Enhancing Social Skills in Adolescents with High Functioning Autism using Motor-based Role-play Intervention

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Abstract

The purpose of this pilot study was to collect pilot data evaluating whether a motor-based role-play intervention using a canine animal assistant can enhance social skill use in two adolescents with HFA. A single subject ABA design across two participants was used. The intervention consisted of four 1-hour sessions over 4 weeks. The quality of social interaction was measured by the Evaluation of Social Interaction (ESI) administered at baseline and the 3-month probe. Frequency of targeted social skill use was measured during baseline, intervention, and probe phases. Participant 1 experienced statistically significant increases in both ESI scores (p = .012, t = -5.488) from baseline to the 3-month probe. Participant 2 also experienced a statistically significant increase in ESI scores from baseline to probe (p = .002, t = -10.167), but he was unable to fully maintain these gains at the 3-month probe. This pilot study's findings suggest that the intervention produced positive effects in both participants and warrant further investigation.

Keywords

Cover Page Footnote

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High functioning autism (HFA) is an autism spectrum disorder (ASD) in which people have normal or above average intelligence but have difficulty interpreting and using social skills (APA, 2000). HFA can severely impair a person's ability to use facial expressions, body language, gestures, and vocal intonation to convey personal needs and decode the meaning of others' communication. Youth with HFA may perform well academically, but they have a narrowed social sphere characterized by few friendships and limited participation in social activities with peers (Tantam & Girgis, 2009). If such deficits remain unaddressed, young adults with HFA may have difficulty transitioning from high school to postsecondary education and employment (Taylor & Seltzer, 2011). Although the prevalence of HFA is not well established, the frequency rate of ASD is believed to be 1 in 110 (Kogan et al., 2009) and more commonly affects boys at a 4:1 ratio (APA, 2000).

While the causes of ASD are not well understood, genetic and neurological factors are believed to play major roles. One neurological system recently implicated in the etiology of ASD is the mirror neuron system (Rizzolatti & Fabbri-Destro, 2010). Found in the primary motor cortex, prefrontal cognitive centers, and parietal sensory areas, mirror neurons are specialized cells that appear to function in the deciphering of motor acts and may serve as a primary system through which humans learn to associate movement with specific cognitive and emotional meaning (Rizzolatti & Sinigaglia, 2010). ASD researchers have suggested that deficits in the mirror neuron system may, in part, account for difficulty with linking facial expressions, body language, gestures, and vocal intonation to their emotional meanings (Enticott, Johnston, Herring, Hoy, & Fitzgerald, 2008).

ASD researchers have also argued that social skill interventions for youth with HFA should focus on connecting the motor actions underlying facial expressions and body language to

a person's emotional intentions (Fabbri-Destro, Cattaneo, Boria, & Rizzolatti, 2009). One occupational therapy intervention that appears to enhance social skills effectively in adolescents with HFA is a motor-based role-play program developed by the first and second authors. Based on mirror neuron theories and the premise that intervention must address the disrupted chain linking motor behaviors and emotional meaning, we developed a manual of role-play activities designed to help adolescents with HFA identify and assign meaning to the facial expressions, body language, gestures, and vocal intonation used in specific real-life scenarios commonly encountered in the school, family, and community environments. The intervention has received preliminary support for effectiveness in several empirical studies (Gutman et al., 2010; Gutman, Raphael-Greenfield, & Rao, in press; Gutman, Raphael-Greenfield, & Rao, 2012; Gutman, Raphael-Greenfield, & Salvant, 2012).

In the present study we added additional role-play activities that incorporated into the intervention the use of a canine animal assistant. Animal assistants—animals who are trained to provide specific services to recipients whose disabilities impede daily function—are increasingly used with children with ASD to stop wandering behaviors, decrease anxiety, and enhance social interaction (Burrows, Adams, & Spiers, 2008). Dogs may be especially suited to the needs of youth with ASD because canine communication is thought to be less dependent on subtle variations of facial expressions, body language, and vocal intonation and may be easier to interpret (Prothmann, Ettrich, & Prothmann, 2009). There is also a growing body of research demonstrating that dogs have been bred to readily identify, decode, and respond to human gestures and vocal intonation more efficiently than other domesticated animals (Riedel, Schumann, Kaminski, Call, & Tomasello, 2008).

While a variety of animal assistants are increasingly used to help youth with ASD function more optimally in their environments, there is little research supporting the effectiveness of such intervention. Several studies demonstrated that equine therapy enhances motor control and diminishes sensory seeking and distractibility in youth with ASD (Bass, Duchowny, & Llabre, 2009; Kern et al., 2011; Wuang, Wang, Huang, & Su, 2010). Two intervention effectiveness studies found that the use of animals (i.e., dogs, llamas) in counseling and occupational therapy sessions with children with ASD increased social interaction with the therapist (Redefer & Goodman, 1989; Sams, Fortney, & Willenbring, 2006). Few studies, however, have examined the effect of canine animal assistants as part of the therapy to enhance social interaction skills in youth with ASD and no studies have examined the impact of animal assistive therapy with pairs or groups of interacting adolescents.

The purpose of this pilot study was to determine if a motor-based role-play intervention, in which a canine animal assistant was incorporated into all role-play activities, could enhance social interaction in adolescents with HFA. We used a single subject design across two participants who received the intervention as an after school social skills program. Specifically, we asked whether two adolescents with HFA could enhance the quality and frequency of their paired social interaction through participation in a motor-based role-play intervention that included a canine animal assistant.

Methods

Research Design

This study used a single subject ABA design across two participants in which A consisted of a 2-week baseline data collection phase, B involved a 4-week intervention period with data collected at each weekly session, and A was a 3-month follow-up probe with data collected over

1 week. Each participant served as his or her own control (Bloom, Fischer, & Orme, 2009; Kazdin, 1982; Kennedy, 2005). The study was approved by Columbia University's Institutional Review Board and by the high school principal of the participating site. Participants' parents provided written consent while participants provided verbal assent.

Participants

The study took place at a high school for adolescents with learning challenges (e.g., HFA, ASD, pervasive developmental delay, learning disability) located in a large metropolitan city in the northeastern United States. The high school administrator identified six potential high school students as having severe social skill deficits and mailed information about the study to their respective parents. Inclusion criteria required that the participants be between 14 and 17 years old, have a diagnosis of HFA listed in their individualized education plan, have a normal intelligence quotient as determined by school aptitude testing, and be English speaking. Students were excluded from participation if they had a severe behavioral management disorder or had allergies to or a fear of dogs. Parents and students who were interested in participating contacted the researchers. Of the six recruited parents and students, four demonstrated interest, but two students had allergies to or a fear of dogs. The remaining two students were enrolled in the study.

Instruments

Evaluation of Social Interaction (ESI). The ESI is an observational rating assessment that includes 27 items categorized into seven domains of social interaction: initiating and terminating social interaction, producing social interaction, physically supporting social interaction, shaping content of social interaction, maintaining flow of social interaction, verbally supporting social interaction, and adapting social interaction. Items are scored on a 4-point

Likert scale (4=competent or supports on-going social action, 3=questionable, 2=interferes with social action, and 1=unacceptable or causes breakdown of on-going social interaction). Rating involves direct observation of the participant's social interaction quality as observed in two real-life social interactions with common social partners lasting for a minimum of 10 minutes. Raters must be trained, certified, and calibrated as reliable and valid. The ESI is scored using online software that incorporates a many-facet Rasch analysis program to generate linearized measures. Criterion-based interpretations determine if a participant's social interaction quality is above or below a 1.0 logit competence cut-off score. The ESI demonstrates high inter- and intra-rater reliability ($r = .98$). Parallel forms reliability among different types of social exchanges was $r = .86$, the many-facet Rasch equivalent of Cronbach's alpha was $r = .93$, and the mean standard error of ESI measures was 0.17 logit supporting high reliability (Fisher & Griswold, 2010; Søndergaard & Fisher, 2012). The ESI was administered during the baseline and probe phases in the present study.

Frequency of targeted social skills. Frequency of targeted verbal and nonverbal behaviors was tallied during the baseline, intervention, and probe phases using a recording sheet created by the first two authors (see Table 1). The authors completed the recording sheet development after a literature review identifying the core foundational verbal and nonverbal skills comprising typical social skill interaction (Leutenberg & Liptak, 2008; Liptak, 2004; Myles, Trautman, & Schelvan, 2004; Williamson & Dorman, 2002). After initial construction, the recording sheet was assessed for face validity by a panel of seven occupational therapists with doctoral research degrees who possess expertise in social skill development or autism. Based upon the panel's feedback, the 10-item recording sheet was expanded to 12 items and

specific skills were more precisely defined and operationalized. No other psychometric

properties have been established for this recording sheet.

Table 1

List of Verbal and Nonverbal Behaviors on Recording Sheet.

Verbal Behaviors
• Is able to verbally greet or say goodbye to another (peers, instructors) in a socially acceptable way (can say hello, make eye contact, and speak in an audible way)
• Is able to initiate appropriate conversations with peers and/or instructors (can initiate conversation when desired, uses audible speech that can be heard by others, conversation topics are of appropriate content, and conversation is made at appropriate times)
• Is able to maintain a conversation by contributing to it appropriately (dysfunction is indicated by silence, short answers that do not invite further conversation, excessive questions that make others uncomfortable, and odd responses that make others uncomfortable)
• Is able to accurately interpret social cues and verbally respond appropriately (can accurately interpret communication that requires some abstraction/inference, such as innuendo, jokes, tonal inflections; can offer appropriate verbal responses that do not make others uncomfortable)
• Is able to bring a conversation to an appropriate end or allow a conversation to be ended by another (dysfunction is indicated by excessive, unending verbalizations without awareness that the other person is trying to end the conversation)
Nonverbal Behaviors
• Maintains eye contact (for approximately 10-15 sec interval or longer)
• Stands at appropriate distance (arm's length) from another (is able to acknowledge and respect the personal space of another)
• Orients body to face the other individual (and is able to maintain this orientation for at least 10-15 seconds)
• Is able to generate or reciprocate appropriate physical touch if needed (e.g., shaking hands, hugging peer or family member)
• Is able to generate or reciprocate appropriate facial expressions (e.g., smiling)
• Is able to generate or reciprocate appropriate body language and gestures that are appropriate to the situation (e.g., waiving, pointing)
• Is able to tolerate the presence of others demonstrated by the ability to join social interaction independently or when invited (dysfunction is indicated by isolative behaviors)

Intervention

The intervention was provided as a 4-week after school social skills program to the two participants, who remained paired for all intervention activities. Intervention took place once per week in 1 hour sessions. The first two authors manualized the intervention, and the manual addressed intervention training, intervention administration, and intervention fidelity assessment. The original manual consisted of seven modules (healthy self-care habits supporting social participation; social skills in the classroom, lunchroom, and gym; developing and maintaining friendships; social skills supporting family relationships; social skills supporting sports team membership; social skills in the community; and exploring dating), each having a selection of three warm-up and three role-play activities. In previous studies, the most relevant modules were selected for specific participants based on their self-reported interest and modules were addressed in order of participant preference.

In the present study, the first two authors added an eighth module addressing dog ownership and care. Warm-up and role-play activities included opportunities to practice social skills with the paired partner and therapist based on scenarios involving the dog (e.g., taking the dog to the vet, taking the dog for a walk in the community, taking the dog to the groomer, asking a pet owner for permission to pet the dog, helping a friend to decrease fearfulness of dogs). In the present study, we only addressed the eighth module to determine if this specific set of animal assisted, motor-based role-play activities could enhance quality and frequency of social interaction in the participants.

Each session began with 15 minutes of warm-up activities in which the participants used motor-based games and activities to learn to decode and express the emotions underlying facial expressions, body language, and vocal intonation. For example, in one warm-up activity, the

participants pretended that they were opening imaginary birthday gifts presented by the dog. While one participant practiced using facial expressions and body language to convey specific emotional responses to the gift, the other participant tried to decode the meaning of those motor-based cues.

After warm-up activities, the participants engaged in role play for approximately 45 minutes. Role play required that the participants use verbal and nonverbal communication to interact with their partner, the dog, and the therapist. In one role play, one participant took the dog for a walk in the community and came across two people (the other participant and the therapist) who wanted to meet the dog. The participant acting as the dog owner answered questions about the dog while practicing eye contact, facial expressions, body language, and vocal intonation. After the first completion of each role play, the therapist and participants reviewed the role play by talking about and practicing the specific motor actions (e.g., facial expressions, body language) they used to identify and express emotion and thought. This review provided the opportunity to make corrections and changes in verbal and nonverbal communication. Following the review, the participants completed the role play at least one more time, allowing them to experience the scenario using more appropriate facial expressions, body language, and vocal intonation. The participants received immediate feedback through the use of mirrors and video. It was common to complete 2-3 role-play scenarios in a 1-hour session.

Intervention training and administration. Intervention was carried out by three occupational therapy student therapists (the third, fourth, and fifth authors) who received 8 hours of training in intervention administration from the first two authors. In each session, two student therapists directly interacted with the participants while the third video recorded the session. Student therapists rotated their roles as therapist and video recorder. The canine animal assistant

was a 3-year old Havanese, a certified animal assistant with a work history of providing service to geriatric populations and an individual with multiple sclerosis.

Intervention fidelity. To ensure proper administration of the intervention, the first two authors developed a fidelity checklist that contained 12 items deemed as necessary components of intervention administration. The first author supervised each therapy session and completed the checklist for all student therapists, who were required to score 85% or greater in manual adherence for each session. Intervention fidelity was established at 95% or greater for each student therapist in all sessions. At the end of each session the first author and three student therapists reviewed the session and discussed plans for the following session.

Data Collection

Baseline. The second author, a certified ESI administrator, administered the ESI during baseline data collection on two separate 10-minute occasions for each participant. During each ESI observation, the participant engaged in social interaction with a teacher or peer in the high school environment.

Using the recording sheet, the second author also completed a frequency tally of targeted social skills for each participant during baseline data collection. The participants were observed for four 20-minute sessions over the course of two weeks. Observation occurred in the high school environment in settings allowing for greater opportunities for social interaction (i.e., lunchroom, gym, small class discussions, and free periods). Although the second author was not blind to the purpose of this study, she was blind to the participants' intervention performance and was not involved in intervention administration or intervention data collection.

Intervention. A student therapist video recorded all intervention sessions. Video recordings were later analyzed by an occupational therapy student researcher who was external

to the study and blinded to the study's purpose, baseline and probe data, and intervention session order. Analysis of intervention sessions occurred after completion of probe data collection. The external student researcher tallied frequencies of exhibited social skills using the recording sheet. Each 1-hour video-recorded session was divided into three 20-minute periods for analysis. The frequencies of each 20-minute intervention period were then averaged into one frequency score for each session, per participant. The external student researcher received 8 hours of training in recording sheet use from the first author and achieved inter-rater agreement of 95% with the second author (as described below).

Probe. Probe data were collected by the second author who administered the ESI at the 3-month follow-up. For each participant, the ESI was completed on two separate 10-minute occasions in the high school environment during interactions with a teacher or peer.

At the 3-month probe, the second author also used the recording sheet to tally the frequency of social skills exhibited during four 20-minute observation periods over one week. Observations were carried out in the same high school settings used for baseline data collection (i.e., lunchroom, gym, small class discussions, free periods).

Inter-rater agreement. Inter-rater agreement was established at 95% between the second author and external student researcher after completion of probe data and prior to the external student researcher's analysis of video-recorded intervention data. Inter-rater agreement was achieved by observing the social interactions of self-identified adolescents with HFA posted on YouTube.

Data Analysis

ESI raw data were transformed into logit competence scores using the ESI many-facet Rasch analysis software program (Fisher & Griswold, 2010). Adjusted pre- and post-

intervention ESI scores were calculated to determine whether the participants experienced a statistically significant change in the quality of social interaction from the baseline to the 3-month probe. Paired *t*-tests were used to determine whether the participants experienced a statistically significant change in the frequency of social skill use between (a) baseline and intervention and (b) intervention and probe (Bloom, Fischer, & Orme, 2009). Baseline, intervention, and probe data collection phases were also graphed to allow visual inspection of the trend lines (Kazdin, 1982; Kennedy, 2005). When the above analysis methods are triangulated in a single subject design, there is greater confidence that the results accurately reflect true intervention effects (Bloom et al., 2009). Significance level was set at 0.05. Statistical analysis was completed in SPSS PASW Statistics, version 19.0.

Results

Participant 1 was a 15 year old Hispanic female in the 10th grade who had difficulty initiating and maintaining eye contact and conversation, possessed diminished use of facial expressions and body language, spoke in a monotone voice, and did not orient her body to others during social interaction. Her ESI converted logit scores increased from .6 (mildly to moderately ineffective and/or immature social interaction skills) at baseline to 1.2 (competent to occasionally questionable social interaction skills) at the 3-month probe. According to the generated ESI criterion-based report, the participant's .6 score increase from baseline to probe represented a statistically significant change in social skill quality.

Participant 1 demonstrated a similar increase in the frequency of social skill use across the study phases (see Figure 1). A paired *t*-test showed that participant 1 experienced a statistically significant increase in social skill use from baseline to intervention ($p = .012$, $t = -5.488$). Another paired *t*-test demonstrated no statistical significance between intervention and

probe mean frequencies, indicating that participant 1 was able to maintain the gains in social skill use at the 3-month probe.
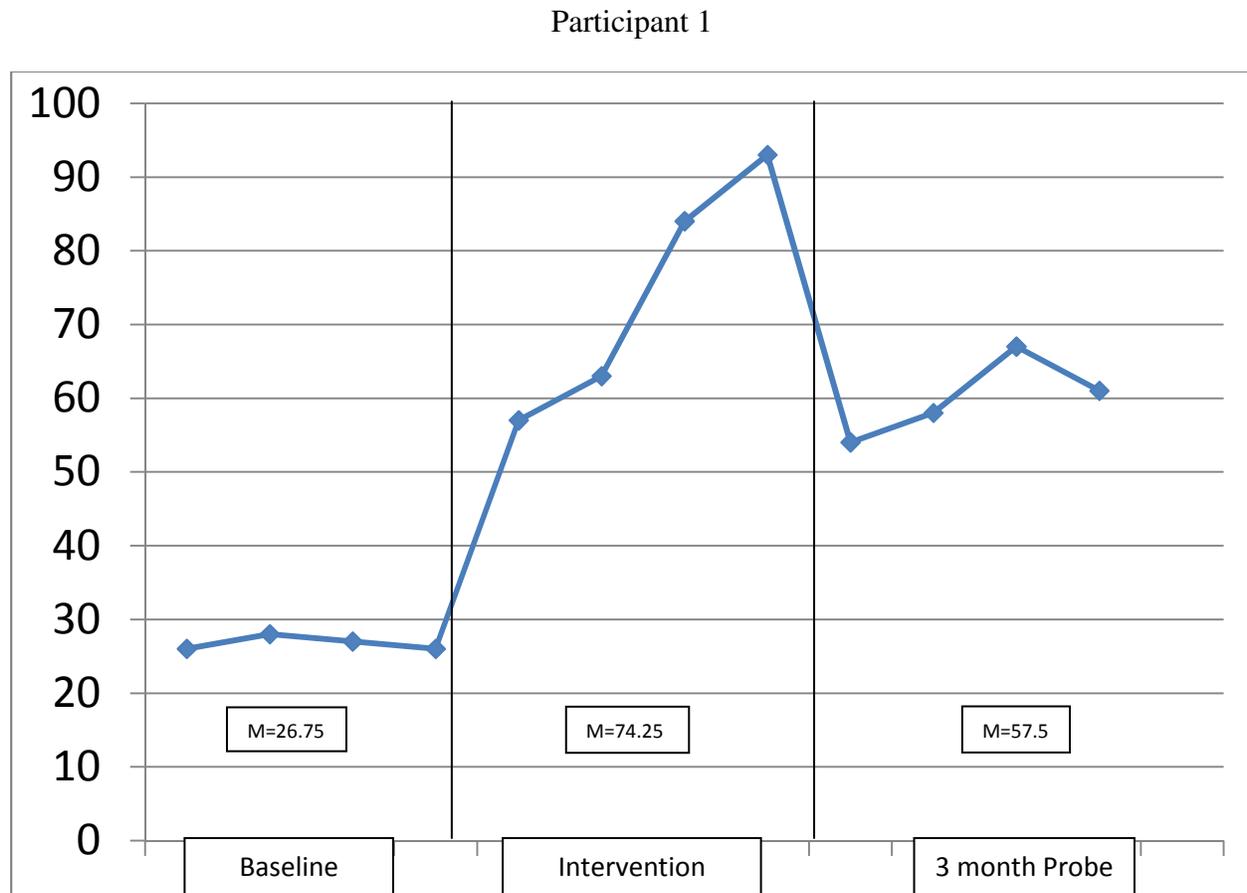
Participant 1

Figure 1. Graphed data points collected over baseline, intervention, and probe phases.

Participant 2 was a 15 year old Hispanic male in the 10th grade who was initially unable to regulate speech rate and vocal intonation, had difficulty initiating conversation and allowing conversation to end, and lacked an understanding of appropriate personal space and verbal content. His ESI converted logit scores increased from .5 (mildly to moderately ineffective and/or immature social interaction skills) at baseline to 1.0 (competent to occasionally questionable social interaction skills) at the 3-month probe. According to the generated ESI

criterion-based report, the participant's .5 score increase from baseline to probe represented a statistically significant change in social skill quality.

A paired *t*-test indicated that participant 2 experienced a statistically significant increase in the frequency of social skill use from baseline to intervention ($p = .002$, $t = -10.167$). A second paired *t*-test showed that participant 2 also experienced a statistically significant change between intervention and probe frequency means ($p = .024$, $t = -4.234$), indicating that although his probe mean was higher than the baseline mean, participant 2 was unable to fully maintain his social skill gains at the 3-month probe (see Figure 2).
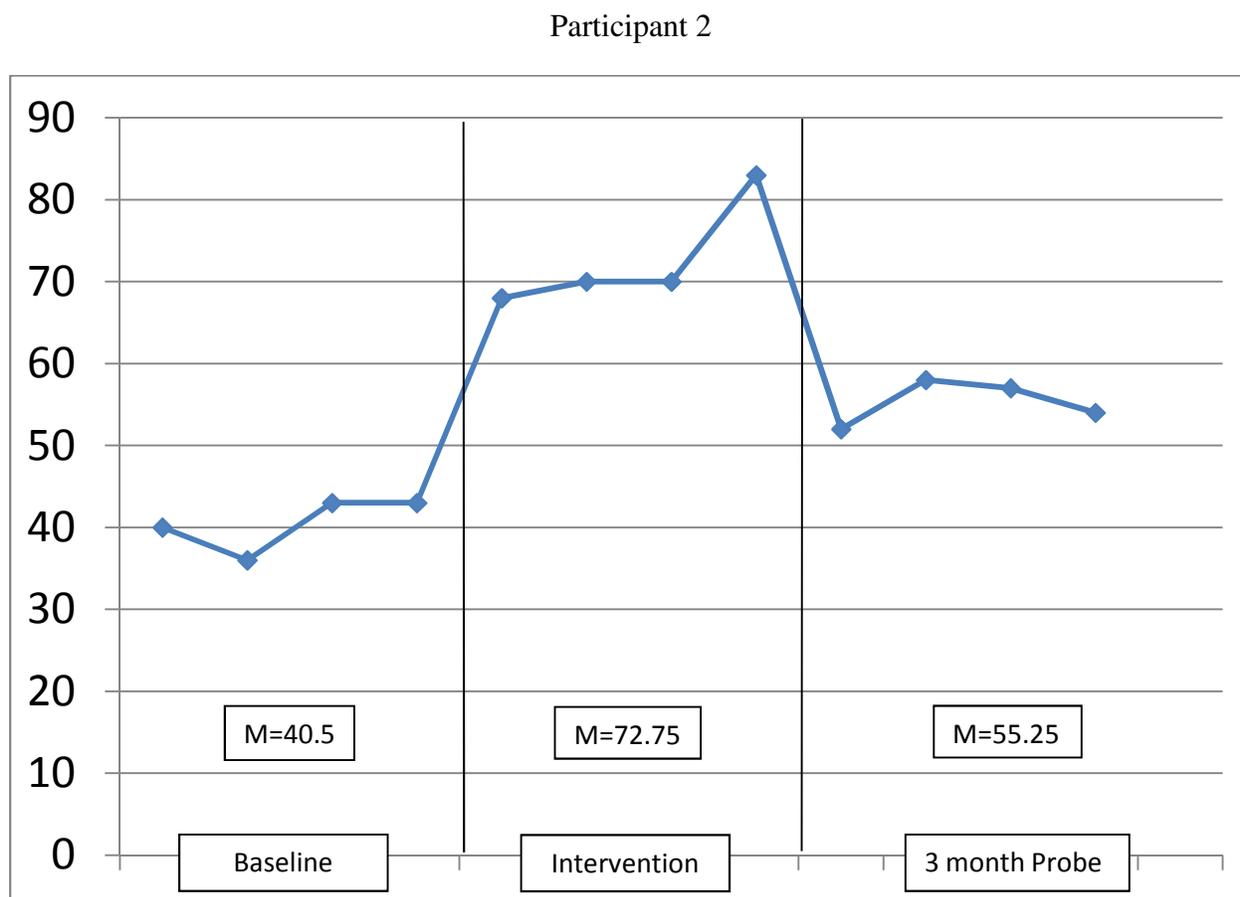
Participant 2

Figure 2. Graphed data points collected over baseline, intervention, and probe phases.

Discussion

Both participants experienced significant changes in the frequency and quality of social skill use as a result of participation in the intervention. Although participant 1 was able to maintain social skill gains made during the intervention at the 3-month probe, participant 2 was not. The intervention consisted of four sessions over 4 weeks. The short intervention length and participant 2's inability to maintain gains at the 3-month probe raise the question of whether both participants' gains would have been larger and lasted longer if the frequency or length of the intervention sessions had been greater. The high level increase in the frequency and quality of social skill use achieved by both participants in only four sessions suggests that the intervention was effective but it may have had longer lasting effects if it had been of greater duration. Additionally, the large gains made by both participants during intervention may suggest that these participants would have benefitted from the continued partnership of a canine animal assistant, particularly participant 2 who was unable to maintain social skill gains at the 3-month probe.

Although future studies using randomization and control are necessary to determine if the motor-based role-play intervention effectively enhances social skills in adolescents with HFA, confidence in intervention effectiveness has been enhanced by the combined support of four previous single subject design studies (Gutman et al., 2010; Gutman, Raphael-Greenfield, & Rao, in press; Gutman, Raphael-Greenfield, & Rao, 2012; Gutman, Raphael-Greenfield, & Salvant, 2012). The present pilot study was the first to assess the incorporation of a canine animal assistant into the motor-based role-play intervention. We believe that the motor-based role-play activities provided the opportunity for the participants to begin to systematically identify and decode the meaning of motor actions underlying facial expressions, body language,

gestures, and vocal intonation. We suggest that the presence of the canine animal assistant may have further enhanced the motor-based role-play activities by facilitating social interaction. Both participants appeared highly motivated to interact with the dog and to seek the sensory input provided through this interaction (e.g., petting the dog's fur; smelling the scent of the animal; being caressed by the dog's tongue and wet nose; feeling the dog's weight press against the participants' legs, arms, and torso; gazing at the dog's multi-colored fur). Although such sensory input appeared to enhance the participants' comfort level with social interaction, we did not measure this phenomenon. Some literature supports the assertion that an animal assistant can facilitate comfort with social interaction in youth with ASD (Martin & Farnum, 2002; Solomon, 2010), but this claim requires further studies.

Although the presence of the dog may have facilitated some comfort with social interaction, it is doubtful that the dog's presence alone would have enhanced the ability to identify and decode the meaning of human facial expressions, body language, and vocal intonation. We suggest that the motor-based role-play intervention is needed to learn and practice appropriate social skill use and that the incorporation of the canine animal assistant enhanced the intervention. We further suggest that certain youth with HFA would benefit from the daily partnering with a canine animal assistant to facilitate social interaction and maintain the social skills initially learned through occupational therapy intervention. The effect of personal canine animal assistants on the social functioning of youth with HFA requires examination through empirical study.

Limitations

As mentioned above, the small sample size and a lack of randomization and control limit the findings of single subject design studies. Confidence in the findings of single subject design

studies increases when several single subject design studies show support for the effectiveness of one intervention, as in the case of the motor-based role-play intervention assessed in this study. It should be acknowledged that the second author who collected baseline and probe data was not blinded to the study's purpose, although she was blinded to the participants' intervention performance. Although our baseline and probe outcome measures were based on real-life observations of the participants in their high school environment, we did not assess social skill functioning in family interactions or extracurricular school activities that may have provided a more in-depth or fuller perspective of the participants' social skills. We also did not assess the participants' own perceptions about intervention satisfaction or comfort level in the presence of the dog assistant. Seeking the participants' perceptions, as well as parental and teacher perceptions, may provide valuable insight into the participants' social skill use in future studies.

Future Research

Future studies should involve more rigorous designs with randomization and control. A comparison study that assigns participants to one of three groups, (a) motor-based role-play intervention, (b) motor-based role-play intervention and a dog assistant, and (c) the presence of a dog assistant alone, would provide greater insight into the specific factors underlying the effectiveness of the intervention. The participants' personal experience of the intervention and social participation in contexts beyond the intervention setting should be studied through qualitative methods to gain a richer understanding of the participants' perspective, desires, and goals.

Conclusions and Clinical Implications

This single subject design study across two adolescents with HFA contributes to previous studies demonstrating preliminary effectiveness of the motor-based role-play intervention

investigated. While the motor-based role-play activities appeared to help the participants understand the meaning of motor actions underlying facial expressions, body language, and vocal intonation, the incorporation of a canine animal assistant may have facilitated their comfort level with social interaction. Occupational therapists can use the motor-based role-play intervention to help youth with HFA begin to connect specific motor behaviors involved in social interaction with their emotional meanings. The sensory input provided by a canine animal assistant may enhance the participants' comfort level with social interaction and their desire to engage in role-play activities involving a dog. Further research, however, would more accurately determine how a canine animal assistant impacts intervention.

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