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## Examining prerequisite skills for learning through video modeling

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**Examining Prerequisite Skills for Learning Through Video Modeling**

**A Thesis Presented**

**by**

**Meghan Robinson**

The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

for the degree of

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## Abstract

In the following study 12 preschool students diagnosed with an autism spectrum disorder were assessed for 10 potential pre-requisite skills for video modeling performance. The purpose of the study was determined which skills were necessary for children to learn through video modeling. In the first Experiment it was found that 8 of the 12 students demonstrated mastery of all assessed skills including video modeling. The four students who did not demonstrate learning through video modeling, also did not demonstrate successive discrimination skills. Experiment 2 tested to see if teaching these skills (i.e. delayed imitation, delayed matching), would produce learning through video modeling. Participants with average video modeling scores of 50% or higher showed improved learning through video modeling after mastering delayed matching, while students scoring 25% or less on video modeling assessments, were considered to have no change in video modeling performance. The results suggested that delayed matching and delayed imitation may be prerequisite skills for learning through video modeling, and that training successive discriminations to students with video modeling scores of 50% or higher will improve learning through video modeling performance. Future research is warranted on the role of successive discriminations on learning through video modeling, as well as the overall academic and social development of children diagnosed with developmental disabilities.

## Examining Prerequisite Skills for Learning through Video Modeling

Video modeling is a teaching strategy for children with an autism spectrum disorder that demonstrates much promise to teachers and researchers (McCoy & Hermansen, 2007). It utilizes video models to promote skill acquisition and has been shown to be an effective teaching strategy for individuals diagnosed with developmental disabilities across a variety of skills (Nikopolous & Keenan, 2004; LeBlanc, Coates, Daneshvar, S., Charlop-Christy, Morris, & Lancaster, 2003; Charlop & Milstein, 1989; Conyers, Miltenberger, Peterson, Gubin, Jurgens, Selders, Dickinson, & Barenz, 2004; Morgan & Salzberg, 1992; McCoy & Hermansen, 2007). Video modeling has effectively been used to teach complex verbal skills (Charlop & Milstein), increase compliance for dental procedures (Conyers et al.) and help adults diagnosed with mental retardation fix and report work problems in their vocational jobs (Morgan & Salzberg). Nikopolous and Keenan found that by showing children a videotape of a typically developing peer playing, social attention and reciprocal play of a student with autism was enhanced. In addition, LeBlanc et al. found that video modeling is an effective technology for teaching perspective taking and also fostered generalization of these skills

McCoy and Hermansen (2007) completed a review of the effects of models across 34 experiments and found that studies utilizing adults as models demonstrated effectiveness in enhancing play skills, perspective taking, conversational skills, purchasing skills and the spelling of words. In addition to enhancing the behavior of individuals observing videos, video modeling has many procedural advantages. Morgan and Salzberg, (1992) noted that video modeling (1) presents behaviors in naturalistic settings, (2) may be a useful medium for individuals who cannot take the advantage of print, (3) allows for the observer to repeatedly review the model's behavior and (4) standardizes the

presentation of the stimuli in training. Overall, video modeling shows much promise as an efficient and effective procedure for teaching children with an autism spectrum disorder a variety of skills.

Although video modeling has many advantages, it is not an effective procedure for all individuals. The biggest criticism is not all children learn through video. Failure of participants to acquire targeted skills with video modeling has been documented across multiple studies. Three of the 7 participants in Nikopolous and Keenan (2004) showed no change in social initiations or reciprocal play when students with an autism spectrum disorder were exposed to a video modeling procedure. This also occurred in Sherer et al. (2001), where 2 out of 5 participants failed to acquire a scripted conversation modeled by a peer with a teacher.

Though many authors have speculated about why children do not acquire skills through video modeling, only one has systematically examined the possible prerequisites to video modeling. Janelle, Champenoy, Coombes, and Mousseau (2003) systematically manipulated variables within a video modeling procedure to determine characteristics of video modeling protocols that correlate with greater accuracy. They found that when experimenters used visual and verbal cues within their video modeling procedures there were collectively fewer errors across acquisition and retention trial blocks compared to other groups.

Charlop-Christy, Le, and Freeman (2001) hypothesized that the effectiveness of video modeling may be due to television being an engaging medium, which results in longer sustained attention. It has also been suggested that video modeling permits accentuation of certain stimulus features and minimization of distracting or irrelevant features to help address the problem of stimulus overselectivity (Spradlin & Brady, 1999).

Weiss and Harris (2001) noted that one-step imitation is a skill children should demonstrate before exposing them to a video modeling protocol. Imitation is also a fundamental mechanism for learning (Dawson & Osterling, 1997). Therefore, the role of imitation in video modeling is also

justified in future research (McCoy & Hermensen, 2007).

Weiss and Harris (2001) also stated that attending from at least a 5-foot distance and an interest in videos, are skills children should demonstrate before exposing them to video modeling. They suggested that without these prerequisite skills, a child is not likely to perform the video modeling task. Along the same lines, Bandura (1977) noted that a person cannot imitate the behavior of a model if the person does not attend to the model's behavior. Therefore, attending to a video is another component to consider for children to be successful with video modeling protocols.

Another variable potentially affecting video modeling performance is a participant's ability to remember the behavior of the model. In video modeling the child observes the desired action and then must imitate the behavior. This requires that the student remember the video model for the duration of the video and the time before the materials are presented to the student. Delayed matching to sample measures memory in terms of overt behavior and its relationship with controlling environmental stimuli. It has been historically used to measure memory (Blough, 1959), and therefore is an appropriate tool to measure and assess memory. Sargisson and White (2001) studied memory with a delayed matching procedure by observing the key pecking patterns of pigeons to different light presentations. In their study, they birds were trained to peck a red or green sample which turned the light off. After a 2-s, 4-s, or 6-s delay the birds were presented with red and green comparison stimuli. A correct response occurred when a bird pecked the green light given the green sample or the red comparison when presented with a red sample. The results of this study showed greater accuracy occurred at the training time. Constantine and Sidman (1975) also explored memory with a delayed matching protocol. In their study they compared the use of dictated names rather than pictures as a sample in delayed matching protocol with individuals diagnosed with mental retardation. Constantine and Sidman went on to determine that participants who labeled the sample picture could correctly perform the delayed matching task. They also determined that greater decreases in accuracy occur with

individuals with developmental disabilities compared to typical individuals when given delayed matching tasks. Therefore delayed matching is an appropriate tool to measure and assess memory with individuals with developmental disabilities.

Teresko, Macdonald and Ahearn (2007) began to assess the possible prerequisite skills for learning through video modeling. In this study, they assessed the following skills in 4 students diagnosed with an autism spectrum disorder: gross motor imitation, actions with objects, motor skills, picture-to-object matching, computer screen picture-to-object matching, attending to a preferred video, delayed picture-to-object matching, and delayed computer picture-to-object matching. They found that students who did not perform delayed matching accurately also did not demonstrate learning through video modeling. Following assessment, the authors developed a segmented video modeling procedure in which each step of the video modeling task was trained independently. The students were shown the video model broken down into segments of one step at a time in a forward chain. The number of steps shown in the video model increased as the participant completed the step with 100% accuracy for two consecutive sessions. All of the students demonstrated learning through the segmented video modeling procedure. More importantly, Teresko et al. demonstrated that there may a correlation between performance on delayed matching tasks and learning through video modeling.

The current study was a systematic replication and extension of the research by Teresko et al. (2007). The first purpose was to assess students on 10 possible prerequisite skills to video modeling and to further explore the relation between delayed matching and the acquisition of an 8 step video model. The second purpose was to determine if teaching delaying matching would result in an increase in learning using video modeling. Students who did not demonstrate delayed matching or video modeling, were taught delayed matching to mastery. Video modeling performance data was assessed before and after delayed matching training in order to determine if teaching delayed matching would result in an increase in video modeling performance.

## Experiment I

### Method

#### *Participants*

Twelve students attending an early intensive behavioral intervention program participated in this study. They were all diagnosed with an Autism Spectrum Disorder (ASD). All participants received 30 hours of one-on-one instruction per week and were referred to the study as increasing their play repertoires was an objective for each child. Of the 12 total participants 9 were male and 3 were female. The students ranged in age from 3 to 7 years old. The participants and their results for the Core Skill assessment for receptive language, expressive, language, and object imitation are respectively listed; Hannah (5, 5, 5), Craig (5, 5, 5), Ike (5, 5, 5), Katie (5, 5, 5), Sam (5, 5, 5), Paul (5, 5, 5), Ernie (5, 5, 5), Maggie (5, 5, 5), Nick (2, 2, 3), James (1, 1, 2), Andy (5, 5, 5), and Cameron (5, 5, 5).

#### *Setting*

All sessions were conducted in a 2.7 x 4.3 m therapy room located at the participant's day services program. In the therapy room there were two tables, two chairs, a video camera, a shelf with break activities, and materials necessary to conduct the sessions. An experimenter was present for all sessions, and during discrete trials the experimenter sat at the same table as the student. Sessions were conducted 2 to 3 times per week.

#### *Skills Assessed*

The stimuli used for each assessment are listed in Table 1. During assessment sessions the materials necessary to test each skill were present in the room. Three highly preferred edibles were also present in the room through all the assessments. The edibles were considered highly preferred based on reports of teachers working regularly with each student. The edibles delivered in each assessment were chosen based on the results of a brief preference assessment prior to the start of each session. The student selected one edible out of three highly preferred edibles to be used as a reinforcer during all

assessments. Matching stimuli were 6 common household items (e.g. book, cup, spoon, fork, ball, and plate) and identical pictures of each object. These objects were part of the assessments in Experiment 1. During the attending assessment, a portable DVD player was placed on the table in front of the student.

In the video modeling assessments, a laptop computer was on one table and materials needed for the student to make the construct were placed on another table. A video camera was present during all sessions as all sessions were videotaped. The materials needed to build the video modeling constructs varied depending on the construct being assessed. The Mega Bloks<sup>®</sup> made by MegaBrand<sup>®</sup> were used to build Guy A, B, C and D. Pictures of the MegaBrand<sup>®</sup> guy structures appear in Appendix 1. The Hamburger and Fruit Salad were made by Melissa and Doug<sup>®</sup>, and the Robo-Dog and Robo-Pup were constructed by International Playthings Inc<sup>®</sup> from the RoboPops<sup>®</sup> play set.

#### *Independent Variable*

In Experiment 1, the independent variable was the number of independent correct responses on the each assessment. In matching tasks, a *correct response* was defined as the student independently touching the object that matched the picture presented as a sample. For imitation tasks, a *correct response* was defined as the student placing the objects in the same sequence as demonstrated by the experimenter. Attending was scored as an independent response when the student's eyes were oriented to the video screen.

#### *Dependent Variable*

The dependent variable was the number of correct independent steps completed in the video modeling assessment. A correct independent response was defined as the student placing one piece in the same sequence as the model on the video tape. Each video modeling construct consisted of 8 total steps. If the student placed all the pieces in the 8-step sequence as modeled by the experimenter then the video modeling performance was considered 100% accurate. For every video modeling probe, the

participant was assessed twice giving them two scores out of 8.

### *Data Collection*

During discrete trial training, data were collected in vivo by the experimenter. The responses by the student were recorded as independent, prompted and incorrect responses. During the video modeling assessments, data were taken on the independence of each step in the response chain.

Attending was defined as the student orienting his/her eyes and head in the direction of the DVD screen. The student was presented with a preferred movie for 3 minutes and attending was measured using 10-s partial-interval time sampling. The experimenter then calculated the % of intervals on which attending occurred out of 18 possible intervals. If the student attended to the video at any point during a 10 s interval then this was scored as an independent correct response.

### *Procedures*

*Assessment.* A total of ten tasks were used to assess potential pre-requisite skills for video modeling performance. The tasks were selected based on the suggestion of Weiss and Harris (2001), who stated that the prerequisites for video modeling included one-step imitation, attending from at least a 5-foot distance, and an interest in videotapes. Each of the skills is described in Table 1. Included in the description of each skill is the discriminative stimulus, the experimenter's behavior, and the materials used.

Each assessment occurred in a discrete trial format with either 9 or 18 total trials per session except attending to a preferred video which was scored with 10-s partial-interval time sampling. The reinforcers for discrete trials were selected based on the results of a brief preference assessment prior to the start of each session. Three highly preferred edibles were presented to the student at the start of each session and the student was told to pick one. The chosen edible was delivered on a continuous schedule of reinforcement for correct responses. If a student had an incorrect response the next trial was presented, but if the student had two errors in a row an edible was delivered to the student in order

for their responses not to be placed on extinction.

The first category of skills assessed was imitation tasks. The first skills assessed were generalized motor imitation, imitating actions with objects, and motor skills (assessing the motor strength of each student with the materials necessary to build a construct). The students were also assessed on a delayed imitation skill. In the delayed imitation assessment the experimenter said, “do this” and modeled a 1-step action such as putting a ball in a cup, or a fork next to a spoon. The experimenter then removed the materials from the eyesight of the student for a 3-s interval and then presented the materials necessary to replicate the action.

The second category of skills assessed was matching tasks. This consisted of picture-to-object matching with a 3-stimulus array, and delayed picture-to-object matching with a 3-s delay between the removal of the sample and the presentation of the comparison stimuli.

Attending was the third category of skills assessed. The tasks consisted of attending to a preferred video for 3 minutes, computer screen picture-to-object matching where the sample picture was on the computer, and delayed computer screen picture-to-object matching where there was a 3-s delay between the removal of the sample and presentation of comparison objects. In the computer tasks the sample was presented on the computer and the comparisons were placed on the table in front of the student. Students were tested on computer assessments due to the topography of this task more closely resembling the topography of the video modeling assessment.

The final assessment was a video modeling probe. In the video modeling assessment a DVD player was on one table and materials needed for the student to make the construct were placed on another table. A video modeling probe consisted of showing a video of an adult slowly assembling an 8-step toy construct from the point of view of a person completing it. The video was presented twice for the student and then the student was brought to the table with all the materials necessary to make the construct shown in the video. The student was then told, “It’s time to play” and given 2 minutes to

construct the figure. Students were given a preferred edible at the end of each video modeling session, regardless of performance.

### *Interobserver Agreement*

All sessions were video taped. Interobserver agreement was recorded from the video taped sessions. The independent observer was a graduate student trained in the principles of applied behavior analysis. Interobserver agreement was calculated by dividing the total number of agreements by the total number of agreements plus disagreements. A total of 48% of the assessment sessions were scored with an average score of 99.2% agreement and a range from 94 % - 100%. IOA for each assessment was as follows; motor imitation 100%, actions with objects 98.7% (range, 98.7% - 100%), motor skills 100%, picture to object matching 97.2% (range, 88% - 100%), computer screen picture to object matching 100%, attending to a video 99.1% (range, 94% - 100%), delayed picture to object matching 100%, and delayed computer screen to object matching 100%. Interobserver agreement was also calculated for video modeling probes. Interobserver agreement was calculated by taking the total number of agreements on completing each step in the video modeling task and dividing it by the total number of agreements plus disagreements. A total of 36.1% of the video modeling probes were also scored with an average of score of 98.3% agreement and with a range from 87.5% - 100%.

### Results and Discussion

Eight out of the 12 participants demonstrated mastery of all the assessments including the video modeling task. The results of all 12 participants and their corresponding assessment scores are listed in Table 2. Sam, Paul, Ernie, and Maggie scored above 77% (7/9 or 14/18 correct responses) on all of the assessments. More importantly they scored highly on all successive discrimination tasks (delayed imitation and delayed matching) and on video modeling probes. These four participants demonstrated high video modeling performance with the scores of (8/8, 8/8) for Sam, (8/8, 8/8) for Paul, (8/8, 8/8)

for Ernie, and (8/8, 8/8) for Maggie.

Four participants left the research project before finishing each assessment. As a result Hannah, Craig, Ike and Katie were not assessed on delayed imitation. These four participants had scores above 77% (7/9 or 14/18) on all of the assessments, and scored highly on all video modeling probes. On the video modeling assessment the correct number of steps completed were (8/8, 8/8) for Hannah, (8/8, 8/8) for Craig, (8/8, 8/8) for Ike, and (8/8, 8/8) for Katie.

Four participants did not demonstrate learning through video and also did not display successive discrimination skills. Their performance scores are listed in Table 2. In the video modeling assessment Nick, James, Andy and Cameron scored (1/8, 5/8), (0/8, 2/8), (4/8, 8/8), and (0/8, 0/8) respectively. Their scores on the delayed imitation assessment were (1/9), (2/9), (6/9) and 5/9). In terms of delayed picture to object matching their scores on the tabletop were (9/18), (6/18), (15/18) and (15/18), and on the computer were (10/18), (4/18), (13/18) and (15/18).

Cameron, Andy, James and Nick served as participants to the second experiment. The purpose of Experiment 2 was to examine if teaching delayed matching would improve video modeling performance. The students participating in Experiment 2 demonstrated low scores of delayed matching and learning through video modeling. By training delayed matching and then assessing video modeling performance with these students, the relationship of delayed matching as a prerequisite to video modeling was assessed.

## Experiment 2

### *Participants and Setting*

Four participants were selected from Experiment 1 due to their lack of acquisition through video modeling and delayed match-to-sample. All were diagnosed with an Autism Spectrum Disorder, did not engage in independent play, and would often engage in repetitive behaviors if left alone. Their limited play skills were considered a significant concern by the educators, clinicians, and parents of the

students.

The participants were Cameron (chronological age 6 yr., Vineland Adaptive Behavior Scales Expressive Language 8m, Play and Leisure 8m), Andy (CA 7 yr., Autism Diagnostic Observation Schedule-General 15, Vineland Expressive Language 2y1m, Play and Leisure 10m), James (CA 6 yr., ADOS 22, Vineland Expressive 10m, Play and Leisure 1y), and Nick (CA 5 yr., PPVT-III 102 ADOS, 22, Vineland Expressive 2y2m, Play and Leisure 1y 9m). The setting remained the same as Experiment 1.

### *Independent Variable*

In Experiment 2, the independent variable was training successive discrimination tasks. This included both delayed matching and delayed imitation. In delayed matching, a response was considered correct and independent when the student used an isolated point to the correct comparison after a 3-s delay between the removal of the sample and the presentation of the comparisons. In delayed imitation, a correct independent response was defined as the student replicating the action demonstrated by the experimenter after a 3-s delay interval from the presentation of the model to the presentation of the materials necessary to repeat the action.

### *Design*

The effect of successive discrimination training on video modeling performance was assessed using a multiple baseline across participants. Experimental control was demonstrated through baseline and post-intervention data for each participant. Verification in this design occurs through the unchanging behavior of the other subjects who are still in baseline, and replication of the effects of the treatment are inferred from the changes in behavior of the other participants when they come into contact with the independent variable, the successive discrimination training (Cooper, Heron & Heward 2007).

### *Procedure*

*Video Modeling Baseline.* The video modeling procedure was the same as the video modeling assessment conducted with each participant in Experiment 1. In the video modeling baseline, each participant was shown a video of an adult slowly assembling an 8-step toy construct. They were then brought to a table with all the materials necessary to make the construct shown in the video. Students were given an edible regardless of performance.

### *Delayed Matching Training*

The goal of training delayed match to sample was to increase the delay between the sample and the comparison stimuli to 3 s. Prompting was broken down into 5 levels where the delay between the sample and comparison stimuli was systematically increased. The five levels were simultaneous matching, immediate delay, 1-s delay, 2-s delay, and 3-s delay. The criteria to increase a level was 8 out of 9 correct for a block of trials at any prompt level, and the criteria to decrease a prompting level was 2 consecutive errors or 3 total errors during one session. As in Experiment 1, each session consisted of 9 total trials, reinforcers were selected using a brief preference assessment, and reinforcers were delivered on a continuous schedule of reinforcement for correct responses. During training, if a student had an incorrect response, the materials were removed for 5 s and the trial was presented again with full manual guidance.

A within session prompting hierarchy was used in order to make training more efficient. There were 6 prompting levels. The hierarchy started with an immediate point cue, faded to a 1-s delay and continued all the way up to a 5-s delay. If a participant made 3 consecutive correct responses, then the prompt level was increased. The criterion to decrease a level was 2 consecutive incorrect responses. Criteria for mastery of delayed matching was 8 out of 9 correct across 3 novel and untrained sets of stimuli.

*Video Modeling Probes.* Once a participant met criteria for mastery on a successive discrimination skill, a video modeling probe was conducted in order to determine if performance on

video modeling increased as a result of training delayed matching. After completing training, the participant was shown a novel video modeling task (i.e. building a monster, making a sandwich, or constructing a dog). This was done in order for acquisition of video modeling to be attributed to acquisition of successive discrimination and not to multiple exposures to the same video modeling task. High scores on multiple novel video modeling structures would demonstrate generalized video modeling performance.

### *Delayed Imitation Training*

The goal of training delayed imitation was to increase the delay between the experimenter's modeled action with an object and the participant's imitation of that modeled action to 3 s. A correct independent response was defined as the student independently imitating actions after a 3 s delay interval between the model by the experimenter and the presentation of materials to the student. Prompting was broken down into 5 different levels in which the delay between the sample and comparison stimuli was systematically increased. The five levels included: immediate presentation of materials, brief removal of the items (less than 1 s), 1-s delay, 2-s delay, and finally a 3-s delay between the modeled actions and the presentation of the materials.

The criteria to increase or decrease a level, the criteria to increase or decrease a prompt, and the consequences for correct and incorrect responses remained the same as the delayed matching protocol. Once the participant demonstrated 8/9 independent correct responses across 3 novel and untrained sets of stimuli, then delayed imitation was considered mastered.

## Results

In baseline, Cameron's performance was variable with scores of (0/8, 0/8) with Guy B, (8/8, 5/8) with Guy A, and (6/8, 5/8) with Guy E. His average percent of correct independent responses was 50% (24 correct steps out of 48 steps) in baseline. Cameron did not participate in delayed matching training; he acquired delayed matching through contact with regular instruction. After he met the

mastery criteria of 8/9 correct across 3 novel and untrained sets of stimuli, a video modeling probe was conducted. Cameron scored (8/8, 8/8) with Guy F, (4/8, 8/8) with Guy B, and (8/8, 8/8) with Guy E. Cameron's performance improved from 50% in baseline to 91.7% (44 correct steps out of 48 steps) after mastery of delayed matching to sample. The results for Cameron are depicted in Figure 1 (top graph).

During baseline, Andy also showed variable performance, similar to Cameron. The number of correct responses for Andy were (4/8, 8/8) with Guy B, (4/8, 6/8) with Robo-Dog, (8/8, 8/8) with Guy E, and (4/8, 4/8) with the Hamburger. The average percent correct during baseline was 71.9% (46 correct steps out of 64 steps) for Andy. Andy was then trained delayed match to sample. The data from Andy's delayed matching training are depicted in Figure 2. It took Andy 14 sessions of delayed matching training to master the first set of the delayed matching stimuli. Andy subsequently demonstrated 8/9 correct across 3 novel and untrained sets of stimuli in the delayed matching protocol. After delayed matching training, Andy's performance on video modeling probes increased to (8/8, 8/8) for Robo-Pup, (7/8, 7/8) for Fruit Salad, and (8/8, 8/8) for Guy A. Andy's video modeling performance increased from 71.9% in baseline to 95.9% (46 correct steps out of 48 total steps) after training and is depicted in Figure 1.

Performance on video modeling probes for James is shown in Figure 3. The number of independent correct responses for James were (4/8, 2/8) with Guy B and (0/8, 2/8) with Guy E. In baseline, James correctly responded 25% of the time (8 correct steps out of 32 steps). James started the delayed matching training protocol, but made no progress across 12 consecutive sessions and as a result the training was terminated. After demonstrating mastery of delayed imitation training James' video modeling performance was (3/8, 3/8) for Guy F, (2/8, 3/8) for Robo-Dog, and (0/8, 1/8) for the Hamburger. James' average score on video modeling was 25% (12 correct steps out of 48 steps) after training.

Nick's video performance is depicted in Figure 3. Nick's baseline performance for video modeling was (1/8, 5/8) for Guy B and (0/8, 2/8) for Guy A. The average correct during baseline was 25% correct (8 correct steps out of 32 steps). After demonstrating mastery of delayed matching, Nick was then assessed twice on Guy F and scored (5/8, 0/8) on the first probe and (6/8, 0/8) on the second probe. His average video modeling performance increased slightly to 31.2% (10 correct out of 32 opportunities). Delayed matching on the computer screen was then trained to Nick since this skill more similarly resembles the topography of the video modeling assessment. After mastering delayed matching on the computer, Nick scored (2/8, 1/8) on Guy F, which is 18.8% average correct in video modeling performance. Delayed imitation was the last skill Nick was trained. After mastering this skill his performance decreased to (1/8, 0/8) with Guy B, (1/8, 0/8) with Guy A, and (0/0, 0/0) with the Robo-Dog giving him an average video modeling performance of 4.2% (2 correct steps out of 48 steps).

### Discussion

In the second experiment the students not demonstrating learning through video modeling, and displaying low performance on successive discrimination were trained either delayed matching or delayed imitation skills. For 2 of the participants this resulted in an increase in learning through video modeling, but for 2 other participants this was not the case and video modeling performance did not change. The results of this study suggest a potential relationship between successive discrimination tasks and learning through video modeling. In addition, the current data indicate that delayed imitation may also be a prerequisite for learning through video modeling, as demonstrated by the increased video modeling scores for Cameron and Andy after successive discrimination training.

In the first experiment, 8 out the 12 students assessed learned through video modeling and had high performance scores on all prerequisite skills. More importantly the students demonstrating learning through video modeling also demonstrated successive discrimination skills (i.e. delayed

imitation and delayed matching). These 8 participants confirm our hypothesis that delayed matching may be a prerequisite for video modeling since they had high scores on all skills assessed including video modeling. Four of the 12 participants from Experiment 1 did not demonstrate learning through video modeling. The results from Experiment 1 replicate the findings of Teresko et al. (2007) which found that successive discrimination may be prerequisite skills for learning through video modeling since participants with low performance scores on delayed imitation and delayed matching also did not learn through video modeling.

The four students who did not demonstrate mastery of learning through video modeling were Cameron, Andy, James and Nick. All of these students had low scores on delayed imitation, and three did not display delayed matching performance during assessments. Performance on video modeling probes increased for Cameron and Andy after training delayed matching. Cameron and Andy both had average video modeling scores above 50% correct while James and Nick demonstrated an average 25% correct in their baseline video-modeling assessments. There appear to be two groups of students with profiles that could potentially predict the effectiveness of successive discrimination training. This then may suggest that delayed matching training for participants with emerging skills above 50% may be more effective at increasing video modeling performance than participants with video modeling scores below 25% correct.

When further examining the distinction between Cameron and Andy as a separate group from James and Nick, there are clear diagnostic differences. The Core Skills Assessment at The New England Center for Children is a yearly evaluation administered to every student at the participant's service program. Each skill is assessed on a scale from 1 to 5, with the highest number of 5 representing mastery of the skill. A low score represents deficits within that area. It includes 48 different skills that the center considers essential to student success. The results of Andy's and Cameron's Core Skills Assessment are as follows; receptive language (Andy 5, Cameron 5) expressive

language (Andy 5, Cameron 5) and object imitation (Andy 5, Cameron 5). Nick and James have significantly lower scores for receptive language (Nick 2, James 1), expressive language (Nick 2, James 1) and object imitation (Nick 3, James 2). When comparing the most recent Core Skills Assessment for the two groups there are distinct differences in the areas of receptive language, expressive language, and object imitation. The students with high Core Skills results showed improved video modeling performance after successive discrimination training, while the students with lower Core Skills results did not.

The distinction between the two groups of students in the current study is consistent with Sherer and Schreibman (2005), who examined profiles of students to predict success with a pivotal response training procedure. They determined that children with pretreatment responder profiles demonstrated positive changes as a result of the treatment procedure while students with nonresponder profiles showed no change in behavior after treatment. Our current results confirm the notion that behavioral profiles may help to predict effectiveness of training procedures. In order to determine if the behavior profiles found within the current study are predictors of successful successive-discrimination training, more studies replicating the behavioral profiles found in this study are necessary.

Another factor requiring future research is the characteristics of the delayed matching and the delayed imitation protocols. For example, in delayed imitation training only 2 items were placed on the table at a time. This requires the student to attend to only the action being demonstrated and did not require the student to attend to which materials are being used in the model. It may not reflect the harder discrimination skills inherent in the video modeling assessment. In the video modeling assessment, 8 stimuli were presented to the student in a non-linear array, and the student was required to place each piece in a specific sequence to be considered correct. A more successful delayed imitation procedure may be one with distracter items on the table, which would require the student to perform an action with only two of the objects. The student would have to scan all the materials on the table and

perform the action with only the specified materials.

There is another possible characteristic of the delayed matching procedure that may have contributed to James and Nick demonstrating no change in video modeling performance. It is possible that the 3-s delay interval was not a long enough interval to significantly improve their video modeling scores. In video modeling, the retention interval, which is the duration of the video and the time the materials are presented to the student, is typically longer than the 3-s delay that was trained in this experiment. Lastly, another variable in the delayed imitation that may alter the effectiveness of training is increasing the amount of actions performed in the imitation task. The delayed imitation task in the current study required the participant to perform only one action (i.e. putting a call in a cup, or closing a book). Since the video modeling task involves multiple steps to complete, requiring the student to perform multiple imitations in the delayed imitation tasks more closely resembles the skills necessary in the video modeling task. Future research examining the effectiveness of different successive discrimination trainings (i.e. increasing the delay interval, placing more than 2 objects on the table, and increasing the amount of steps in delayed imitation) is warranted. This research is also applicable for individuals with baseline video modeling scores of 25% or lower since video modeling scores did not improve after delayed matching training.

One disadvantage to this study is that the different levels of each video modeling task were not assessed. All the video modeling tasks required 8 steps to complete, and were determined to be of equal difficulty by the experiment but there was no systematic evaluation to determine difficulty of the task. This is a disadvantage because the scores of the video modeling assessments may have been more variable as a result. It was necessary to use multiple sets of video modeling stimuli in order for each student to demonstrate generalized video modeling performance, but a systematic evaluation of the difficulty of each task would have strengthened the results of this experiment.

Another limitation to this study is that only one student, Andy, increased video modeling

performance as a result of successive discrimination training. Cameron's video modeling performance did increase after mastery of delayed matching, but contact to his natural environment. Since only one student's training successfully increased their video modeling scores as a result of successive discrimination, future research is warranted on variables affecting video modeling performance especially with participants scoring lower than 25% correct independent responses in video modeling assessments.

By exploring the relation between video modeling performance and delayed matching, it was determined that delayed matching is a prerequisite skill for learning through video modeling. The successive discrimination training used in this study increased video modeling performance for some of the participants. The delayed matching protocol used in the current study is just one type of successive discrimination training, which has been historically used to measure and assess memory. Deficits in memory occur more frequently with individuals diagnosed with an Autism Spectrum Disorder (Hauck, Fein, Maltby, Waterhouse & Feinstein, 1998) and researchers in the field should be more focused on strategies to improve the memory of individuals within this population. The impact of successive discrimination training has not been fully explored and deserves more attention due to its potential impact on the overall academic and social development of children diagnosed with an autism spectrum disorder.

## References

- Bandura, A. (1977) Self Efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191 – 215.
- Charlop-Christy, Le and Freeman (2001) A comparison of Video Modeling with In Vivo Modeling for Teaching Children with Autism. *Journal of Autism and Developmental Disorder*, 30 (6), 537 – 552.
- Charlop, M. H., & Milstein, J. P. (1989) Teaching autistic children conversational speech using video modeling. *Journal of Applied Behavior Analysis*, 22, 275-285.
- Conyers, C., Miltenberger, R. G., Peterson, B., Gubin, A., Jurgens, M., Selders, A., Dickinson, J., & Barenz, R. (2004). An evaluation of in vivo desensitization and video modeling to increase compliance with dental procedures in persons with mental retardation. *Journal of Applied Behavior Analysis*, 37, 233-238.
- Cooper, J.E., Heron, T. E., & Heward, W. L. (2007) *Applied behavior analysis* (2<sup>nd</sup> ed.). Upper Saddle River, NJ: Pearson Education.
- Constantine, B., & Sidman, M. (1975) The role of naming in delayed Matching-to-Sample protocol. *American Journal of Mental Deficiency*, 79(6), 680 -689.
- Dawson, G., & Osterling, J. (1997) Early Intervention in Autism. *Early language: Acquisition and intervention* (pp. 139-168). Baltimore: University Park Press.
- Hauck, M., Fein, D., Maltby, N., Waterhouse, L., & Feinstein, C. (1998) Memory for Faces in Children with Autism. *Child Neuropsychology*, 4(3), 187 – 198.
- Janelle, C. M., Champenoy, J. D., Coombes, S. A., & Mousseau, M. B. (2003) Mechanisms of intentional cueing during observational learning to facilitate motor skill acquisition. *Journal of*

*Sports Sciences, 21*, 825-838.

- 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.
- Nikopoulous, C. K., & Keenan, M. (2004). Effects of video modeling on social initiations by children with autism. *Journal of Applied Behavior Analysis, 37*, 93-96.
- McCoy, K., & Hermansen, E., (2007) Video Modeling for Individuals with Autism: A review of Model Types and Effects. *Education and Treatment of Children. 30 (4)*, 183 – 213.
- Morgan, R. L. & Salzberg, C. H. (1992) Effects of video-assisted training on employment-related social skills of adults with severe mental retardation. *Journal of Applied Behavior Analysis, 25*, 365-383.
- Sargisson, R. J. & White, G. (2001). Generalization delayed matching to sample following training at different delays. *Journal of Experimental Analysis of Behavior, 75*, 1-14.
- Sherer, M., Pierce, 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 – 157.
- Sherer, M.R., & Schriebman, L. (2005) Individual Behavioral Profiles and Predictors of Treatment Effectiveness for Children with Autism. *Journal of Consulting and Clinical Psychology, 73 (3)*, 525 – 538.
- Spradlin, J. E., & Brady, N. C. (1999) Early childhood autism and stimulus control. In P.M. Ghezzi, W. L. Williams, & J. E. Carr (Eds.), *Autism: Behavior analytic perspectives* (pp. 49 – 65). Reno, NV: Context Press.
- Tereshko, L, MacDonald, R., & Ahearn, W. (2007) Strategies for Teaching Children with Autism to

Imitate Response Chains Using Video Modeling. Unpublished master's thesis. Northeastern University, Boston Massachusetts, United States of America.

Weiss, M.J., & Harris, S.L. (2001). *Reaching out, joining in: Teaching social skills to young children with autism*. Bethesda, MD: Woodbine House, Inc.

Assessment	Discriminative Stimulus	Experiments Behavior	Stimuli Used
<b>Motor Imitation</b>	Do this	Example: Clap hands	9 different gross motor imitations
<b>Actions with objects</b>	Do this	Do a 1-step task such as, put a fork in a cup	A cup, fork, ball, cup, plate, spoon used for 9 different 1-step actions
<b>Motor Skills</b>	Do this	Example: Put a Megablock in another Megablock	7 Different Megablocks pieces
<b>Delayed Imitation</b>	Do this	Do a 1-step task such as put a fork in the cup. Remove the items from the table and wait 3 seconds before giving the student the materials	A cup, fork, ball, cup, plate, spoon used for 9 different 1-step actions
<b>Picture to Object</b>	None	Place 3 comparison objects and a picture of one identical object as the sample on the table	A cup, fork, ball, cup, plate, spoon and identical pictures of these items
<b>Delayed Picture to Object</b>	None	Present a picture for 3 seconds, remove picture and wait 3 seconds before presenting 3 object comparisons	A cup, fork, ball, cup, plate, spoon and identical pictures of these items
<b>Computer Picture to Object</b>	None	Present computer sample and place 3 objects in front of the computer	A cup, fork, ball, cup, plate, spoon and identical images of these items on the computer
<b>Delayed computer Picture to Object</b>	None	Present computer sample for 3 second, remove and wait seconds before presenting 3 object comparisons	A cup, fork, ball, cup, plate, spoon and identical images of these items on the computer
<b>Attending to a Preferred Video</b>	It is time to watch a movie	Present student with highly preferred video for 3 minutes	Prompt student to sit in chair

Table 1.

The discriminative stimulus and the experimenter's behavior during Experiment 1.

<u>Participants</u>	<u>Motor Imitation</u>	<u>Actions with Object</u>	<u>Motor Skills</u>	<u>Picture to Object</u>	<u>Computer Screen to Object</u>	<u>Attend to Video</u>	<u>Delayed picture to Object</u>	<u>Delayed Computer to Object</u>	<u>Delayed Imitation</u>	<u>Video Model</u>
<b>Hannah</b>	9/9	9/9	9/9	18/18	18/18	18/18	16/18	16/18	N/A	8/8
										8/8
<b>Craig</b>	9/9	9/9	9/9	18/18	17/18	18/18	16/18	16/18	N/A	8/8
										8/8
<b>Ike</b>	9/9	9/9	9/9	18/18	18/18	18/18	18/18	16/18	N/A	8/8
										8/8
<b>Katie</b>	9/9	9/9	9/9	17/18	18/18	18/18	17/18	17/18	N/A	8/8
										8/8
<b>Sam</b>	9/9	9/9	8/9	18/18	18/18	18/18	16/18	14/18	7/9	8/8
										8/8
<b>Paul</b>	9/9	9/9	9/9	18/18	18/18	17/18	16/18	16/18	9/9	8/8
										8/8
<b>Ernie</b>	9/9	9/9	9/9	18/18	18/18	18/18	14/18	18/18	9/9	8/8
										6/8
<b>Maggie</b>	9/9	9/9	9/9	14/18	17/18	17/18	17/18	17/18	7/9	6/8
										8/8
<b>Nick</b>	9/9	7/9	9/9	17/18	18/18	15/18	9/18	10/18	1/9	1/8
										5/8
<b>James</b>	9/9	7/9	7/9	17/18	16/18	17/18	6/18	4/18	2/9	0/8
										2/8
<b>Andy</b>	9/9	8/9	9/9	14/18	17/18	17/18	15/18	13/18	6/9	4/8
										8/8
<b>Cameron</b>	9/9	9/9	8/9	18/18	18/18	18/18	15/18	15/18	5/9	0/8
										0/8

Shaded boxes display the participant's depict skills.

Table 2.

Summary data for the pre-assessments.



Toy A



Toy B



Toy C



Toy D

## Appendix 1

MegaBrand<sup>®</sup> Toy Constructs used in Video Modeling Assessments.

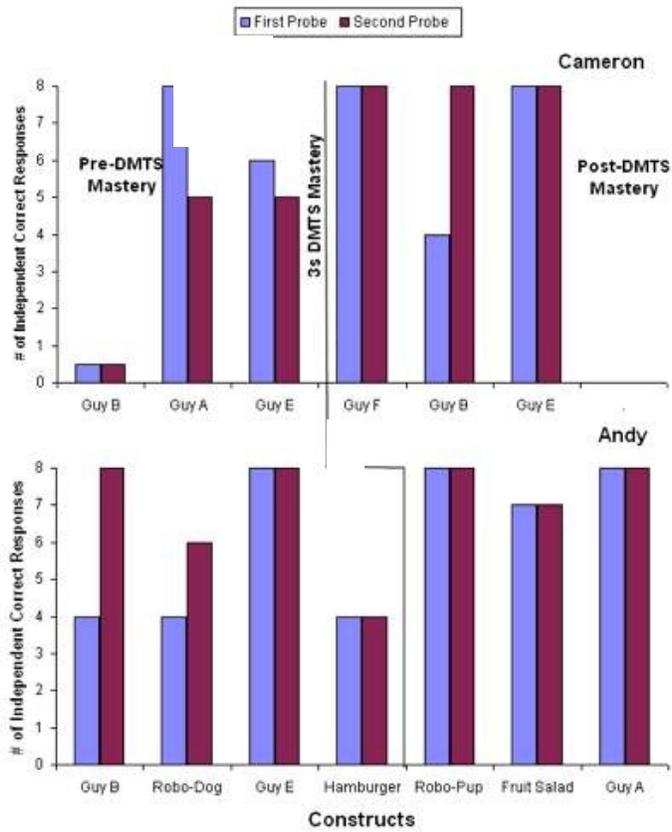
## Figure Captions

*Figure 1.* Successive Training and Video modeling data for Cameron and Andy.

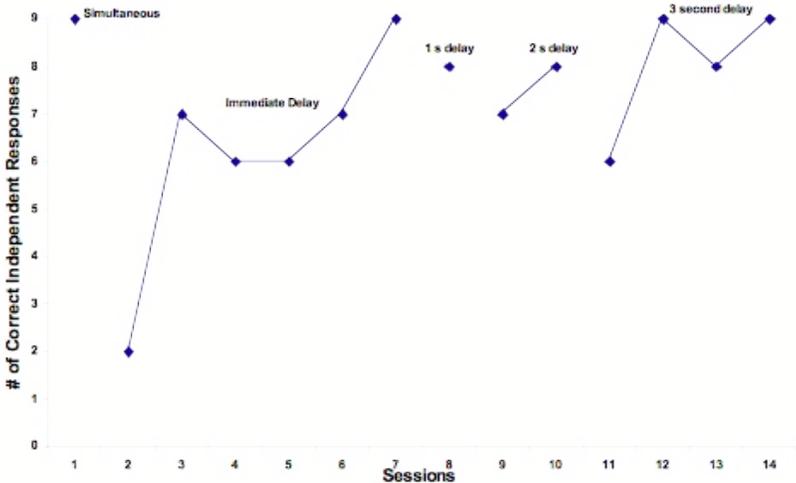
*Figure 2.* Andy's Delayed Matching Training to Mastery for Stimuli Set 1.

*Figure 3.* Successive Training and Video modeling data for James and Nick.

## Number of Independent Steps Completed in Video Modeling Probes



Delayed Matching Training for Andy



### Number of Independent Steps Completed in Video Modeling Probes

