8-2008

An Evaluation of Preference for Modeling Interventions

Kaneen B. Geiger

AN EVALUATION OF PREFERENCE FOR MODELING INTERVENTIONS

by

Kaneen B. Geiger

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
August 2008

AN EVALUATION OF PREFERENCE FOR MODELING INTERVENTIONS

Kaneen B. Geiger, M.A.

Western Michigan University, 2008

Video modeling is an instructional technique demonstrated to effectively increase social skills, academic skills, daily living skills and play skills of children with autism. There are several hypotheses for why video modeling is effective. One hypothesis is that children with autism prefer watching videos to looking at people, thereby enhancing motivation and making attending to the video model automatically reinforcing, however, preference for video has not been experimentally examined. This study assessed participants' preference for either video modeling or in vivo modeling using a concurrent-chains arrangement. None of the three participants showed a preference for either video modeling or in vivo modeling. Also, participants showed similar performance and attention to the model for both of the modeling conditions. The results suggest that not all children with autism prefer video modeling, in contrast to the widely held hypothesis.

TABLE OF CONTENTS

Table of Contents—continued

LIST OF FIGURES

INTRODUCTION

Autism

Autism is a developmental disorder first identified by Leo Kanner (1943) based on his careful observations of 11 patients. Kanner described the patients as being socially aloof, generally having adequate language but not using it to communicate, and having an insistence on sameness or resistance to change. The definition of autism has been refined over time to allow for more precise diagnosis (Volkmar, Chawarska, & Klin, 2005). Currently, autism is classified in the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text revision) under the class of Pervasive Developmental Disorders (American Psychiatric Association, 2000). The core deficits include qualitative impairments in communication and social interaction and excesses in restricted, repetitive and stereotyped patterns of behavior. Common communication problems include language delays, problems initiating or sustaining a conversation, and use of stereotyped, repetitive or idiosyncratic language. Social interaction problems include poor peer relationships, poor use of nonverbal behaviors (e.g., eye contact, facial expressions) to regulate interactions, and a lack of social or emotional reciprocity. Finally, ritualistic and repetitive behavior includes intense interests, strict adherence to nonfunctional routines, and stereotyped and repetitive movements (e.g., hand flapping).

Autism has become an increasingly diagnosed condition over the past two decades. Previous reports estimated approximately 3.4 in 1000 live births resulted in autism (Yeargin-Allsopp et al., 2003) while the current estimate has doubled to approximately 6.7 in 1000, or 1 in 150 children diagnosed with an autism spectrum disorder (Centers for Disease Control and Prevention, 2007). Males are four times more likely to be affected by autism than females (Yeargin-Allsopp et al.), though females are more likely to have comorbid mental retardation (Centers for Disease Control and Prevention).

Treatment for Autism

Of the many treatments for autism, applied behavior analysis (ABA) offers the only empirically supported intervention to produce significant improvements in core deficits and overall intellectual and adaptive functioning (Green, 1996). Early intensive behavioral intervention (EIBI) generally consists of up to 40 hours per week of intensive one-to-one training with the child using common ABA instruction techniques, such as prompting, reinforcement, shaping, and modeling to teach new skills (Green). A number of recent studies have shown EIBI to increase the intellectual and adaptive repertoires of children with autism (Cohen, Amerine-Dickens, & Smith, 2006; Eldevik, Eikeseth, Jahr, & Smith, 2006; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Sallows & Graupner, 2005; Smith, Eikeseth, Klevstrand, & Lovaas, 1997).

In their replication of Lovaas et al. (1987), Cohen et al. (2006) found that after three years, the EIBI group had significantly higher IQ and adaptive behavior scores than the comparison group with a typical special education curriculum. Additionally, of the 21 participants in the EIBI group, 6 advanced to regular education without support and 11 advanced with support, compared to only 1 of 21 who advanced in the comparison group (Cohen et al.). Howard et al. (2005) found similar results when they compared EIBI with "eclectic" special education interventions and non-intensive special education curriculums. They found the EIBI group had higher mean standard scores than both groups in cognitive and adaptive functioning (Howard et al.).

Recently, researchers have examined variations of the traditional Lovaas (1987) model and showed similar effectiveness (e.g., Eldevick et al., 2006; Sallows & Graupner, 2005). Sallows and Graupner compared the traditional EIBI intervention to a parent-directed group with equal hours of instruction, but less supervision. After four years of treatment, they found the groups to have similar improvements in intellectual and adaptive skills (Sallows & Graupner). Additionally, out of both groups, 48% of the children had advanced to regular education classrooms, which was consistent with Lovaas' original findings. Alternatively, Eldevick et al. compared lower intensity EIBI (12 hours per week) with eclectic interventions. After two years of treatment, they found the EIBI group made larger improvements than the eclectic group (Eldevick et al.). However, the results were not as robust as previous research with more hours per week of the EIBI intervention, suggesting that length of instruction is a critical variable to effectiveness. While this research is a step in the right direction, there needs to be further examination of the critical variables that make EIBI effective, as well as instructional techniques that enhance the efficiency of instruction.

Video Modeling with Children with Autism

Teaching with Technology

One potential means to enhance instruction with children with autism is incorporation of technology in teaching practice (Goldsmith & LeBlanc, 2004). Video is a particularly popular technology enhancement due to ease of use, accessibility, and low cost (Goldsmith & LeBlanc). Video has typically been incorporated into instruction with individuals with autism as a means of providing an appropriate model for the child to imitate. Video modeling involves the learner observing a video of a model correctly performing the target behavior and then performing the target behavior himself (Delano, 2007). Video modeling has been successfully employed to teach a variety of skills to children with autism including social initiations (Nikopoulos & Keenan, 2004), perspective taking (Charlop-Christy & Daneshvar, 2003; LeBlanc et al., 2003), giving compliments (Apple, Billingsley, & Schwartz, 2005), daily living skills (Lasater & Brady, 1995; Rehfeldt, Dahman, Young, Cherry, & Davis, 2003), academic skills (Kinney, Vedora, & Stromer, 2003), and conversational speech (Buggy, Toombs, Gardener, & Cervetti, 1999; Charlop & Milstein, 1989). Video modeling has become such a popular instructional technique for children with special needs that *Journal of Positive Behavior Interventions* devoted a special issue to the topic (Sturmey, 2003).

Video Modeling Procedures

The specific procedures for video modeling vary somewhat across experiments but are typified by three studies described here. Nikopoulous and Keenan (2004) used video modeling to teach children with autism to initiate social interactions. The participants watched a video model and were placed in a room with similar toys and given 25 s to initiate a social interaction which one child did. Two children did not provide a response within 25 s of being placed in a condition similar to baseline and were shown a video of a less complex interchange which resulted in an increase in social initiations. LeBlanc et al. (2003) used video modeling to teach perspective-taking skills by showing a video of an adult correctly completing a perspective-taking task with the video focused on a relevant “clue” in the visual field. If children answered subsequent perspective taking questions correctly, they received a variety of reinforcers while incorrect responses resulted in a repeat of the video. All children were able to correctly respond to the presented perspective taking tasks following video modeling. Finally, Charlop and Milstein (1989) used video modeling to teach children with autism to engage in appropriate scripted conversational speech. The entire scripted conversation was modeled on a videotape three times followed by the therapist's instruction to, "Let's do the same" and provision of the first line of the scripted conversation. Generalization probes of untrained conversations were tested to determine whether conversational skills generalized across conversational topics. One participant was able to meet the criterion for both the modeled conversation and the generalization topic after viewing one videotaped conversation. A second participant met the criterion for generalization after viewing two video models of conversations and a third participant met these goals after viewing three different conversation video models.

Benefits of Video Modeling

There are many suggested benefits to using video modeling with children with autism. First, video modeling removes the social component of instruction, which is often aversive for children with autism, allowing the child to focus solely on the target skill (Bellini & Akullian, 2007). Additionally, it has been hypothesized that many children with autism respond best to visual stimuli, so instruction that depends heavily on visual observation, such as video modeling, may be suited to their particular needs (Sherer et al., 2001). Videos also allow consistency of presentation of the behavior across trials and can allow the therapist to isolate and enhance aspects of the behavior that are particularly salient to acquisition (LeBlanc et al., 2003). Video models can also be observed in the absence of a trained therapist, increasing the amount of exposure a client is likely to have to the modeled behavior.

Effectiveness of Video Modeling

One study suggests that video modeling may also be a particularly efficient instructional method. Charlop-Christy, Le, and Freeman (2000) conducted a comprehensive study comparing the effectiveness and efficiency of video modeling with in vivo modeling. Participants with varying levels of functioning were taught different types of skills, including expressive labeling of emotions, play skills, greetings, conversations, oral comprehension and self-help skills. Overall, video modeling required fewer training sessions to skill mastery and skills taught via video modeling generalized across people, settings, and stimuli. For the one of the participants, video and in vivo modeling were equally effective, each requiring only two presentations of the model for skill mastery, but only video modeling produced generalization. Charlop-Christy et al. also recorded the time and cost efficiency of in vivo modeling versus video modeling. For four of five participants, video modeling required less time and less money to implement than in vivo modeling. For the fifth participant, equal amounts of time were required for video and in vivo modeling and video modeling cost five dollars more than in vivo modeling.

Charlop-Christy et al. (2000) presented a number of hypotheses for why video modeling proved so effective. One hypothesis is that because video modeling can focus solely on the salient features of the model, it compensates for instructional problems associated with stimulus overselectivity. If children with autism have difficulties responding to multiple cues in the environment, or respond to irrelevant cues, video modeling may correct this problem by zooming in on only the salient features of the target behavior thereby reducing the possible cues to respond to. Another listed hypothesis is that video modeling removes distractions associated with social interaction requirements allowing the student to focus on the target behavior.

Because individuals with autism have social deficits, they may find instructional scenarios with live instructors distracting because of the added pressures of attempting to behave in a socially appropriate manner (e.g., appropriate eye contact, distance from instructor). Additionally, the potential for a history of reinforcement with ineffective in vivo instruction may disadvantage in vivo modeling compared to limited experience with video models.

The final hypothesis Charlop-Christy et al. (2000) proposed was that video modeling improves motivation because watching videos may be automatically reinforcing for children with autism. Watching videos has a history of being associated with recreation, which may improve the motivation to attend to the video (Dowrick, 1986). Indeed, when describing participant characteristics, several studies include the participants' preference for watching television or average duration of television watching (e.g., Charlop-Christy et al.; Hine & Wolery, 2006; Lasater & Brady, 1995; Shipley-Benamou, Lutzker, & Taubman, 2002) further supporting this hypothesis. Although each of the hypotheses Charlop-Christy et al. presented are plausible, to date, no attempt has been made to experimentally demonstrate whether any of them are critical to the effects of video modeling. Preference for video is frequently reported in video modeling studies, suggesting that it may be the more widely accepted hypothesis. However, no studies have clearly demonstrated that children with autism prefer video modeling to in vivo modeling, which could be experimentally investigated using a procedure such as a concurrent chain preparation

Concurrent-Chains Preference Assessments

When working with individuals with limited verbal repertoires, it is often difficult to determine their preferences for protracted events (Hanley, Iwata, & Lindberg, 1999). However, concurrent-chains preference assessments have shed light on intervention preferences for individuals who are unable to express their preferences due to severe language or cognitive impairment (Hanley, Iwata, & Lindberg, 1999; Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997; Hanley, Piazza, Fisher, & Maglieri, 2005; Heal & Hanley, 2007). In the concurrent-chains preference assessment, an initial link behavior (e.g., switch press, card selection) results in access to the terminal link activity or intervention for a brief period of time. Participants are repeatedly exposed to the chain of selection followed by access to intervention. After the participants have been exposed to these chains, preference for a particular intervention is determined by differential selection in the initial link.

Hanley et al. (1997) used a concurrent-chains arrangement to determine participants' preferences for functional communication training (FCT), noncontingent reinforcement (NCR), or extinction as a treatment for problem behavior. In this study, participants were trained to press one of three different colored micro-switches followed by a two-min session of the corresponding intervention (i.e., FCT, NCR, extinction). Both participants indicated a preference for FCT based on differentially higher frequency of switch presses even though NCR and FCT were equally effective at reducing problem behavior.

Hanley et al. (1999) utilized the concurrent-chains arrangement as an assessment of preference for leisure activities for adults with developmental disabilities. The initial link response was selection of a picture card representing an activity (e.g., picture of the participant riding a bike), which was followed by brief access to the activity (e.g., riding a bike). After the selections were followed by access to the activity, clear preferences emerged. Additionally, three participants' preferences were modified to less preferred but more socially accepted activities by introducing highly preferred edibles for appropriated responding in the less preferred activities.

This was indicated in the initial link by representing the preferred edibles in the picture card (e.g., inserting a candy wrapper in the picture card).

Hanley et al. (2005) again used a concurrent-chains arrangement to determine participants' preferences for FCT with punishment, FCT without punishment, and punishment alone. The procedure was identical to Hanley et al. (1997), including training with three different colored micro-switches followed by two minutes of access to the corresponding treatment. Both participants differentially responded in favor of FCT with punishment, indicating a preference for the combination of FCT and punishment over FCT alone and punishment alone. For both participants, FCT and punishment produced differentially better treatment effects than FCT alone in a prior evaluation leaving open the possibility that differential effectiveness contributed to differential preference.

Heal and Hanley (2007) used a concurrent-chains arrangement to determine preschoolers' preferences for different motivational systems during instruction. Their preparation included card selection rather than micro-switch pressing as the initial link, but was otherwise similar to Hanley et al. (1997). The four motivational systems compared were embedded (highly preferred teaching materials), sequential (highly preferred edible reinforcers), control (neither highly preferred teaching materials nor reinforcers), and play (unstructured, "child-led" activity). All of the participants preferred the sequential system over the embedded system, but the play condition was the most highly preferred.

Rationale for the Present Study

Researchers have demonstrated video modeling to be an effective technique to teach a wide variety of skills to children with autism. Researchers have touted numerous benefits to video modeling and several hypotheses for why it is effective.

One hypothesis, preference for video, is particularly widely accepted; however, no studies have attempted to demonstrate that children with autism prefer video modeling to in vivo modeling. The present study used a concurrent-chains arrangement to determine if children with autism had a preference for either video modeling or in vivo modeling. Additionally, several video modeling studies report participants' preference for watching videos, however, the relationship between preference for videos and preference for video modeling has yet to be experimentally demonstrated. This study also measured initial preference for videos in relation to other leisure items to assess whether that preference is a predictor of video modeling preference. Finally, this study also investigated whether there is improved attention to the model or differential effectiveness associated with video modeling or in vivo modeling.

METHOD

Participants and Setting

Participants

Three children with a diagnosis of autism, provided by a school district or psychologist, were included in this study. Diagnoses were confirmed and language skills were assessed with the Gilliam Autism Rating Scale-Second Edition (GARS-2; Gilliam, 2005), Autism Diagnostic Observation Schedule-Generic (ADOS-G; Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, et al., 2000), and Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, & Hale, 2007).

Participant 1

Sam was a seven-year-old boy diagnosed with Down Syndrome with autistic features. He spoke mostly in one to two word phrases and was able to complete all of the level one (0-18 months) tasks and some of the level two (18-30 months) tasks on the VB-MAPP indicating that he had the required imitative, echoic and direction following skills to participate in the study. His combined social and communication score on the ADOS-G was 10, meeting the spectrum cut-off score of 8 and his mother's report on the GARS-2 (76) indicated a possibility of autism.

Participant 2

Dave was an eight-year-old boy with a diagnosis of autism. He spoke mostly in two to three word phrases and was able to complete all of the level one tasks and some of the level two tasks on the VB-MAPP. His combined social and communication score on the ADOS-G was 22, meeting the spectrum cut-off score of 8 and his mother's report on the GARS-2 (79) indicated a possibility of autism.

Participant 3

Joe was a nine-year-old boy with a diagnosis of autism. He spoke in full sentences that were grammatically correct and was able to complete all of the level one and level two tasks on the VB-MAPP. His combined social and communication score on the ADOS-G was 11, meeting the spectrum cut-off score of 7 and his parents' report on the GARS-2 (104) indicated a very likely probability of autism.

Setting

All sessions took place in suite 1504 of Wood Hall. The initial link in the concurrent chain occurred in the suite hallway outside of two identical treatment rooms where instruction occurred. While in the suite hallway, the doors to the treatment rooms were closed and each door had a colored poster (i.e., blue or red) with a picture on it representing the type of modeling condition (i.e., a TV for the video modeling condition or a person modeling a task for the in vivo modeling condition). Each room included either red or blue poster boards hanging on each wall of the room as a discrimination aid for the condition (i.e., video modeling, in vivo modeling), a table and chair for the child, and either a person to perform the in vivo model or a television with a DVD player to present the video model. The child was provided with the necessary materials to complete the modeled task (e.g., markers and paper for a drawing task).

Experimental Design

A learning history with two interventions was created and evaluated using an alternating treatments design (Cooper, Heron, & Heward, 2007) to target two yoked skills. The skills were yoked based on type and difficulty level according to a survey of 29 autism professionals. The autism professionals' experience in behaviorally oriented autism education programs ranged from 2 to 25 years. In order for a skill pair to be included in the study, at least 75% of the professionals had to agree that the two skills were of equal difficulty. Parents were provided with the list of skill pairs and were asked to nominate the pairs that their child could not perform independently and that were high priorities for them to target. The child was assessed to ensure that he could not independently perform each target skill before baseline data collection commenced. A concurrent schedules design (Herrnstein, 1964) was used to evaluate the child's preference for either video or in vivo modeling for learning a third skill using a concurrent chain schedule arrangement.

Procedure

Parents completed the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD; Fisher, Piazza, Bowman, & Amari, 1996) and the results were used to select items to include in a multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) preference assessment. The MSWO was administered to determine the child's preference for watching videos in relation to other leisure activities. Six to eight toys or leisure items, including 3 to 4 videos, were placed in an array in front of the participant who was instructed to pick one. Once the participant selected one of the toys or leisure items, he was allowed to interact with the object, while the remaining items were rearranged in another array. After selection, the item was not returned to the array, but the participant was able to select from the remaining items. This process was repeated until all items were selected or the participant refuses to select an item. The MSWO procedure was conducted a total of two times. Preference was determined by the number of selections divided by the number of presentations across the two arrays, multiplied by 100%.

Baseline

During baseline, the child was seated at the table and given the context and materials needed to complete the targeted skill. For example, for drawing, the child would be given a piece of paper and some markers. The child was then given specific instructions to complete the task. For example, the researcher would say, "Draw a house."

Exposure Trials

During the exposure trials, the child was taught two separate but comparable skills, one for video modeling and one for in vivo modeling. For example, if the target was drawing, the researcher would teach "drawing a sun" with video modeling and "drawing a smile" with in vivo modeling.

In Vivo Modeling Trial

The in vivo modeling trial started in the suite hallway where the researcher presented one red card by holding it directly in front of the child. The researcher then instructed the child to select it. After the child selected the card, either by pointing to it, grabbing it or saying the name of the color, the child was escorted into one of the identical treatment rooms, with red poster boards hanging on the walls, and instructed to sit in a chair. The researcher instructed the child to “watch this,” and modeled the task. When the model was complete, the researcher provided the child with the relevant materials and instructed the child to perform the task using the same instructions that were used in baseline (e.g., “Draw a smile.”). After the child had an opportunity to perform the task, the process was repeated a second time, starting with the researcher instructing the child to watch the model. After the two trials were complete, the child was escorted out of the room, into the suite hallway where he was presented with another card.

Video Modeling Trial

The video modeling trial started in the suite hallway where the researcher presented one blue card by holding it directly in front of the child. The researcher then instructed the child to select it. After the child selected the card, the child was escorted into one of the identical treatment rooms, with blue poster boards hanging on the walls, and instructed to sit in a chair. The researcher then instructed the child to “watch this,” and played a video of a person performing the task. Once the video was complete, the researcher provided the child with the relevant materials and instructed the child to perform the task using the same instructions that were used in baseline (e.g., “Draw a sun.”). After the child had an opportunity to perform the task, the process was repeated a second time, starting with the researcher instructing the child to watch the video. After the two trials were complete, the child was escorted out of the room, into the suite hallway where he was presented with another card.

Termination Criteria

The termination criteria for the exposure condition were one target skill reaching mastery criterion (four consecutive trials of 100% accuracy on the skill) and the other target skill reaching four consecutive trials of at least 75% accuracy. This allowed for equal amounts of exposure to the video modeling and in vivo modeling conditions without artificially altering preference by disadvantaging one of the conditions due to repeated exposure after mastery.

Evaluation of Preference for Treatment

During the concurrent-chains preference evaluation, the participant was taught a new skill. Prior to entering the room, the researcher held the red and the blue card in front of the participant and instructed him to select one. The researcher held both cards at the same height, equally distant from the child. After the participant selected the card, he was instructed to enter the corresponding room, sit down in the chair, and watch the model. If the participant selected the red card, he entered the room to the left and an in vivo model was presented for two trials. If the participant selected the blue card, he entered the room to the right and a video model was presented for two trials. In each trial, the in vivo or video model was presented and the participant was provided with the relevant materials and instructed to perform the skill. After the end of the two-trial block, the participant was instructed to exit the room where he was given the opportunity to select between the red and blue card again. The concurrent-chains preference evaluation condition terminated when the participant reached mastery criterion for the target skill (four consecutive trials of 100% accuracy).

If the participant did not differentially select one modeling condition more than the other, a third (yellow) card was introduced. The yellow card represented a control condition (play) in order to distinguish between indiscriminant and indifferent selection. Once the control card was introduced, a 33% selection percentage for each of the three cards would indicate indiscriminant responding. Alternatively, if the selection percentage for the yellow card deviated from 33%, either above or below, it would indicate that the participant was selecting meaningfully and was indifferent towards the modeling conditions. If participants mastered the target skill before the control card could be introduced, a second skill was targeted so that the control card could be included.

Measurement

The primary dependent measure was cumulative card selection. Card selection was defined as the child's hand touching the card or naming the color on the card. During the exposure tasks and the preference evaluation task, measurements were taken on 1) the percentage of target skill components completed and 2) the duration of attention to the model. See Appendix A for a sample card selection and skill completion data sheet. Attention to the model was defined as direct eye gaze to the video or live model. Card selection and target skill completion measures were scored during the session. Attention to the model was scored via video from a camera positioned near the video or live model.

A second trained observer collected interobserver agreement (IOA) data for 100% of trials across all phases of the study. For card selection, agreement was scored when two independent observers recorded the same card selection for the trial. For skill completion, agreement was scored when both observers recorded that a specific step of a targeted skill either occurred or did not occur. Percentage of agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Finally, for attention to the model, agreement was calculated using total agreement, meaning the smaller duration of attending was divided by the longer duration of attending and multiplied by 100%.

For card selection, observers scored with 100% agreement for all three participants. For skill completion, Sam's average agreement score was 99% (range, 60%-100%), Dave's average agreement score was 98% (range, 60%-100%), and Joe's agreement score was 100%. Finally, for attention to the model, Sam's average agreement score was 98% (range, 83%-100%), Dave's average agreement score was 94% (range, 0%-100%), and Joe's average agreement score was 99% (range, 89%-100%).

Procedural integrity was also measured for 71% of trials across all phases of the study. See Appendix B for the procedural integrity data sheet. Treatment integrity was calculated as the percentage of steps correctly completed by the researcher. An average percentage of correctly completed steps were reported for each condition. Primary treatment integrity data were collected during the session, and secondary treatment integrity data were collected via videotape for 74% of the trials coded for procedural integrity. Overall agreement was used to calculate IOA; meaning that an agreement was scored when two independent observers recorded that a specific step of a trial was implemented either correctly or incorrectly. Agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. The therapist implemented the procedures with 100% procedural integrity with both Sam and Dave while procedural integrity averaged 94% (range, 75%-100%) with Joe. The two scorers agreed for 100% of scores for procedural integrity data.

RESULTS

Preference

All participants had a moderate preference for watching recreational videos in relation to other toys or leisure items. Figure 1 depicts the results of the MSWO preference assessment for toys, leisure items and videos. Sam's selections are depicted in the top panel with one video in the top half of his array, whereas the other two videos were his least preferred items in the array. Thus, he preferred watching one video more than playing with some toys, but he did not prefer watching all videos over playing with preferred toys. Joe's selections are shown in the middle panel. Joe's top two preferred items were videos, but the other two videos were low preference in relation to toys indicating that Joe preferred watching some (but not all) videos over playing with toys. Dave's selections are shown in the bottom panel. Like Joe, Dave's top two preferred items were videos. Additionally, Dave's other two videos were preferred over all other toys but the bubbles illustrating Dave's preference for watching videos over playing with all toys except bubbles.

Figure 2 depicts the participants' cumulative selections of modeling conditions in the concurrent-chains preference evaluation phase. Sam (top panel) showed no differentiation in his selections between video and in vivo modeling for both preference skills, selecting video modeling a total of 15 times and in vivo modeling a total of 14 times. Once the control card was introduced, he selected it every time it was available indicating that he discriminated between the conditions and had no preference for either modeling condition. Joe (middle panel) showed no differentiation in his selections between video and in vivo modeling, selecting video

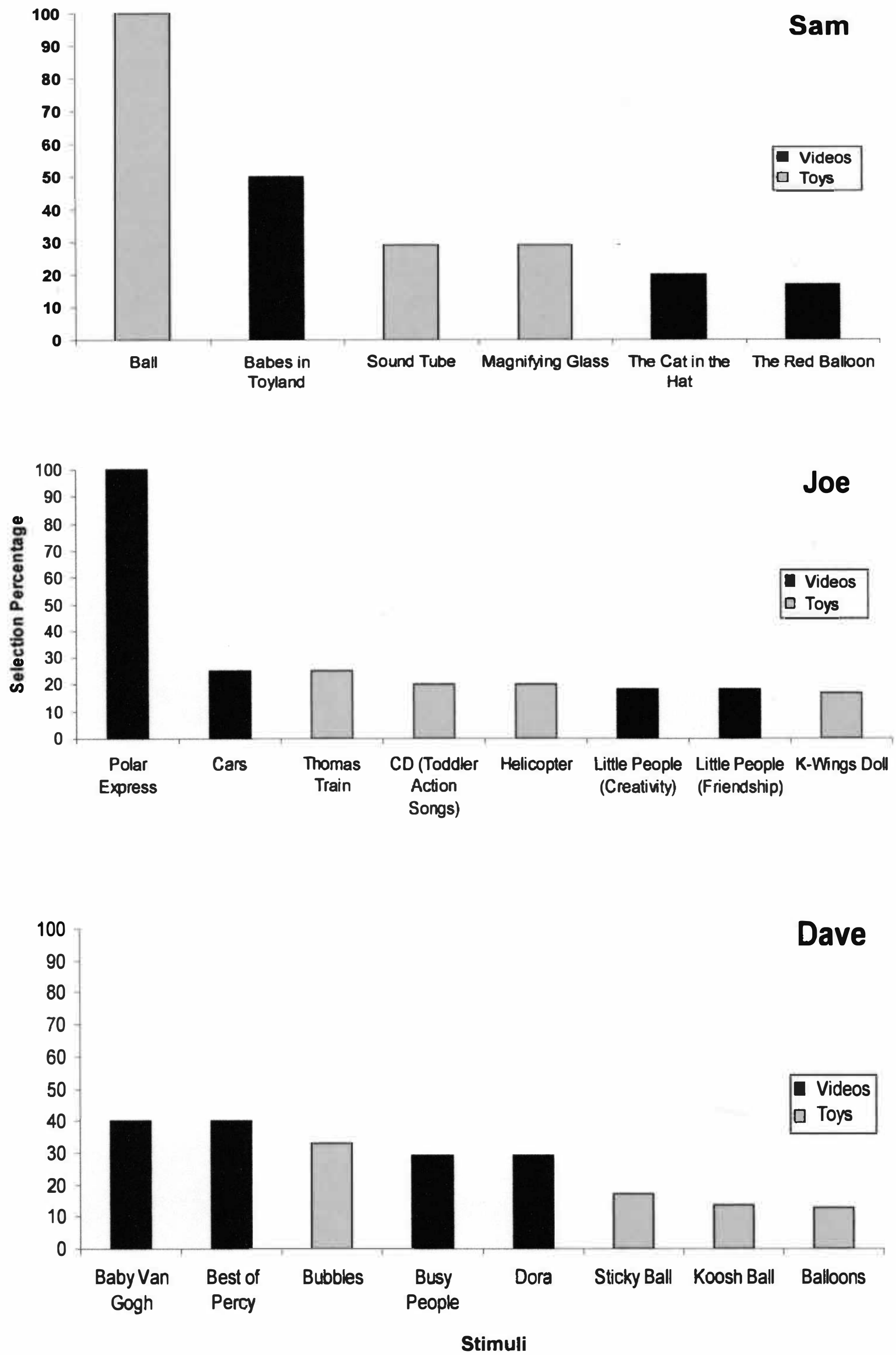

Figure 1. MSWO preference assessment for leisure items and recreational videos.

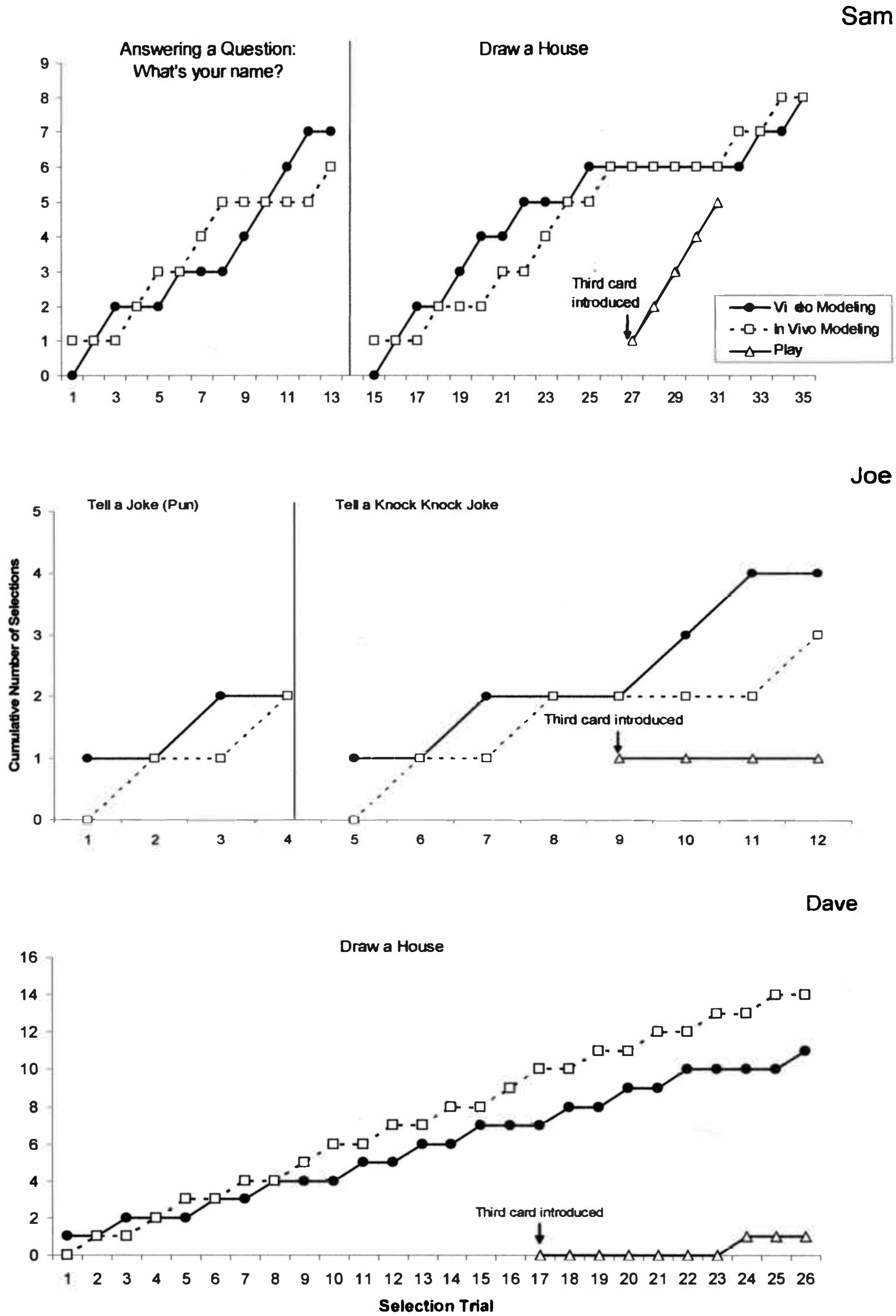

Figure 2. Cumulative number of selections for video modeling and in vivo modeling.

modeling a total of six times and in vivo modeling a total of five times. When the control card was introduced, he selected it once and accompanied the therapist down the hall to play. He did not select it again, saying that he did not want to walk so far down the hallway to the playroom. Joe's results indicate that he discriminated between the conditions and had no preference for either modeling condition. Dave (bottom panel) showed no differentiation, selecting in vivo modeling 14 times and video modeling 11 times. Dave selected the control card only once out of the 10 times it was available, indicating that access to the play room was not preferred. When he was in the play room, he avoided interactions with the experimenters and did not play with many toys. Dave's results indicated that he discriminated between the conditions and had no preference for either modeling condition.

Figure 3 displays the selection percentage of the modeling conditions when only two cards were available for selection and both the modeling conditions and the control condition when all three cards were available. All three participants had similar selection percentages for the modeling conditions, ranging from 44% to 56% selected when only two cards were available, indicating that no participants showed a differential preference for either modeling condition. Sam preferred the play condition to modeling, Joe preferred video modeling over play, and Dave preferred both modeling conditions over play. Sam's control card selection percentage was 100% and Dave's was 10%. Because these results deviate from 33% (the level of indiscriminate selection) they show that both Sam and Dave distinguished between the cards and were making meaningful selections. Joe's selection percentage was 25%, which does not deviate from the level of indiscriminate responding. However, Joe verbally explained why he didn't want to select the control card and named the rooms as he selected the colored card ("TV room," "your room," and "play room") indicating that he discriminated between the cards and was selecting meaningfully.

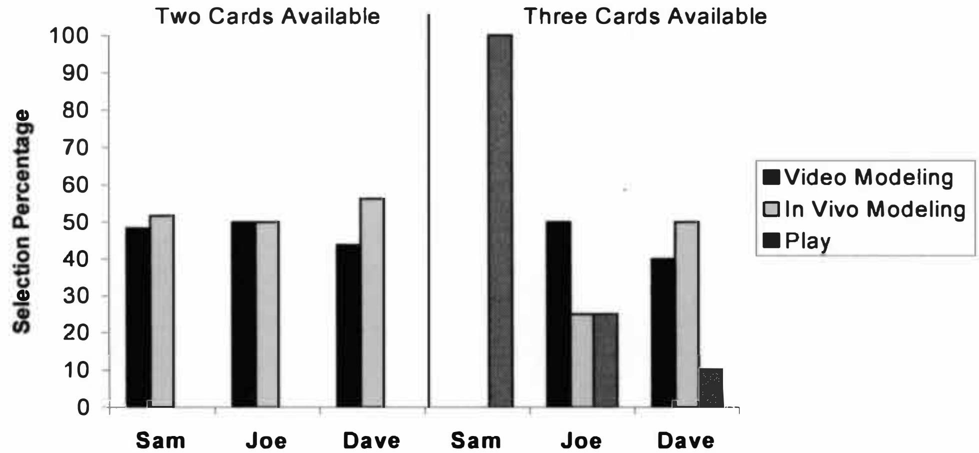

Figure 3. Percentage of selections for video modeling, in vivo modeling when only two cards were available and percentage of selections for video modeling, in vivo modeling, and play conditions when all three cards were available.

Acquisition and Efficiency

Figure 4 displays the participants' performance on targets in the exposure condition. In baseline, Sam (top panel) responded similarly to the two instructions (drawing a smiley face and drawing a sun). Once video and in vivo modeling were implemented, Sam improved at a similar rate on both targets. However, Sam mastered the in vivo modeling task (draw a smile) and was unable to master the video modeling task (draw a sun) before the exposure condition terminated.

Joe's performance data in baseline (middle panel) indicate equivalent and poor performance on two skills, constructing a cat and a bug. As video and in vivo modeling were implemented, Joe again performed exactly the same on both targets, mastering each in four trials. These results indicate that in vivo and video modeling were equally effective for Joe. Dave (bottom panel) performed similarly on the two skills during baseline. Dave's performance improved very quickly on the in vivo

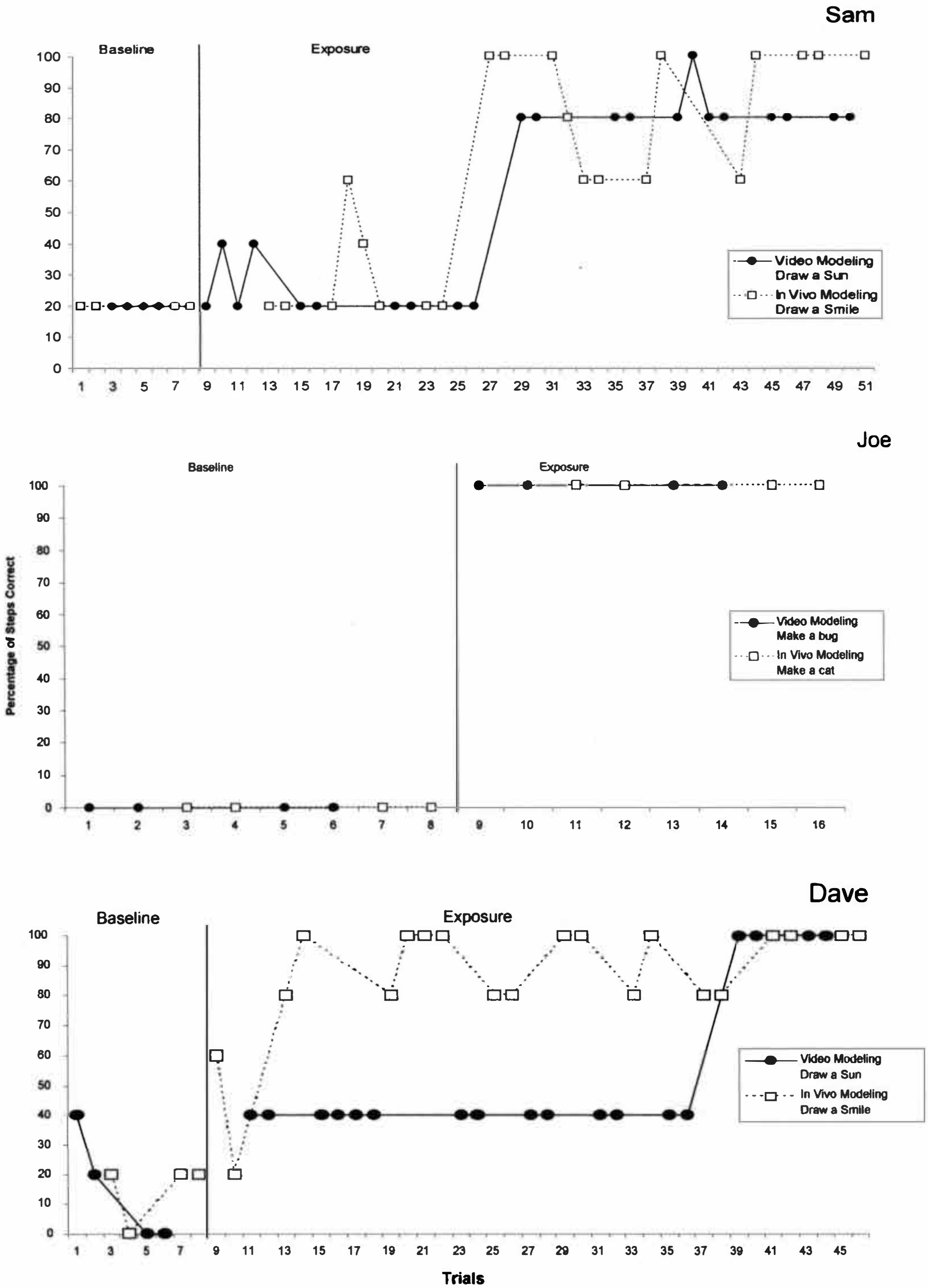

Figure 4. Percentage of correctly completed steps for video modeling and in vivo modeling during exposure tasks.

modeling task (draw a smile), but remained at baseline levels for the video-modeling task (draw a sun). However, Dave reached the mastery criterion on the video modeling task in 18 trials and the in vivo modeling task in 20 trials. These results indicate that although in vivo modeling produced quicker gains, Dave mastered the two skills in a similar number of trials.

Figure 5 depicts the participants' performance on targets in the preference evaluation condition. Sam (top panel) performed poorly in baseline on his target skill (answering the question, "What's your name?"). When modeling was implemented, Sam continued to perform poorly for 22 trials, until he mastered the task. Joe (middle panel) performed poorly in baseline on his target skill (telling a pun joke). When modeling was implemented, he quickly improved and mastered the task. Dave (bottom panel) performed poorly in baseline on his target skill (drawing a sun). When modeling was implemented, he continued to perform at baseline levels. Once error correction was implemented with in vivo modeling, Dave improved and mastered the skill.

Figure 6 depicts Sam's and Joe's performance on their second targets for the preference evaluation condition. Sam (top panel) performed poorly in baseline on his second target skill (draw a house). When modeling was implemented, he continued to perform at baseline levels. Sam, again, failed to improve on the skill after error correction was added to modeling. Joe (bottom panel) performed poorly in baseline on his target skill (telling a knock knock joke). When modeling was implemented, he quickly improved and mastered the task.

The percentage of time in which the participants were orienting towards the model is displayed in Figure 7. Both Sam and Joe attended slightly better to the video model (93% and 96% attention respectively) than the in vivo model (77% and 87% attention respectively). Dave attended better to the in vivo model (56% attention) than the video model (42% attention); though his attention to both models was much lower than both Sam and Joe.

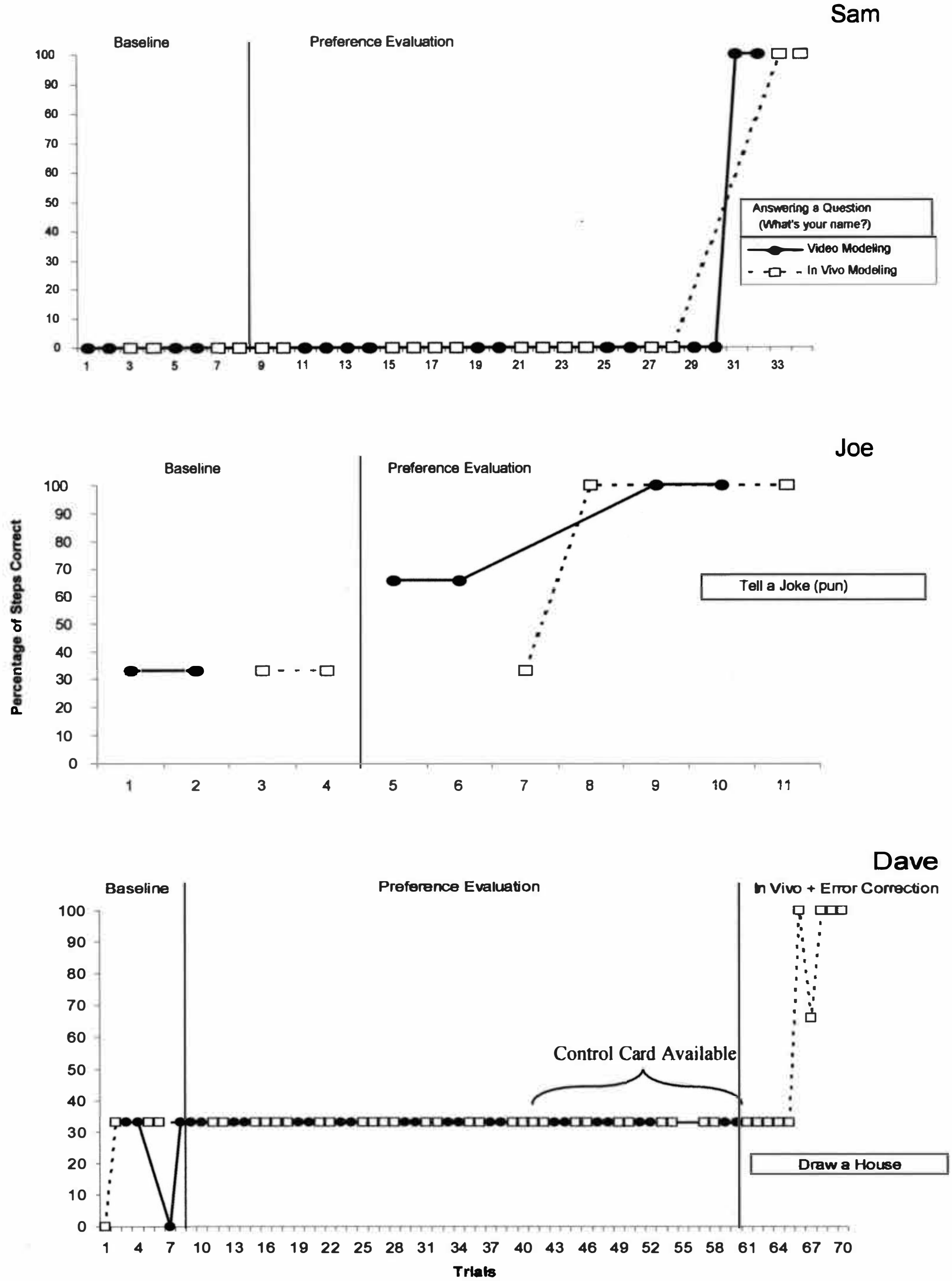

Figure 5. Percentage of correctly completed steps for video modeling and in vivo modeling during the first preference task.

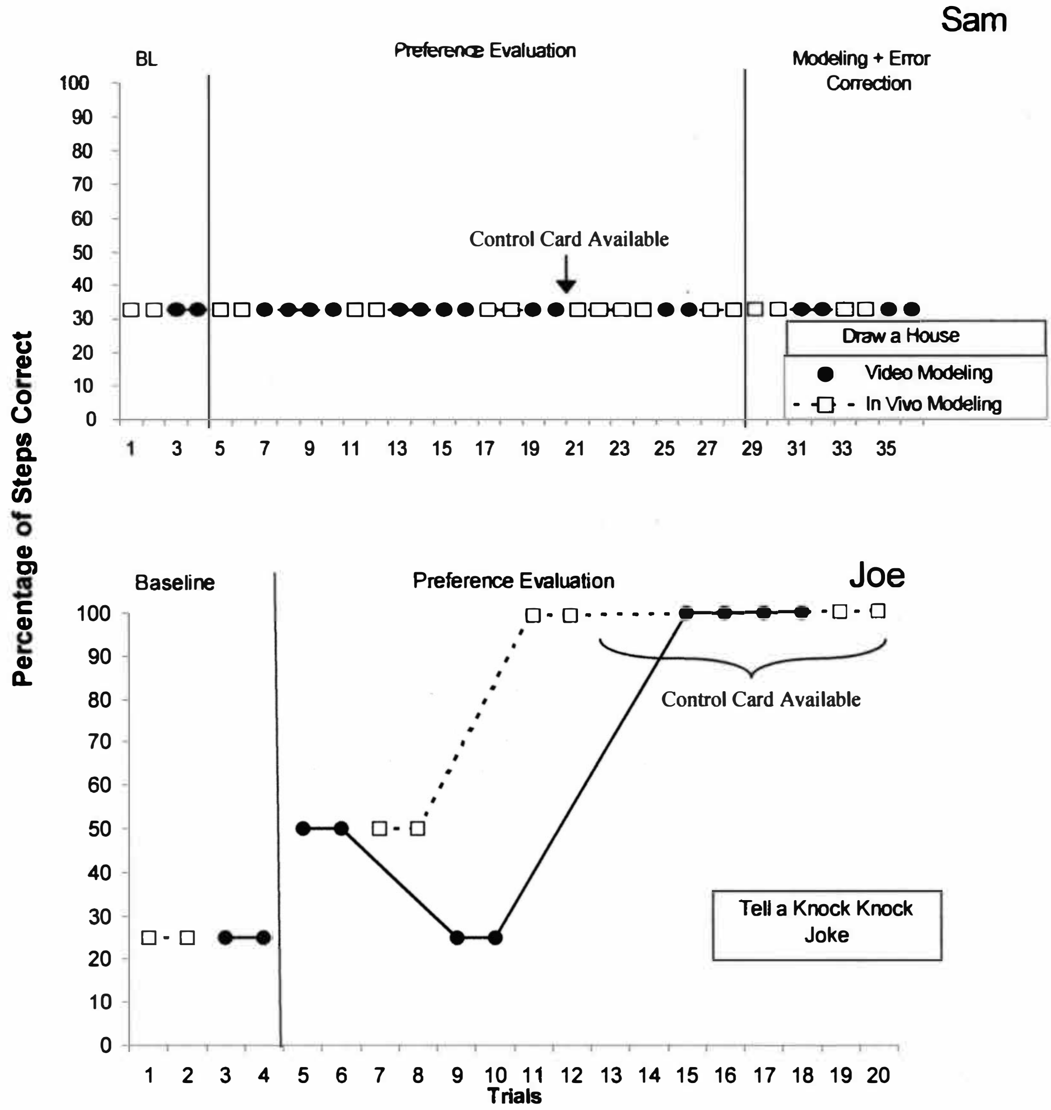

Figure 6. Percentage of correctly completed steps for video modeling and in vivo modeling during the second preference task for Sam and Joe.

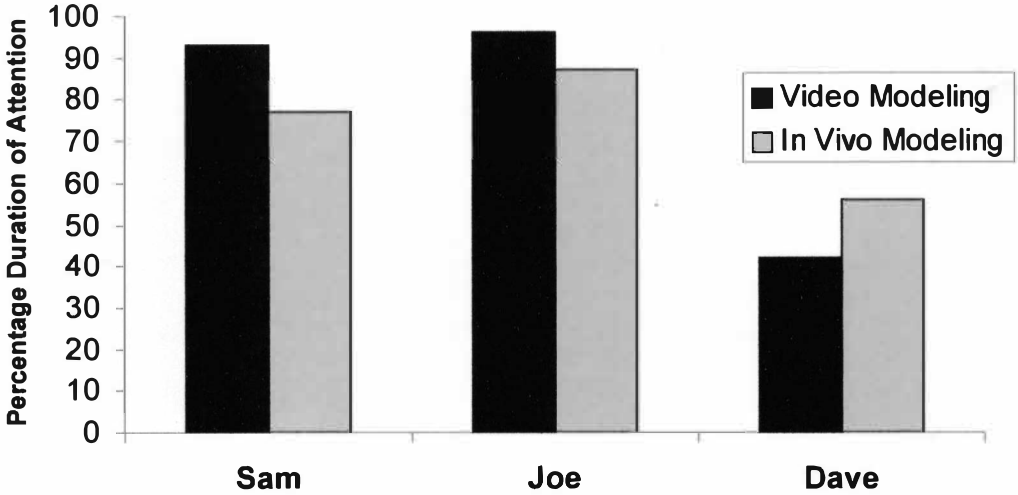

Figure 7. Percentage of attention to the model for video modeling and in vivo modeling.

DISCUSSION

Major Findings

Previous concurrent-chains evaluation studies examined participants' preference for treatments for problem behaviors (Hanley et al., 1997; Hanley et al, 2005), protracted leisure activities (Hanley et al., 1999), and motivational systems during instruction (Heal & Hanley, 2007). This study extends the use of the concurrent chain procedures to evaluation of preference for specific instructional techniques (i.e., video modeling, in vivo modeling) allowing examination of the validity of an often cited potential benefit of video modeling. Researchers have hypothesized that video modeling produces differentially better effects than in vivo modeling because children with autism prefer video modeling (Charlop-Christy et al., 2000) and that watching videos is automatically reinforcing for children with autism, whereas looking at people is neutral or sometimes aversive (Dowrick, 1986). The findings of this study show that watching video models was no more or less reinforcing than watching the live models for these participants and that no participants had a differential preference for either modeling condition. This finding is in contrast to the widely held belief that all children with autism prefer video modeling. At this time there is no evidence to support the hypothesis that children with autism prefer video modeling. Future studies on preference for video modeling versus in vivo modeling are warranted to either confirm or contradict the findings of this evaluation.

All three participants had a moderate preference for recreational videos in the MSWO preference assessment. Because the participants had a similar level of preference for recreational videos and none showed a preference for either modeling condition, this investigation was unable to demonstrate that a previous preference for recreational videos predicts preference for video modeling. Perhaps participants with higher or lower preferences for recreational videos may show differential preference for video or in vivo modeling. Future investigations could investigate whether participants with low preference for recreational videos do not prefer video modeling and whether participants who have a high preference for recreational videos prefer video modeling.

This study also contributed to the research literature on video modeling by conducting another comparison of video and in vivo modeling for effectiveness. In the first comparison study, Charlop-Christy et al. (2000) found that video modeling was generally more effective than in vivo modeling. In contrast, our participants performed similarly in the video and in vivo modeling conditions and required more trials to achieve skill mastery than in the Charlop-Christy et al. study. In Charlop-Christy et al., 2 to 11 presentations of the model were required to reach mastery criterion whereas in the current study, 4 to 43 presentations were required to reach the mastery criterion. Additionally, in Charlop-Christy et al. all participants mastered all of the target skills, whereas in the present study, two participants did not master target skills without additional instructional procedures (i.e., error correction). It is possible that procedural variations between Charlop-Christy et al. and the current study contributed to the different findings. For instance, in Charlop-Christy et al., the researchers presented the model twice for the first presentation and once in all subsequent presentations. In the current study, all presentations of the model showed the model only once. Additionally, in the earlier study participant attention to the model was reinforced, whereas in the current study, researchers did not reinforce attention to the model.

Finally, this study provides information about the impact or lack of impact of participant behaviors (i.e., attending to the model) on video modeling effectiveness allowing examination of potential means by which video modeling might work. Prior publications have suggested that differentially better attending to video over in-person models might account for differential effectiveness (Charlop-Christy et al., 2000; Dowrick, 1986). In this study, two participants (Sam and Joe) attended better to video models than in vivo, but the third (Dave) attended better to the in vivo model. These findings are in contrast to the widely held belief that video modeling produces substantially better attention to the model because watching television is automatically reinforcing. Also, differences in attention to the model did not translate to better performance on the target skill in the exposure condition. Sam attended better to video models but performed better on in vivo model task. Also, Joe attended better to video models but performed the same on the two tasks. Finally, Dave attended better to the in vivo model and mastered both skills at similar times. He also attended poorly to both the models and still mastered the skills. However, it took many more presentations of the model than the other two participants for him to master skills. The results of this study indicate that the differences in attention to the model may be due to individual differences rather than the characteristics of the models.

The findings of similar effectiveness of video and in vivo modeling may have contributed to participants' indifference between the modeling procedures. In Hanley et al. (2005), researchers found a positive relationship between the effectiveness of a treatment for problem behavior and the probability of reinforcement when that treatment was implemented. Both participants preferred the more effective treatment, which also had a higher probability of reinforcement. It is possible that this similar probability of reinforcement between the conditions contributed to the participants' indifference. However, Hanley et al. (1997) and Heal and Hanley (2007) found that treatments for problem behavior and motivational systems during instruction had similar effectiveness, but participants had a differential preference for one condition. Thus, differential effectiveness and a differential rate of reinforcement are not required for a differential preference for a certain condition.

Limitations

Several limitations of this study are noteworthy. First, the manner of target selection was parent report and some of these parents were not accurate reporters of their sons' abilities. Though lack of skill was confirmed in baseline, the skills targeted may have required pre-requisite skills that were not in the participants' repertoires, which may have contributed to the varying number of trials to skill mastery. It might have proven more efficient for researchers to cooperate with the child's school to have access to school curriculum with more accurate report of the child's abilities.

Another limitation of the study was that in order to isolate the modeling conditions for comparison of effectiveness, no other instructional techniques were included because they may have accounted for any observed differential effectiveness. Eliminating these other strategies may have decreased the effectiveness of both types of modeling and reduced the probability of reinforcement for skill completion. Also, it is possible that this made modeling conditions less reinforcing which may have led to indifferent selections. However, Charlop-Christy et al. (1999) didn't use other instructional techniques (except for reinforcement of attention to the model) in their comparison between video and in vivo modeling and participants mastered the target skills relatively quickly.

Finally, tasks were yoked based on equal difficulty based on a survey of autism professionals in the field. It is possible that the criteria for matching the skills were overly stringent resulting in matched skills that were too similar so that once a participant improved in one target, it suppressed responding in the other target. Indeed, several incorrect responses, particularly on the drawing tasks, were when a participant drew the wrong shape for the modeling condition (e.g., drawing an in vivo model target, a smile face, in the video modeling condition). Because the tasks had such similar physical features, the participants may have struggled to discriminate between the tasks, and continued to perform the target that they were improving on more rapidly. Task similarity may have produced multiple treatment interference that could have affected participants' performance in either or both of the modeling conditions.

Conclusion and Suggestions for Future Research

In summary, this study provided information that not all children with autism prefer video modeling to live modeling and that video modeling did not produce differentially better attention to the model or fewer trials to skill mastery. These results show that for some children video modeling is just as effective as in vivo modeling, though not more effective. Instructors of children with autism should test both interventions with an individual child before consistently instructing with one method. Future research should investigate further comparisons of video and in vivo modeling for effectiveness, since the current study had contrasting results with previous comparative literature. Additionally, future investigations of participant preference for video modeling might target individuals with varying levels of preference (i.e., high preference and low preference) for recreational videos to determine if a preference is required for a differential preference for video modeling or differential effectiveness of video modeling. Finally, future investigations of video modeling should further examine the relationship between attention to the model and trials to skill mastery.

Appendix A

Sample Card Selection and Skill Completion Data Sheet

Telling a Pun Joke

Participant: ____________________ Date: ____________________

Observer: ______________________ Primary / Secondary

Instructions:

- For each trial, circle the "Y" if the participant correctly completed the component or circle the "N" if the participant did not correctly complete the component.
- In the "Total" write the total number of Y's circled.
- If IOA was collected, in the "% Agreement" column, fill in the percentage of components that the two observers agreed on.
    - For each component score an agreement only if both observers circled a Y or an N.

To calculate the agreement percentage: Agreement Percentage = Agreements / (Agreements + Disagreements) * 100%

Child selected: (V)ideo or (I)n Vivo	Trial #	Stands at appropriate distance & orients toward therapist	Says, "What do baseball players eat on?"	Waits for Therapist to say "What?" Then says, "Home plates."	Total	% Agree-ment
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		
V I		Y N	Y N	Y N		
		Y N	Y N	Y N		

Appendix B

Procedural Integrity Data Sheet

Procedural Integrity Data Sheet

Participant: ______________ Date: _____________

Observer: ________________ Primary / Secondary IOA: ______

For each trial, did the researcher:

Video or in vivo	Trial	Hold up a card in front of the child?	Instruct the child to select the card?	Escort the child into the correct room? (Blue card-video, red card-in vivo)	Say "Watch this" and press play on the DVD? Or begin modeling task?	Give the child an opportunity to perform the task?	Praise the child for correct performance on the task?	Escort the child out of the room?
V I	1	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	2	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	3	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	4	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	5	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	6	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	7	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	8	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	9	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	10	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	11	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	12	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No
V I	13	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No N/A	N/A
	14	N/A	N/A	N/A	Yes No	Yes No	Yes No N/A	Yes No

Appendix C

Human Subjects Institutional Review Board (HSIRB) Approval Letter

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: December 18, 2007

To: Linda LeBlanc, Principal Investigator
Courtney Dillon, Student Investigator for dissertation
Kaneen Geiger, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair Amy Naugle

Re: HSIRB Project Number: 07-11-01

This letter will serve as confirmation that your research project titled "Evaluating the Effectiveness of Video Modeling for Children with Autism: Preference and Point of View vs. Scene Modeling" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: November 21, 2008

Walwood Hall, Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276

BIBLIOGRAPHY

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. text revision). Washington, DC: Author.

Apple, A. L., Billingsley, F., & Schwartz, I. S. (2005). Effects of video modeling alone and with self-management on compliment-giving behaviors of children with high-functioning ASD. *Journal of Positive Behavior Interventions, 7*, 33-46.

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional Children, 73*, 264-287.

Centers for Disease Control and Prevention (2007). CDC releases new data on autism spectrum disorders (ASDs) from multiple communities in the United States. Retrieved from http://www.cdc.gov/od/oc/media/pressrel/2007/r070208.htm.

Charlop, M. H., & Milstein, J. P. (1989). Teaching autistic children conversational speech using video modeling. *Journal of Applied Behavior Analysis, 22*, 275-285.

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30*, 537-552.

Charlop-Christy, M. H., & Daneshvar, S. (2003). Using video modeling to teach perspective taking to children with autism. *Journal of Positive Behavior Interventions, 5*, 12-21.

Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA model in a community setting. *Journal of Developmental & Behavioral Pediatrics, 27*, 145-S155.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis (2nd ed.)*. Upper Saddle River, NJ: Merrill/Prentice Hall.

Delano, M. E. (2007). Video modeling interventions for individuals with autism. *Remedial and Special Education, 28*, 33-42.

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*, 519-533.

Dowrick, P.W. (1986). *Social survival for children: A trainer's resource book.* New York: Brunner/Mazel.

Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low-intensity behavioral treatment for children with autism and mental retardation. *Journal of Autism and Developmental Disorders, 36*, 211-224.

Fisher, W. W. Piazza, C. C., Bowman, L. G., & Amari, A. (1996). Integrating caregiver report with a systematic choice assessment. *American Journal on Mental Retardation, 101*, 15-25.

Gilliam, J. E. (2006). *Gilliam Autism Rating Scale, Second Edition (GARS-2).* Austin, TX: Pro-Ed.

Goldsmith, L.A., & LeBlanc, L.A. (2004). Use of technology in interventions for children with autism. *Journal of Early and Intensive Behavior Intervention, 1*, 166-178.

Green, G. (1996). *Early behavioral intervention for autism: What does research tell us?* Southborough, MA: New England Center for Autism.

Hanley, G. P., Piazza, C. C., Fisher, W. W., Contrucci, S. A., & Maglieri, K. A. (1997). Evaluation of client preference for function-based treatment packages. *Journal of Applied Behavior Analysis, 30*, 459-473.

Hanley, G. P., Iwata, B. A., & Lindberg, J. S. (1999). Analysis of activity preferences as a function of differential consequences. *Journal of Applied Behavior Analysis, 32*, 419-435.

Hanley, G. P., Piazza, C. C., Fisher, W. W., & Maglieri, K. A. (2005). On the effectiveness of and preference for punishment and extinction components of function-based interventions. *Journal of Applied Behavior Analysis, 38*, 51-65.

Heal, N. A., & Hanley, G. P. (2007). Evaluating preschool children's preferences for motivational systems during instruction. *Journal of Applied Behavior Analysis, 40*, 249-261.

Herrnstein, R. J. (1964). Secondary reinforcement and rate of primary reinforcement. *Journal of the Experimental Analysis of Behavior, 7*, 27-36.

Hill, A., Bölte, S., Petrova, G., Beltcheva, D., Tacheva, S., & Poustka, F. (2001). Stability and interpersonal agreement of the interview-based diagnosis of autism. *Psychopathology, 34*, 187-191.

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26*, 359-383.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Kinney, E. M., Vedora, J., & Stromer, R. (2003). Computer-presented video models to teach generative spelling to a child with an autism spectrum disorder. *Journal of Positive Behavior Interventions, 5*, 22-29.

Lasater, M. W., & Brady, M. P. (1995). Effects of video self-modeling and feedback on task fluency: A home-based intervention. *Education & Treatment of Children, 18*, 389-407.

LeBlanc, L. A., Coates, A. M., Daneshvar, S., Charlop-Christy, M. H., Morris, C., & Lancaster, B. M. (2003). Using video modeling and reinforcement to teach perspective-taking skills to children with autism. *Journal of Applied Behavior Analysis, 36*, 253-257.

Lord, C., Risi, S., Lambrecht, L., Cook, Jr., E. H., Leventhal, B. L., DiLavore, P. C., et al. (2000). The Autism Diagnostic Observation Schedule – Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders, 30*, 205-223.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*, 3-9.

Nikopoulos, C. K., & Keenan, M. (2004). Effects of video modeling on social initiations by children with autism. *Journal of Applied Behavior Analysis, 37*, 93.

Rehfeldt, R. A., Dahman, D., Young, A., Cherry, H., & Davis, P. (2003). Teaching a simple meal preparation skill to adults with moderate and severe mental retardation using video modeling. *Behavioral Interventions, 18*, 209-218.

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation, 110*, 417-438.

Sherer, M., Pierce, K.L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schreibman, L. (2001). Enhancing conversation skills in children with autism via video technology: Which is better, "Self" or "Other" as a model? *Behavior Modification, 25*, 140-158.

Shipley-Benamou, R., Lutzker, J. R., & Taubman, M. (2002). Teaching daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions, 4*, 165-175.

Smith, T., Eikeseth, S., Klevstrand, M., & Lovaas, O. I. (1997). Intensive behavioral treatment for preschoolers with severe mental retardations and pervasive developmental disorder. *American Journal on Mental Retardation, 102*, 238-249.

Sturmey, P. (2003). Video technology and persons with autism and other developmental disabilities: An emerging technology for PBS. *Journal of Positive Behavior Interventions, 5*, 3-4.

Sundberg, M. L. & Hale, L. M. (2007, May). The VB-MAPP: An overview and field test data from Oregon and California. In M. L. Sundberg (Chair), *The Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP): Field-test data from typical children and children with autism.* Symposium conducted at the 33rd Annual Convention of the Association for Behavior Analysis, San Diego, CA.

Volkmar, F., Chawarska, K., & Klin, A. (2005). Autism in infancy and early childhood. *Annual Review of Psychology, 56*, 315-336.

Yeargin-Allsopp, M., Rice, C., Karapurkar, T., Doernberg, N., Boyle, C., & Murphy, C. (2003). Prevalence of autism in a US metropolitan area. *Journal of the American Medical Association, 289*, 49-55.