resulted in increases in initiations. In later phases, responses and initiations maintained when the video was withdrawn, but only responses maintained when reinforcement was withdrawn. The authors concluded that reinforcement and adult monitoring were the variables that controlled initiations. One possible limitation, however, was order effects.

Because of the problems with establishing independence when procedures rely on adult prompts, Apple et al. (2005) conducted a second experiment evaluating the effectiveness of self-management for increasing compliment initiations and responses. One child from the previous experiment participated as well as two additional boys (4 and 5 years old). Video modeling was implemented with the two new participants. As in the prior experiment, responses increased but not initiations. When in vivo self-monitoring was introduced, immediate increases in initiations occurred for all three participants. Initially, prompts were provided to remind children to offer the predetermined number of compliments (i.e., two); however, they were necessary during only one session with two of the participants and two sessions with the third.

Although the intervention focus was not social interactions, Alcantara (1994) conducted a component analysis of a videotape instructional package to teach grocery purchasing skills to three elementary students (i.e., two boys and one girl) with autism. The package consisted of viewing videotapes of an adult performing the skills, in vivo prompting, and reinforcement for acquisition and generalization of purchasing skills. Video instruction was effective but did not lead to mastery of all steps of the grocery store task analysis. When the in vivo prompting was introduced, all students successfully learned the grocery purchasing task. Thus, students learned most of the skills with video instruction, but needed in vivo prompting to acquire all of the purchasing skills.

In summary, both video-based interventions and self-monitoring have demonstrated effectiveness for improving social interactions of children and adolescents with autism. Research has examined the additive effect of these procedures; however, from a cost-efficiency perspective, it is important to determine whether single interventions are sufficient to improve behaviors. Although some studies have compared these procedures in isolation, no studies were identified that specifically compared video feedback and in vivo self-monitoring. It appears that responsiveness to these types of interventions may be idiosyncratic and depends on individual characteristics and behaviors (e.g., Apple et al. 2005; Maione and Mirenda 2006). The purpose of the current study was to further evaluate and compare the effectiveness of video feedback and in vivo self-monitoring with a student with Asperger syndrome.

Method

Participant and Setting

The participant, Carl, was a 14-year-old adolescent. Carl was a Caucasian male who was in 7th grade when the study was conducted. He had a diagnosis of Asperger's disorder and engaged in extensive perseveration and social difficulties. Carl attended a university-affiliated private school serving students with severe emotional and behavioral challenges. He was described by his teachers as intelligent, inquisitive, and creative. Carl was functioning on or above grade level in all academic subjects; however, he had significant difficulties interacting with others. His teachers and parents reported high rates of inappropriate behavior during social situations. This took the form of repetitive questions, repetitive talk, and inappropriate noises (e.g., singing, humming, and making a continuous "sssss" sound). Numerous interventions had been implemented to reduce Carl's inappropriate interactions without success, including ignoring, differentially reinforcing appropriate behavior, providing corrective feedback, having him work alone, and requiring him to write his questions and thoughts in a journal when repetitious statements began.

The study was conducted in Carl's school and home. A conference room adjacent to Carl's homeroom was used at school for peer and teacher activity sessions as well as video feedback sessions. In Carl's home, activity sessions were conducted in the living room.

Materials

Materials included a Sony camcorder to videotape all sessions and a color monitor to view the tapes. Carl used a self-monitoring sheet to monitor his appropriate and inappropriate interactions. The self-monitoring sheet consisted of three columns. The first column contained the interval number. The second column contained the question "Did I have appropriate interactions?" and the choices of response "Yes" and "No." The third column was used to record if the student's response matched with the observer's response. The points and corresponding rewards were also described at the bottom of the sheet. The self-monitoring sheet had 20 rows when used for video feedback sessions and 15 rows when used for in vivo self-monitoring sessions.

Several interactive games that required turn-taking were used for activity sessions. The individuals participating in each activity session were encouraged to choose the game together. Chess was most frequently selected for activity sessions.

Measurement and Data Collection

Direct observation data were collected on Carl's inappropriate social interactions, inappropriate noises, and appropriate social exchanges. *Inappropriate social interactions* were defined as a verbal utterance that included one or more of the following: (a) speaking in a volume louder than typical conversation; (b) interrupting another person's statement; (c) repeating a statement more than one time (e.g., "C'mon just let me have it, C'mon just let me have it, C'mon just let me have it"); (d) making a negative remark about another person (e.g., "You are wrong, I know better. Why do you say that?"); (e) making a statement questioning the game rules or activity guidelines (e.g., "Why can't I take another turn?"); (f) making a demanding or threatening statement (e.g., "Just give it to me" stated in a demanding tone); (g) making a statement or comment irrelevant to the ongoing topic of conversation; (h) using curse words; or (i) failing to answer a question posed by another person. *Inappropriate noises* were defined as making nonword sounds such as "sssss," singing to oneself, or engaging in self-talk not related to the ongoing topic or activity. *Appropriate social interactions* were defined as any instances of verbal exchanges and turn-taking behaviors, including: (a) waiting quietly when another student, parent, or teacher was talking or answering a question (this was included as a target behavior because Carl frequently interrupted others); (b) making or responding to a statement one time in a contextually appropriate manner; (c) asking or answering a question one time in a contextually appropriate manner; (d) providing a validating statement or praising another (e.g., "That's interesting," "Good job"); or (e) making a statement intended to help a peer (e.g., "It's your turn").

Direct observations were collected via videotape during 15-min structured activity sessions. The videotapes were later coded using partial-interval recording during 15-s intervals. For each 15-s interval, the coder recorded whether Carl engaged in an inappropriate social interaction, inappropriate noise, or appropriate

social interaction any time during the interval. If the aforementioned exchange occurred longer than one 15-s interval, it was recorded as a separate occurrence in the next interval.

Social validity data were collected from Carl using the School Intervention Rating Form (SIRF), which was adapted from the Treatment Acceptability Rating Form-Revised, reported to have an overall reliability coefficient of .92 (Reimers et al. 1992). Adaptations were made to make the form suitable for youth, including selecting a limited number of items, reducing the number of Likert scale options, and modifying the wording, so it was relevant to a school setting. The student version contained six questions that pertained to Carl's understanding of the intervention: who well he understood the intervention, how easy the intervention was, how much he liked the intervention, whether there were things he did not like about the intervention, whether the intervention improved his behavior, and whether the intervention made him feel uncomfortable. Each question was rated on a three-point Likert scale with descriptive anchors indicating favorable ratings (very well, very easy, liked a lot, etc.), moderate ratings (somewhat, somewhat easy, liked some, etc.), and unfavorable ratings (not at all, not at all easy, did not like, etc.). Carl responded to SIRF questions regarding both the video feedback intervention and the in vivo self-monitoring intervention.

Interobserver Agreement

Interobserver agreement (IOA) data were collected during 30% of the sessions. Randomly selected videotapes, distributed across experimental phases and settings, were coded by two independent observers who were graduate students in school psychology and had previous experience with data collection. Session interobserver agreement was calculated by using an interval-by-interval procedure, wherein the number of agreements for each interval was summed and divided by the total number of agreements and disagreements for the session, then multiplied by 100%. Total mean agreement was then derived by averaging the session means. Mean interobserver agreement for inappropriate social interactions was 84.78% (range, 59–100%). Mean interobserver agreement for inappropriate noises was 91.02% (range, 73–100%). For appropriate social interactions, the mean interobserver agreement was 72% (range, 59–100%).

Experimental Design and Procedures

A reversal design (ABCBC) with replication across game partners using a multiple baseline design element was used to evaluate intervention effects and compare the video feedback and in vivo self-monitoring. Intervention was intended to be implemented by Carl's mother at home; however, inappropriate behavior decreased prior to implementing the intervention. Thus, this setting served as an opportunity to evaluate generalization. Visual analyses and means within each phase were used to determine intervention effectiveness.

Procedures

General

Throughout all phases of the study, sessions were arranged in which Carl engaged in an interactive game with a teacher, a peer, or his mother. No more than one session was conducted daily. Teacher sessions included Carl's homeroom teacher. Carl's homeroom teacher changed during the course of the study, so two teachers participated. Carl's teachers nominated a pool of four peers for sessions that involved a peer. The peers were nominated based on their willingness to participate in the sessions. Peers were rotated for each session based on availability and desire to participate. Carl's mother participated in sessions in their home.

All sessions were videotaped for data collection and video feedback purposes. A small camcorder on a tripod was placed in the corner of the room. Carl and his game partner jointly chose a game to play. When they began playing the game, one of three intervention facilitators (graduate students in special education or school psychology) pushed the record button. The students played the game under the facilitator's supervision. No interaction or feedback occurred during the session. The facilitator was instructed to provide a neutral response to any of Carl's questions or comments by simply stating "Please focus on playing the game." A timer was set for 15 min to indicate the duration of the game. Carl and his game partner played until the timer rang indicating the session was over.

Baseline

During baseline, Carl and his peer, teacher, or mother jointly chose a game. Carl was instructed that he would be allotted 15 min to engage in the activity. No other instructions were provided. Carl's peer, teacher, and mother were instructed to interact with him in a typical manner. Baseline sessions were videotaped to desensitize Carl to the presence of the camcorder.

Video Feedback

The video feedback phase began with a 15-min initial instructional session. Carl was told that after the session he would watch the videotape and determine whether his interactions were appropriate or inappropriate. Then, an initial training session was conducted in which the use of the self-monitoring recording form was explained to Carl. Subsequently, appropriate and inappropriate behavior during interactive games was described, adhering to the operational definitions. For example, the intervention facilitator explained that appropriate behavior included a volume and tone appropriate for a normal classroom conversation, not interrupting another person, not repeating statements, offering complimentary statements, and so forth. Similarly, inappropriate behavior was described (e.g., continuing talking after asked to stop, talking over someone, pleading, questioning decisions in an aggressive and

demanding way, failing to respond to a question, making noises, etc.). The intervention facilitator then modeled five appropriate behaviors (e.g., stated, "How are you today") and five inappropriate behaviors, particularly those that were problematic for Carl (e.g., making "sssss" noise, repeating "I know the rules, I know the rules, I know the rules") while he labeled each as appropriate or inappropriate. Carl then practiced using the self-monitoring recording form with a 5-min videotape from the last baseline peer session. The videotape was stopped at 15-s intervals, and Carl was instructed to determine whether he was appropriate during the interval and accordingly circle "YES" or "NO" on the recording sheet. By the end of the 5-min video, Carl was able to accurately determine the appropriateness of his interactions. The matching procedures and reward system were then explained to Carl (described below).

Following training, the video feedback phase was initiated. Video feedback sessions occurred on the day following each activity session, just prior to the next day's activity session. During each video feedback session, the operational definitions of appropriate and inappropriate behavior were first reviewed with Carl. To do so, the facilitator modeled three actions that were appropriate (e.g., asking "How are you today, Laura?") and three actions that were inappropriate exchanges (e.g., making the noise "sssss," repeating sentences) and asked Carl to label whether each was appropriate or inappropriate. Subsequently, Carl was instructed to watch himself on the videotape and self-monitor his interactions with his peer or teacher. A randomly selected 5-min segment from the previous session was played. The videotape was stopped at 15-s intervals at which time Carl was asked to respond to the statement "I had appropriate interactions" by marking "YES" or "NO" on a self-monitoring recording sheet.

One of the three intervention facilitators simultaneously viewed each videotaped segment and also recorded the appropriateness of Carl's interactions. Following each 15-s interval, the facilitator compared her answer to Carl's response. Matching occurred when both Carl and the facilitator agreed on the answer, either "YES" or "NO." When either the facilitator or Carl marked "NO," Carl was asked what else he could have done in that situation or what would have been a more appropriate interaction. When either the facilitator or Carl marked "YES," verbal praise and encouragement was provided. When disagreement occurred, the facilitator reminded Carl of the definitions. Carl was awarded two points for each "YES" response and one point for correctly matching with the facilitator. Thus, it was possible for Carl to earn a total of 60 points if all responses were "YES," which matched with the facilitator's responses.

Immediately following each session, Carl exchanged his points for a reward. To identify rewards, Carl was asked what he would like to earn. The only reward he requested was time on the computer. Carl's teachers confirmed that he had a restricted range of interests and that computer time was his only highly preferred activity. Thus, computer time was earned as follows: 0–15 point = no computer time, 16–30 points = 3-min computer time, 31–45 points = 7-min computer time, 46–60 points = 15-min computer time. Computer time was doubled as larger increments of points were earned in order to encourage high rates of appropriate behavior.

In Vivo Self-Monitoring

Just prior to each activity session, the facilitator modeled appropriate and inappropriate interactions and asked Carl to classify each, identical to the video feedback sessions. The facilitator set a vibrating watch for 1-min intervals at the start of the 15-min activity session. Carl was instructed that when the watch vibrated, he should indicate on his self-monitoring recording sheet whether he had appropriate exchanges throughout the prior min by circling "YES" or "NO." A facilitator simultaneously recorded the appropriateness of Carl's interactions. At the end of each session, matching occurred in the same manner as in the video feedback session. Two points were awarded for each "YES" response by Carl and one point for matching the facilitator's response. Thus, it was possible for Carl to earn a total of 45 points if all responses were "YES," which matched with the facilitator's responses.

Computer time was also provided during the in vivo self-monitoring sessions following a similar schedule as in the video feedback sessions: 0–15 point = no computer time, 16–30 points = 3-min computer time, 31–38 points = 7-min computer time, 39–45 points = 15-min computer time.

Results

Figure 1 shows the results for Carl's inappropriate interactions and inappropriate noises. The top graph shows activity sessions with a teacher. During baseline, Carl engaged in inappropriate interactions a mean of 24.8% of intervals (range, 6.66–46.66%), with an increasing trend throughout the phase, while his inappropriate noises occurred during a mean of 37.95% of intervals (range, 26.66–58.33%). When the video feedback phase was introduced, the mean percentage of inappropriate interactions was 20.59%. While this decreased only slightly, the variability increased slightly (range, 3.33–57.4%). The mean percentage of intervals with inappropriate noises also decreased only slightly ($M = 32.17\%$), and variability also increased (range, 6.66–58.33%). Upon initiation of the in vivo self-monitoring phase, reductions occurred in both the mean inappropriate interactions (10.07%) and the range (3.33–22.41%). Similarly, the mean inappropriate noises reduced to 10.42%, and the range decreased to 3.33–15.51% of intervals. During the reversal to the video feedback condition, the mean inappropriate interactions increased (24.83%) while the range remained relatively small (16.04–40%). This pattern also was observed for inappropriate noises, with a mean of 20.54% and a range of 14.28–30%. When the in vivo self-monitoring phase was re-introduced, the mean intervals with inappropriate interactions decreased further (6.46%) as did the range (1.66–20%). This pattern also was observed for inappropriate noises, with a mean of 1.81% of intervals and a range of 0–7.14%.

The middle graph depicts inappropriate interactions and noises with a peer. During baseline, Carl's inappropriate interactions averaged 24.2% of intervals (range, 1.66–73.33%). Inappropriate noises occurred during a mean of 36.58 of intervals (range, 8.33–61.66%). After introduction of the video feedback phase, the

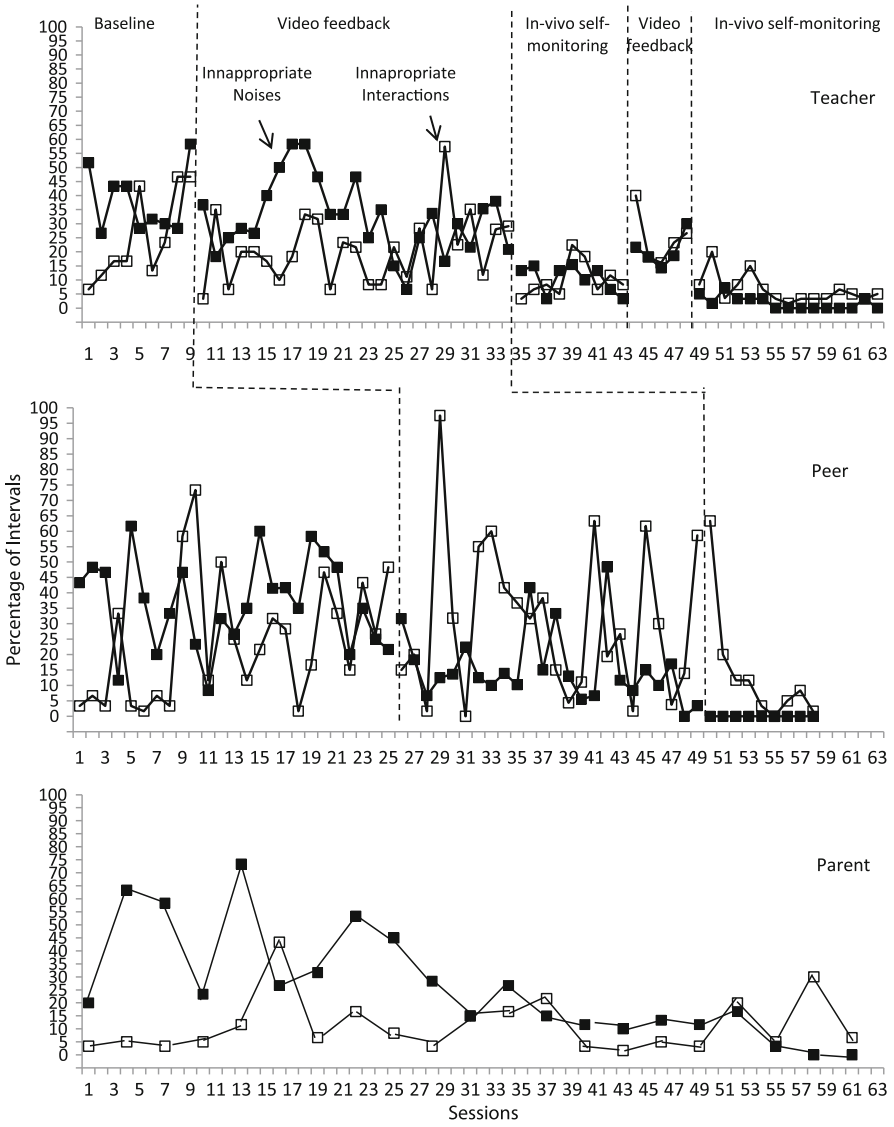

Fig. 1 Carl's inappropriate interactions and inappropriate noises

mean percentage of inappropriate interactions was 30.78 (range, 0–97.5%), showing a slight increase in mean and variability. The mean percentage of intervals with inappropriate noises averaged 15.87 (range, 0–48.38%). A gradual downward trend in inappropriate interactions can be seen throughout the video feedback phase. Upon initiation of the in vivo self-monitoring phase, mean inappropriate interactions occurred during a mean of 13.89 (range, 0–63.33%), with a downward trend throughout the phase. Inappropriate noises never occurred during this phase.

The bottom graph shows inappropriate interactions and noises while Carl was with his mother. No intervention was implemented in this phase. Overall, the data reflect a downward trend in inappropriate interactions and inappropriate noises, with the mean inappropriate interactions at 11.19% of intervals (range, 1.66–43.33%) and the mean inappropriate noises at 26.03% of intervals (range, 0–73.33%). Because of the numerous phase changes that occurred in both the teacher and the peer sessions, it is not possible to determine whether reductions in inappropriate interactions and noises at home coincided with introduction of either intervention at school.

Figure 2 shows the frequency of appropriate interactions. As the top graph shows, during baseline, Carl's appropriate interactions with a teacher occurred during a mean of 29.81% of intervals (range, 11.66–46.66%). During the video feedback phase, the mean percentage of appropriate interactions was 40.87 (range, 10–68.88%), an increase over baseline. During the in vivo self-monitoring phase, appropriate interactions occurred at a mean of 55.75 (range, 43.33–83.33%), an increase over the previous phase. When the video feedback condition was re-introduced, the mean appropriate interactions decreased to 36.75% (range, 20–53.57%). During the final in vivo self-monitoring phase, appropriate interactions occurred during a mean of 41.5% of intervals (range, 16.66–63.33). This represents an increase compared with the previous video feedback phase; however, appropriate interactions were only slightly higher than the initial video feedback phase and did not reach the levels seen in the initial in vivo self-monitoring phase.

The middle graph shows appropriate interactions during activity sessions with a peer. During baseline, Carl's appropriate interactions averaged 22.12% of intervals (range, 10–45%). When the video feedback phase was introduced, the mean percentage of inappropriate interactions was 29.13% (range, 9.67–75%), showing a slight increase. During the in vivo self-monitoring phase, mean appropriate interactions increased to 46.45% (range, 21.66–63.33%). The bottom graph shows that appropriate interactions initiated by Carl toward his mother occurred during an average of 17.60% of intervals (range, 0–71.66%), with a notable increase during the last four sessions.

Social validity results, measured by the SIRF, indicated that Carl responded most favorably (i.e., rated 3 on 3-point scale) to four questions regarding video feedback (understood the intervention, liked the intervention, nothing not liked about the intervention, and nothing uncomfortable about the intervention). Moderate responses (i.e., rated 2 on 3-point scale) were provided for two of the questions (intervention was somewhat easy, intervention helped improve his behavior some). When completing the rating form about the in vivo self-monitoring, all questions received the most favorable rating (i.e., rated all questions 3).

Discussion

The video feedback intervention resulted in only slight reductions in Carl's inappropriate interactions and inappropriate noises. Greater reductions were

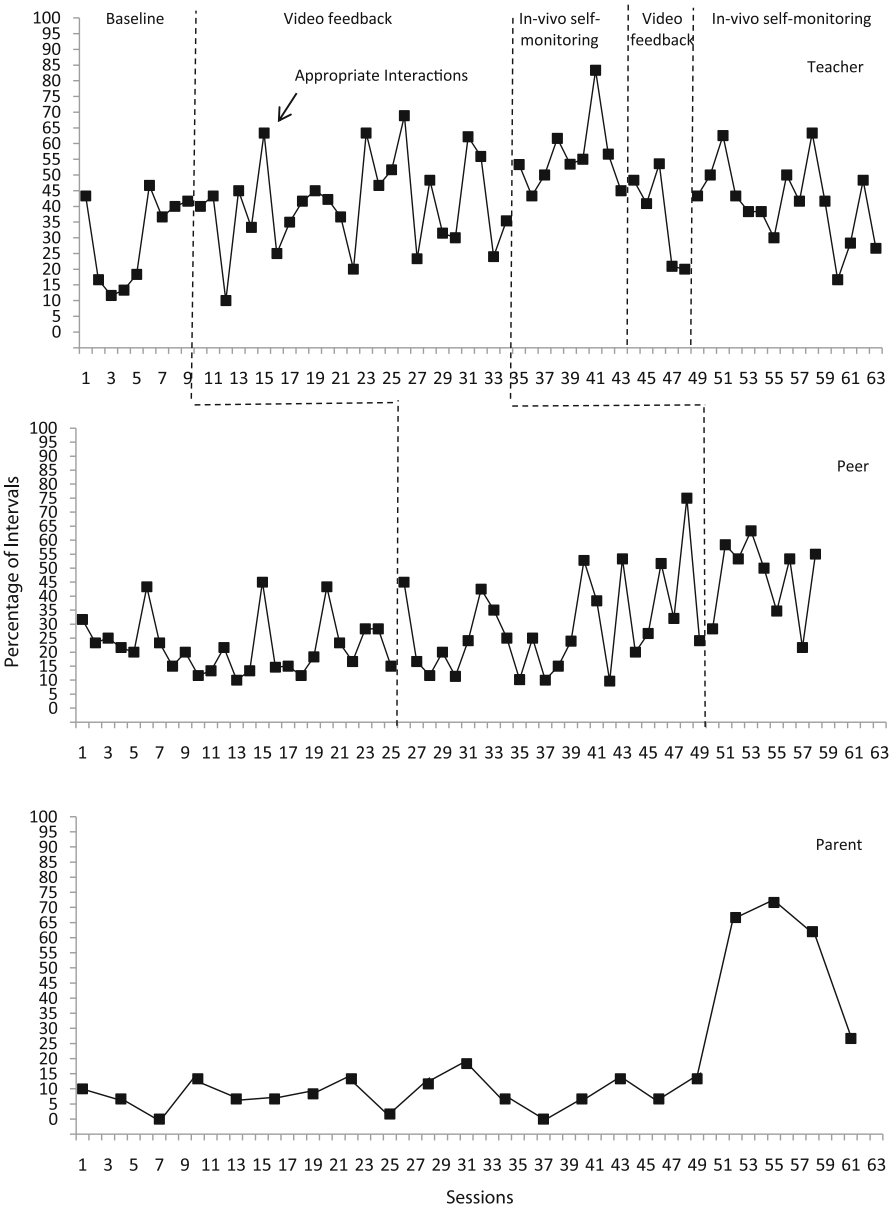

Fig. 2 Carl's appropriate interactions

observed during the in vivo self-monitoring intervention. This was the case for both teacher and peer interactions. These data are consistent with prior research, suggesting that responsiveness to these two types of interventions may be idiosyncratic and depend on participant characteristics and/or behaviors (Apple

et al. 2005; Maione and Mirenda 2006). The findings of Maione and Mirenda indicated that behavior that appeared perseverative required in vivo visual and verbal prompting to reduce it to levels similar to nonperseverative behaviors. It is possible that self-awareness is more difficult for behavior of this nature, thus requiring more immediate feedback. It may also be that it was difficult for Carl to decrease his inappropriate behavior without frequent in vivo prompts associated with the self-monitoring system due to the high frequency of the behavior. Future research might examine whether video feedback or in vivo interventions are more effective for particular types or functions of behavior (e.g., perseverative).

Appropriate interactions also increased during the video feedback and in vivo self-monitoring interventions. One caveat is that the absence of interactions or noises during an interval was coded as appropriate interactions. It is important that an intervention that effectively reduces or eliminates inappropriate interactions or behavior does not eliminate appropriate interactions. Previous research indicates that video feedback and self-monitoring can reduce inappropriate interactions while maintaining or increasing appropriate interactions (e.g., Kern-Dunlap et al. 1992; Kern et al. 1995). It is likely that the skill and ease of participants' appropriate interactions dictate whether they will readily replace inappropriate behavior, as the study by Apple et al. (2005) suggests. Carl had a repertoire of appropriate interactions that he frequently exhibited, evidenced by his baseline data. In his case, however, as well as other students with autism, a decrease in inappropriate behavior may not readily translate into an increase in appropriate behavior. This is an area that warrants further research, particularly for individuals without strong social interaction skills. In that case, it may be necessary to add an additional intervention to teach appropriate social skills.

Intervention was planned in the home for sessions with Carl's mother; however, inappropriate interactions and noises continued to decrease in the absence of intervention. These data suggest that the interventions may have generalized to the home setting. It is not possible to determine a direct link between the introduction of intervention at school and reductions in inappropriate behaviors during home sessions given the many phase changes; thus, this conclusion is speculative. Future research should examine generalization effects of both video feedback and in vivo self-monitoring interventions.

The fact that high treatment acceptability ratings were obtained from Carl is encouraging, particularly given his age and the need to identify interventions that are not stigmatizing. The success Carl experienced with the interventions and the associated reward of computer time, which was a highly preferred activity, may have contributed to his favorable ratings. The higher ratings in the favor of the in vivo self-monitoring indicated Carl's slight preference for this particular intervention.

Several limitations should be acknowledged. First, intervention remained in place throughout the study. Because of the extensive time it took to ascertain intervention effectiveness and achieve within-phase stability, the school year ended before the intervention could be faded. Future research should delineate procedures needed to effectively fade self-management interventions for high rate socially inappropriate

behavior while maintaining reductions in problem behavior (Barry and Messer 2003).

Second, generalization data are limited. Although generalization appeared to occur in the home setting, generalization was not assessed at school. The activities were arranged so that they resembled naturally occurring situations (age appropriate interactive games with teachers and peers) to enhance generalization. However, given that the participants attended a private school serving students with severe emotional and behavioral challenges, it is important to note that Carl was not interacting with "typical" peers within typical settings. Future studies should collect additional data during activities that include typical peers in public schools to fully evaluate generalization.

Third, there are several possible explanations for the outcomes. There were subcomponents across the two interventions could have been responsible for improvement. During both interventions, the facilitators reviewed the operational definitions before the activity, modeled appropriate and inappropriate behaviors, and asked the student to label them accordingly. Additionally, reinforcement by way of computer time was delivered during both interventions. Although it is not possible to ascertain which subcomponent or combination of subcomponents was responsible for improvement, interventions differed in two primary ways. First, feedback was provided as the game was taking place in the in vivo self-monitoring intervention. In the video feedback intervention, feedback was provided the day before the game session was scheduled. The timing of feedback may have accounted for behavioral differences. Second, the video feedback condition involved monitoring at 15-s intervals over 5-min sessions, while the in vivo self-monitoring occurred every minute over 15-min sessions. Feedback was arranged in this way because it took time to discuss the interaction with Carl. Consequently, the session usually lasted around 15 min, similar to the self-monitoring session. Nonetheless, future research may examine differences in the length of intervention feedback to determine whether it accounts for behavioral change.

Another limitation is that the range of IOA for inappropriate and appropriate social interactions was relatively broad (59–100%). This might be explained by the somewhat subjective nature of some terms used to describe the definitions (e.g., "tone louder than typical conversation," "making or responding to a statement one time in a contextually appropriate manner"). Still, the mean IOA across both dependent variables was within acceptable limits (i.e., 84.78% for inappropriate social interactions and 72% for appropriate social interactions).

In summary, both video feedback and in vivo self-monitoring are effective interventions for students with social difficulties. Self-monitoring is a relatively easy intervention to implement, and video feedback is becoming increasingly feasible with advances in technology. When training in natural environments is difficult due to lack of resources, students could be trained using video feedback techniques in school and later exposed to natural settings where the use of self-monitoring could help reinforce the skilled learned in school. Both interventions are promising techniques. For some individuals, however, in vivo self-monitoring might be slightly more effective than video feedback as demonstrated in the current study.

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