

**Critical Review:
Is peer-mediated video-modeling an effective social skills intervention for children with autism spectrum disorder?**

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This critical review examines the effectiveness of peer-mediated video-modeling (VM) as a social skills intervention for children with autism spectrum disorder (ASD). Study designs include single-subject multiple baseline, single subject AB and a case control study. Results of the studies reviewed provide suggestive evidence for the use of peer-mediated VM to increase, generalize and maintain social skills such as affective responses, compliment-giving, initiating, responding, participation, conversational maintenance, and reciprocal play. Recommendations for future research and clinical implications are discussed.

Introduction

Social skills deficits are recognized as a defining feature of Autism Spectrum Disorder (ASD) and are the core deficit in many children with high function autism (HFA), pervasive developmental disorder not otherwise specified (PDDNOS) and Asperger's disorder (Reichow & Volkmar, 2010; Wang, Cui & Parrila, 2011). Children with ASD interact less with peers, make and accept fewer initiations and spend a greater amount of time playing alone in comparison to typically developing peers (Nikopoulos & Keenan, 2007). Difficulties with social skills are a pervasive area of vulnerability for children with ASD despite level of functioning (Reichow & Volkmar, 2010).

In recent decades, research in the area of social skills training has increased dramatically for individuals with ASD. Intervention techniques in the literature include: applied behaviour analysis (ABA), naturalistic techniques such as imitation, parent training, peer training, social skills groups, visual supports and video modeling (Reichow & Volkmar, 2010).

Video modeling is described as viewing the appropriate target behaviour via video model prior to an opportunity to perform the skill. Video instruction techniques include video modeling (VM), video-self modeling (VSM) and point-of-view modeling (PVM) (Schukla-Mehta, Miller & Callahan, 2010).

The model itself has been an important aspect of VM debated in the literature. McCoy and Hermansen (2007) completed a systematic review to evaluate the use of adult, peer, self or point of view models for individuals with ASD. Thirty-four studies published between 1987 and 2006 met the inclusion criteria. The reviewed studies report positive outcomes for social communication skills including: initiation, following directions, greeting, sharing, responding, giving compliments, verbal and facial affect. Overall, peer or

self-models were determined to be the most effective form of video-modeling intervention. The use of peer-mediated models for children with ASD is a recommended practice as it is naturalistic and reduces difficulty with generalization following adult-mediated intervention (Reichow & Volkmar, 2010; Strain, Schwartz & Bovey, 2008). Peer models are defined as the same age, gender and familiar or unfamiliar to the individual (McCoy & Hermansen, 2007).

VM is a promising intervention strategy for children with ASD because it capitalizes on strengths in visual processing, draws attention to relevant stimuli, reduces social anxiety and is intrinsically motivating (Charlop-Christy, Le & Freeman, 2000). In addition, VM results in faster acquisition rates of targeted skills and greater generalization in comparison to modeling in person (Charlop-Christy, Le & Freeman, 2000). The benefit of improved generalization is important as children with ASD have difficulty transferring skills (Bellini & Akullian, 2007). VM is also a structured and systematic intervention approach which corresponds with the preferences of individuals with ASD. Barriers of accessibility to this promising technique have been addressed by the recent availability of inexpensive recording devices as well as the time and cost efficiency of VM compared to modeling in person (Charlop-Christy, Le & Freeman, 2000).

In Canada, inclusive education in a general education setting has become the dominant service delivery model for individuals with ASD. This model heightens the need for effective and comprehensive social skills interventions in order for children with ASD to participate equitably in social and educational practices. The importance of evaluating social skills intervention stems from: parents desire to choose an effective method for their child, clinicians need to implement evidence based practice, educators need to create an inclusive classroom and policy-makers interest in funding programs with positive outcomes (Wang, Cui & Parrila, 2011). If

effective, VM has the potential to inform practice guidelines for social skills intervention for children with ASD.

Objectives

The primary objective of this review is to provide a critical evaluation of existing literature regarding the effectiveness of peer mediated video-modeling as an intervention approach for improving social communication skills in children with ASD. The secondary objective is to propose EBP recommendations for future research and application in clinical practice.

Methods

Search Strategy

Computerized databases including CINAHL, Google Scholar, PubMed, and SCOPUS were searched using the following terms: (autism spectrum disorder) OR (autism) OR (ASD) AND (video-modeling) AND (social skills) OR (pragmatics). In addition, relevant studies meeting the inclusion criteria referenced within acquired articles, specifically systematic reviews and meta-analyses, were included.

Selection Criteria

Studies selected for review were required to examine the use of peer-mediated video modeling for the acquisition of a targeted social communication skill in individuals with ASD. Video instruction utilizing VSM or PVM were excluded from this review. No limits were placed on the intervention program, study design, or outcome measures.

Data Collection

Results of the literature search yielded seven articles that achieved the aforementioned selection criteria for inclusion in this review. These included the following study designs: single-subject, multiple-baseline (5), single subject AB design (1) and a case control study (1).

Results

The use of single-subject research designs is prevalent in the body of literature regarding social skills intervention for children with ASD. Single-subject designs in which the behaviour of one or more participants is measured repeatedly over time is the method of choice for studying children with ASD for several reasons. Children with ASD are a heterogeneous group and progress can be influenced by a number of factors including: age, mental ability, language ability, environmental stimulation, experience, duration and frequency of intervention. The heterogeneity and relatively low prevalence of ASD make random group assignment difficult. Further, ethical considerations limit the use of control groups due to the knowledge that

early intervention is optimal. The use of single-subject designs is also cost effective for clinicians and results in Level 1 research evidence, indicating minimal potential for results to be affected by sources of error (Wang, Cui & Parrila, 2011).

Assessment of the effectiveness of intervention techniques in single-subject research typically relies on visual inspection of outcome graphs to assess variability, trend and overlap of the data points between or within the intervention phases. This method is subjective and low inter-rater reliability has been reported between experienced raters when visually analyzing the effectiveness of studies (Wang, Cui & Parrila, 2011). Therefore, the reader must be critical when visually inspecting the data within the figures, in order to determine if the researchers have drawn rational conclusions from the single-subject data. Another indicator of quality research in single subject designs is the use of a social validity measure to determine intervention fidelity and application in clinical practice (Bellini & Akullian, 2007). Therefore, the following single-subject designs are appropriate for the study of social skills intervention for children with ASD not withstanding any methodological concerns within the individual studies.

Single-Subject Designs

Gena, Couloura and Kymissis (2005) employed a single subject multiple base-line design across participants with a return to baseline. The purpose was to examine the effectiveness of using VM, in comparison to in-vivo modeling, to learn and generalize contextually appropriate affective responses in play based activities. The participants included three children with a diagnosis of ASD ranging from 3 years, 11 months to 5 years, 7 months of age. The categories of affective behaviour addressed included: sympathy, appreciation and disapproval. An appropriate affective behaviour was defined as including congruent verbal responses, facial responses and eye-contact within a latency of five seconds. The VM was composed of a peer of the same gender and age as the target child. Verbal and tangible reinforcement was received in both intervention conditions. The intervention took place in each child's home, between two and four times per week, for approximately 15-20 minutes consisting of 14 trials.

The study design incorporated a return to baseline; this was completed following the participant reaching criterion performance of at least 90% during the first intervention phase. The return to baseline was defined as the participant reaching low and stable levels of performance prior to initiation of the second

intervention phase. Order effects were controlled for by varying the order of presentation of the intervention procedures across participants. Generalization of affective responses in play based activities was assessed with a novel therapist and the participants' mother. Generalization was not completed for additional environments. Follow-up was completed at 1-month and 3-months post intervention. Interobserver agreement was calculated for 30-50% of experimental sessions and was reported to be between 90-100%. Gena and colleagues defined and described the methodology and experimental control in detail allowing for replication and analysis.

The authors visually represented the results in a graph of the percentage of appropriate affective responses for each participant during training and probe trials for each phase of the study. Visual inspection of the percentage of appropriate responses revealed an increase from baseline during the VM and in-vivo modeling condition that was at least partly generalized and maintained at the end of the follow-up period indicating an ability to increase appropriate affective responses. However, outcomes cannot be definitively attributed to the in-vivo or video-modeling intervention as multiple treatment interference may have occurred resulting in a faster acquisition of the contextually appropriate affective responses during the second intervention phase in which either in-vivo modeling or video-modeling was used for intervention. This methodological error significantly jeopardizes the validity of the results. Further, after three incorrect trials using VM, the therapist provided a verbal and facial prompt of the correct affective response. Thus, the VM intervention phase incorporated in-vivo modeling further compromising any comparison between the intervention techniques. The small number of participants additionally challenges the reliability of the authors' conclusions. The results of this study are equivocal given the methodological limitation in the research design and inability to draw conclusions regarding the application of VM or in-vivo modeling for improving affective responses.

Lowy, Apple, Billingsley and Schwartz (2005) appropriately employed a single subject multiple baseline design in two experiments across five participants with ASD ranging from 4 years 1 month to 5 years 9 months of age. A well defined profile of the each participant was provided including near normal language ability, intellectual functioning and academic performance with markedly impaired social skills. The purpose of the first experiment was to assess the effectiveness of teaching compliment-giving initiations and responses using peer VM and explicit adult instruction embedded within the video. Experiment two included the use of a self-management device, wrist

counter or checklist, to increase independence. A prestudy questionnaire for parents and teachers and prestudy student interview was conducted to assess social skills ability in comparison to typically developing peers. The models were classroom peers identified as having a positive relationship with the participant on the pre-study questionnaire. Compliment giving behaviours and structures were clearly defined by the authors and based on the most common compliment-giving structures heard in the classroom during observation prior to the study. The VM was shown approximately three times per week. Data was collected for compliment-giving responses and initiations using a frequency count over a fifteen minute period, during free-play in the child's classroom, following viewing of the VM. Interobserver agreement was 100% and procedural reliability was above 89% for all experiments. A significant merit of this study was the use of informants including the teacher, parent and child, the selection of a desired peer, and data collection in the child's natural environment. A weakness of the methodology is the embedding of explicit adult instruction within the video as this precludes the ability to attribute an increase in behaviour to peer VM alone.

The authors reported the frequency count of compliment-giving initiations and responses per observation period in the form of a graph. Visual inspection of the data reveals that in experiment one, the participants increased compliment responses following VM from the baseline condition and required reinforcement in order to increase and maintain compliment initiations. In experiment two, the participants maintained the increase in compliment initiations and responses following VM using a self-management strategy. Participants additionally demonstrated generalization of skills to other settings, for example on the playground. In a post-study questionnaire the teacher rated the social skills of three out of four participants as increasing by one data point on a five point Likert scale. This measure of social validity was not well established as it is unknown how the teacher was qualifying his/her rating. The evidence is suggestive that peer VM with explicit adult instruction is an effective intervention for increasing and maintaining compliment responses, but not persuasive, because the results are confounded by the use of tangible reinforcement and prompting with the use of external aids. This may suggest that children with ASD require scaffolding of self-management techniques in order for skill acquisition to be internalized. This study did not extinguish the use of external aids, wrist counter or checklist, and therefore it cannot be determined if the social skill learned from the peer VM and explicit adult instruction would have been maintained over time.

Sansosti and Powell-Smith (2008) implemented a single subject multiple-baseline design across three participants with an average age of 8 years, 6 months. Inclusion criteria, performance on standardized measures and detailed participant descriptions were provided. The intervention program was composed of computer presented social stories and corresponding peer VMs to target the social communication skills of children with High-Functioning ASD within a general education curriculum. The targeted skill was identified on an individual basis and included initiation, participation or conversational maintenance. The participant's social story and accompanying VM were played on a self-advancing slideshow on the computer. The design of the social story and video models were well documented. Intervention occurred once per day in the classroom setting prior to the participant engaging in an unstructured school activity such as recess. Observations of the participants were completed twice per week and data was collected using fifteen second partial-interval recording. This method has clinical fidelity as the participants were taught and observed in their natural environment. Observers were blind to initiation of intervention and the target social skill for each participant strengthening the methodology of this study. Peer comparison data was collected in order to determine if intervention results approached the level of typically developing peers. This further increases the clinical fidelity of this study as the authors trained the social skill within an appropriate developmental range. Reliability checks were completed for between 20-25% of observations and interobserver agreement ranged between 81-100%.

Sansosti and colleagues represented their results as a graph of the percentage of intervals per observation and visually inspected changes in the mean, level and non-overlapping data points. Intervention resulted in increased social communication skills in comparison to baseline performance, however modification of the intervention was required for two participants to include social reinforcement. For example, one participant's mean rate of initiation was 4.85% at baseline, 21% during intervention alone, and 61.67% when prompting was initiated. Thus, with intervention and prompting the data approached typically developing peers' mean of 83.17%. Maintenance of the social communication skills was accomplished over a short period of two weeks following intervention for two participants and one participant demonstrated generalization to other settings. Further, participants' rate of social communication skills began to approach the level of typically developing peers. Results of the *Intervention Rating Profile (IRP-15)* given to teachers to evaluate the acceptability of an intervention, indicated that the

intervention was within the acceptable range and implementation within the classroom would be feasible. This measure is a strength of this study and of critical clinical importance as introducing a social skills intervention into the general education classroom would require the support of the teacher.

The results of this study are suggestive as a combined treatment program of VM, social stories and prompting result in a significant increase in the targeted social skills. However, methodological limitations prohibit the ability to determine which intervention lead to the effect due to the combined treatment package. Further, social reinforcement in the form of teacher prompting was required in order for two participants to increase and maintain the targeted social skill. Caution must be taken in interpreting generalization and maintenance outcomes as follow-up was completed only 2 weeks following fading of intervention and generalization was only demonstrated for one participant.

Nikopoulos and Keenan (2004) administered a single-subject multiple baseline design across three children with ASD ranging in age from 7-9 years. There was a significant dearth of participant information provided. The study examined the effects of VM intervention for social initiation and reciprocal play by recording latency of initiation and duration of play in a controlled setting. Maintenance measures were completed at one and three months follow-up. Clear definitions of social initiation and reciprocal play were provided. The video model was composed of a same aged typically developing peer engaged in a simple play based activity with the experimenter. The procedure in which the presentation of VMs was described contained sufficient detail to feasibly replicate the study. Interobserver agreement was collected for over 55% of observations and averaged 98%.

Results of the study were reported in a graphic format and visual analysis revealed that in the baseline condition there were no instances of social initiation or reciprocal play. Following intervention, mean time in reciprocal play increased and latency to social initiation decreased significantly. This outcome was maintained and in some instances improved at one and three months follow-up. The results of this study are suggestive, but not persuasive, as the method of reporting data was difficult to interpret and the authors do not provide a sufficient description or analysis of the results. Further, the clinical fidelity is debatable as the social skills were not generalized outside of the controlled environment and a social validity measure was not conducted.

Nikopoulos and Keenan (2007) conducted a study comprised of two experiments to evaluate the

effectiveness, maintenance and generalization of a sequence of social behaviours following VM intervention. The first experiment was a multiple baseline across three subjects ranging in age from 6.5-7 years. The second experiment was a single subject AB design implemented with a 7.5 year old participant. The research designs were appropriate and implemented effectively. All participants received a diagnosis of ASD and a detailed description was provided. The video model was a peer with learning difficulties and average social skills demonstrating engagement in an increasing number of play activities. The use of a peer that was not typically developing was a unique characteristic of this study. Data was collected for five behaviours including: social initiation, reciprocal play, imitative response, object engagement and “other” behaviours, described as any behaviour not included in the previous categories. Viewing of the VM and data collection occurred in one semi-naturalistic room of the school. The setting, stimulus materials and procedure were described with precision allowing for study replication. Two to three sessions were conducted per day with a maximum of approximately 30 minutes. During the assessment the participant viewed a 20-37 second VM followed by a five minute assessment period. No consequences were provided to the child during the assessment procedure. This is a methodological strength of the study as increased performance cannot be attributed to reinforcement. The procedure for experiment two differed from experiment one in that the participant viewed a VM completing a sequence of three social behaviours following baseline instead of establishing one set of behaviours. The generalization task included a peer in the interaction and the follow-up was obtained one and two months post intervention. A social validation measure was performed in which ten mothers were required to identify the social behaviours and the scenes in which the participants behaved in a similar way to their typically developing children. Interobserver agreement was assessed for 30-39% of all observations and average reliability was between 95-96%.

The authors reported results in graphs of the latency to social initiation, total time engaged in reciprocal play, and the percentage of 10 second intervals the participant was engaged in reciprocal play, object engagement or other behaviours. Visual inspection of the results indicated that VM resulted in development of a sequence of social behaviours for each participant. However, building a sequence of social behaviours required scaffolding as in the second experiment the participant was unable to demonstrate a sequence of three social behaviours prior to learning one or two behaviours. Additional findings include a decrease in the latency for social initiation, increase in reciprocal play and a decrease in competing behaviours.

Generalization of social sequences occurred across peers and was maintained at the one and two month follow-up. The outcome of the social validation measure was not reported adequately as data was not included; instead a qualitative interpretation of the mothers’ reports was provided. The results of this study are compelling as the outcome of the single-subject multiple baseline design was replicated in the follow-up single-subject AB design. Further, results were maintained at one and two month follow-up and generalized to an interaction with a peer. A limitation was that the generalization condition was not completed in a more naturalistic setting, classroom or home, and the environment depicted in the VM was identical to the assessment location. Therefore it is unknown if the intervention had a functional change in the child’s social skills in his/her natural environment. Further, a social validation measure using a parent or teacher as an informant may have yielded information about generalization outside of the intervention condition.

Case Control Study

Kroeger, Schultz and Newson (2007) employed a case-control study utilizing matched random assignment to allocate twenty-five children with ASD to a “direct teaching group” utilizing peer VM or a “play activities group” based on level of functioning. The study design qualifies as a level 2 because group assignment was not completely randomized due to family availability. Participants ranging from 4 to 6 years of age participated in the five week program, three times a week for one hour. A T-test was conducted and revealed that the groups were not statistically different based on age and Autism Quotient standard score from the *Gilliam Autism Rating Scale (GARS)*. Two valid assessment measures were conducted; the *Social Interaction Observation Code* to measure initiating, responding and maintaining social interactions and the *Assessment of Basic Language and Learning Skills (ABLLS) Group Instruction* section focusing on “learning readiness” skill acquisition. Data was collected pre and post intervention for each child during the first and last session of each group. Internal consistency was assessed using the Cronbach’s Alpha for continuous data and revealed that group facilitators’ ratings on the *ABLLS* were internally consistent. Group facilitators and parents were blind to the study hypothesis and proceedings of the other group. A high degree of reliability was obtained as reliability checks were completed for all sessions; overall interrater reliability was reported as 98.4%.

Kroeger and colleagues analyzed the results of the *Social Interaction Observation Code* using a multivariate analysis of variance for repeated measures

using the General Linear Model statistic. The results revealed that both groups demonstrated a statistically significant increase in initiating, responding and interacting behaviours. Moreover, the direct teaching group demonstrated significantly greater gains from baseline in comparison to the play activities group. Visual analysis of graphic representations of the raw mean data validates the findings of this statistical manipulation. Further, the effect size for initiating, responding and interacting were all greater than 0.14, signifying a large effect size. The application of effect size strengthens the validity of the results. The *ABLLS* revealed that both groups increased learning readiness and group orientating behaviours. Parent satisfaction rating scales were used to assess social validity. The results indicated no significant difference in parent satisfaction based on group assignment in the program; satisfaction ranged from satisfied to high-satisfied with the programs. The lack of difference in satisfaction may indicate that the parents perceived a change in their child's social skills regardless of intervention group. The application of a social validity measure provides important information for clinical practice as it indicates that the intervention is likely to be accepted by parents.

Limitations of this study include the collection of data pre and post intervention as information regarding change throughout the course of the intervention program is not available. The pre and post intervention data reflect only one point in time and are not a strong indicator as other factors including adjustment and familiarity to the surroundings are of the utmost importance for many children with ASD. Further, maintenance and generalization data were not reported, therefore limiting the ability to determine if the significant intervention effects would be maintained over time or transferred outside of the clinical setting. Random group assignment would have significantly improved the strength of this study design as it would have qualified as a level 1, randomized control trial. Strengths of the study include the use of standardized assessment procedures, appropriate and convincing statistical manipulations including effect size, and a control group with matched level of functioning. The use of a control group is uncommon in research of social skills in children with ASD as ethical liabilities of withholding a beneficial intervention are of concern. Thus, the results are highly suggestive that video modeling in a direct instruction format increases outcomes for initiating, responding and interacting behaviours.

Discussion

There are inherent limitations in studying the social skills of children with ASD as the heterogeneity of the population and ethical concerns regarding withholding

early intervention preclude the use of randomized control studies. However, the implementation of single-subject designs in the majority (6/7) studies demonstrates Level 1 research evidence. The case control study employed by Kroeger, Schultz and Newson (2007) qualifies as level 2 research evidence. Although group assignment was not randomized there was no statistical difference between the groups strengthening the quality of the research design.

In spite of methodological limitations, the emerging body of evidence has provided suggestive to highly-suggestive evidence that peer mediated VM is an effective intervention approach for social skills in children with ASD. Social skills represent a milieu of complex behaviours and the studies reviewed are not comparable on the basis of the targeted social skill. The social skills targeted include affective responses, compliment-giving, initiating, responding, participation, conversational maintenance, and reciprocal play. All of the studies reviewed conclude that peer mediated VM with or without the addition of reinforcement, prompting or additional intervention techniques was an effective intervention. The implementation of a social validity measure increases the justification for application of peer-mediated VM in clinical practice.

The use of additional treatment techniques in all studies with the exception of Nikopoulos and Keenan (2004) and (2007) indicates that caution must be taken in interpreting the results as a combined treatment approach prohibits the ability to determine if VM alone is an effective intervention technique for social skills. Despite this conclusion the accumulating evidence base has the ability to inform clinical practice as VM may be an effective intervention procedure when accompanied by prompting, reinforcement, social stories, explicit adult instruction or group social skills intervention. The use of the aforementioned techniques may be beneficial in developing a treatment program for individuals with ASD for social skills intervention. The use of prompting and reinforcement was reported in all studies, with the exception of Nikopoulos and Keenan (2004) and (2007), indicating that children with ASD may require external reinforcement and scaffolding in order to internalize social skills learned in treatment. Therefore, natural social feedback may not be intrinsically reinforcing.

Maintenance and generalization of social skills has been an identified issue in social skills intervention for children with ASD. Therefore this issue must be taken into consideration when determining the effectiveness of an intervention approach. Data regarding generalization was limited as four of the seven studies reported generalization data to other settings or novel communication partners. Further, generalization often

may not have been representative of typical peer interactions since generalization was measured in Gena and colleagues (2005) to an adult and in Nikopoulos and Keenan (2007) to a peer remaining in the same environment as intervention. Maintenance effects were reported in six of the seven studies. However, the reliability of these results is debatable as Lowy and colleagues (2005) accomplished maintenance with the use of a self-management strategy and Sansosti and colleagues (2008) measured maintenance inadequately over a two week period following intervention. The potential for maintenance using VM has been demonstrated as Nikopoulos and Keenan (2007) achieved maintenance at one and three months post intervention.

In order to provide more compelling evidence to affect change in clinical practice, future research should consider the following recommendations:

- a.) Greater experimental control to examine the effects of peer-mediated VM alone, without the implementation of additional treatment techniques, prompting, or reinforcement
- b.) Completion of intervention and assessment in the participant's natural environment to increase social fidelity
- c.) Completion of a social validity measure to determine intervention fidelity
- d.) Completion of generalization and maintenance procedures
- e.) Identification of a clearly defined intervention procedure that may be replicated including participants, peer model, setting, duration and frequency of intervention
- f.) Implementation with subsequent fading of a self-management technique, such as a wrist counter, to reduce the need for external reinforcement and prompting

Conclusion and Clinical Implications

VM provides an effective option for clinicians and educators wishing to design social skills interventions for individuals with ASD. The application of VM is a cost and time efficient solution as recording devices are readily available to the general public. The use of a personal data assistant (PDA) would allow the recording and saving of video for the child to review independently. This would allow access to the VM as needed, similar to the use of a social story or visual schedule. Technological advances will allow children with ASD access to social skills interventions such as VM within their natural environment.

As social skills are a core deficit of ASD there is an overwhelming need to identify quality, evidence based practices that are clinically plausible for application

within the general classroom environment. VM shows exceptional potential as an effective intervention strategy for addressing the social-communication deficits of children with ASD. Caution should be taken in interpreting the current research due to methodological limitations, however replication of the findings in future research has the potential to yield evidence that peer-mediated VM is an effective and efficient social skills intervention for children with ASD.

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