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**A Comparison of Methods for Teaching Object Imitation:
In-Vivo versus Video Modeling**

A Thesis Presented

by

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The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

for the degree of

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in the field of

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Running head: TEACHING OBJECT IMITATION

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In-Vivo versus Video Modeling**

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Submitted in partial fulfillment of the requirements for the degree of
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Abstract

The rate at which a 2-year-old child with an autism spectrum disorder acquired imitation of actions with objects was compared across two instructional formats: video modeling (VM) and in-vivo modeling (IM). Four sets of four stimuli were organized into 2 x 2 instructional matrices. Each set was composed of 2 actions with objects to be taught and 2 to be tested subsequently for recombinative generalization (RG). Two stimulus sets were taught using a video model, and 2 stimulus sets were taught using an in-vivo model. Both instructional formats were effective. In the first pair of stimulus sets IM led to quicker acquisition and better RG, and there was no difference between effects of the two modeling strategies on maintenance and stimulus generalization (across model types). In the second pair of stimulus sets, VM led to quicker acquisition and better RG, and IM led to better maintenance and stimulus generalization.

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A Comparison of Methods for Teaching Object Imitation: In-Vivo versus Video Modeling

Imitation can be described as any behavior that follows the behavior of a model, where the topography of the behavior is functionally controlled by the topography of the model's behavior (Baer, Peterson, & Sherman, 1967). Imitation emerges early in typically developing children and appears to play an important role in the development of social and cognitive skills (Ingersoll & Schreibman, 2006) as well as language (Young, Krantz, McClannahan, & Poulson, 1994). Imitation is deficient in children with autism spectrum disorders (ASDs), and such deficits in imitation skills in young children can interfere with the acquisition of more complex behavior such as play skills (Ingersoll & Schreibman, 2006). It has been established that imitation is an important skill, but there has been little research investigating the best way to teach it. In the review of literature that follows there will be a discussion of two innovations in behavioral education for children with ASDs, video modeling and matrix training, and a consideration of how these may enhance imitation skills.

Approaches to Teaching Imitation

Various methods have been implemented for teaching imitation. Baer et al. (1967) used in-vivo modeling to teach motor and object imitation (e.g., putting on a hat, tapping the table,) to children with mental retardation. They taught imitation tasks by saying "do this" and demonstrating the behavior; and utilizing a most-to-least prompting hierarchy. This procedure resulted in the acquisition, generalization, and maintenance of imitation skills for all participants. In a different approach, Ingersoll and Schreibman (2006) taught imitation using a naturalistic behavioral intervention called reciprocal imitation training (RIT). RIT consisted of the experimenter imitating the participant's actions as well as providing a running commentary of the experimenter and participant's actions. The experimenter repeatedly modeled actions, and if

the participant didn't imitate the action after the third model they were physically prompted to do so. This procedure led to significant increases in rate of imitation for all participants. Another well-established method for teaching children with ASDs is video modeling (Charlop-Christy, Le, and Freeman, 2000). This method, however, has not been used to teach simple imitation tasks.

Video modeling is the presentation of a video of a model engaging in a target behavior; the learner watches the video, and then imitates (or is prompted to imitate) the actions displayed in the video. Imitation appears to be an important prerequisite to learning through video modeling. A study by Tereshko, MacDonald, and Ahearn (in press) showed that children were more likely to learn through the use of video modeling if they demonstrated certain prerequisite skills. A few of the suggested prerequisites to learning through video modeling are generalized imitation, motor imitation with objects, and attending to a video.

Many studies have found video modeling to be effective in teaching a wide variety of behaviors to children with ASDs. Video modeling is utilized in teaching various adaptive behaviors (such as conversational speech, meal preparation, play sequences, and self-care skills; Sigafoos et al., 2005). According to Charlop-Christy et al. (2000), the use of video modeling provides a reliable and consistent treatment method because the video presents an identical demonstration of the target behavior each time it's viewed. Charlop-Christy et al. (2000) compared video modeling and in-vivo modeling for teaching social skills and daily living skills to children with autism and found that for 4 out of 5 of the participants, the tasks were acquired more quickly in the video modeling condition than in the in-vivo condition. Murzynski and Bourret (2007) compared video modeling combined with least-to-most intrusive prompting and least-to-most prompting alone in teaching daily-living skills. The results of the study showed that

participants acquired the daily living skills taught with video modeling combined with least-to-most prompting in fewer trials and with fewer prompts than skills taught with least-to-most prompting alone. Video modeling has proven to be an effective tool for teaching a variety of skills; perhaps the use of video modeling could also assist in the teaching of simple imitation skills.

Another advancement in behavioral education for children with ASDs is matrix training (Gouldstein & Mousetis, 1989). Matrix training is an instructional strategy that has been shown to be an effective and efficient means of teaching stimulus relations to in teaching children with ASDs (Dauphin, Kinney, & Stromer, 2004; Kinney, Vedora, & Stromer, 2003). Matrix training is an instructional strategy which organizes stimuli in such a way that a few relations are trained and the emergence of responding to untrained stimulus combinations is later tested (Axe, 2008). According to Dauphin et al., “as learners progress through matrix training protocols, they begin to respond appropriately to novel, untrained antecedent conditions by recombining learned performances” (p. 239). This demonstration of novel arrangements of previously established units is termed recombinative generalization (Goldstein & Mousetis).

Gouldstein and Mousetis (1989) investigated the conditions that contribute to observational learning of generalized language. They created a matrix of words that referred to objects, actions, and locations to teach participants to combine known words into two- and three-word utterances (e.g., penny under bed, comb on couch, etc.). They found that arranging presentations of stimuli using a matrix-training strategy resulted in recombinative generalization. Participants were taught to combine known words into two- or three-word phrases (e.g., “button on rug” and “balloon under TV”); this led to the participants making new combinations without direct teaching (e.g. “button on TV”). In another experiment using a matrix training strategy,

Dauphin et al. (2004) created a 3x3 instructional matrix which defined nine activities to be completed involving combinations of three objects and three actions (e.g., “dog take a drink,” “mom is eating breakfast,” etc.). The activities were presented as computer schedules with video models of what to do and say with certain figurines. For every activity that was taught directly, nearly two additional activities also occurred. Matrix training has also been used to teach more traditionally academic skills. Kinney et al. (2003) organized spelling words into a teaching matrix. Some spelling words from the matrix were taught and others were tested for recombinative generalization. Direct teaching of nine words (three words from three different matrices) led to correct spelling of the 18 other words without direct teaching. Given these successes, matrix training may be an effective strategy for teaching generalized object imitation to children with ASDs.

Imitation appears to play an important role in the development of social skills, cognitive skills (Ingersoll & Schreibman, 2006), and language development (Young et al., 1994). Children with ASDs show deficits in imitation skills (Ingersoll & Schreibman), and therefore it is imperative that effective methods for teaching imitation be identified. The purpose of this study was to investigate effective and efficient strategies for teaching imitation to a young child with ASDs. Specifically, effects of video modeling versus in-vivo modeling on rate of acquisition of object imitation were compared, and acquisition was followed by tests for stimulus and recombinative generalization.

Method

Participants

The participant for this study was Kate, a 2-year-old girl who was diagnosed with an ASD, and received home-based behavioral education services (28 hours per week). She was

selected as a participant because her case-manager reported she showed interest in videos and did not demonstrate a generalized imitation repertoire.

Setting and Materials

All sessions were conducted in the participant's home, in a room equipped with a video camera and a table with two chairs. Materials included object imitation stimuli, preferred edibles, and a laptop with PowerPoint© (in video modeling sessions). All edibles were previously used as reinforcers during home-based therapy and were identified as preferred in parent and teacher reports. Videos presented in PowerPoint© were filmed from the perspective of the participant. They consisted of the experimenter stating, "do this," followed by a close-up of the experimenter's hands completing the action with the object. The final image (e.g. crayon covered by cloth) was displayed on the screen for 5 s at the end of each video clip.

Experimental Design

The participant was exposed to baseline and training conditions in an alternating-treatments design. This design was replicated with two additional stimulus sets in a multiple-probe design. The rate of acquisition with video modeling vs. in-vivo modeling was compared.

Procedure

Baseline. All object-action combinations designated for teaching and testing were presented in baseline sessions. Prior to each session Kate was presented with two highly preferred edibles; the selected edible was delivered paired with verbal praise contingent on either a correct response or on approximately every third trial for good session behavior (quiet voice and eye contact). Baseline sessions in the video modeling condition consisted of the experimenter sitting next to the child and presenting the video. The experimenter placed the objects corresponding to the video clip on the table in front of Kate (to the right of the laptop and

within arms reach), then observed to ensure that she was attending to the video. If Kate was not facing the video, the experimenter modeled appropriate session behavior (sitting up straight with hands in own lap) and waited for Kate to face the video. The experimenter then played the video clip. Any attempts to touch the stimuli or laptop were blocked while the clip was playing. The experimenter waited 5 s after each object-action combination was presented. No prompting was delivered during baseline sessions. If no response occurred in 5 s, the stimuli were removed and the next trial was presented. Correct responses were defined as the participant imitating the action with the object with the same topography as the model. Response definitions are displayed in Table 1.

The baseline for in-vivo modeling was the same as baseline for video modeling with the following exceptions: stimuli were placed on the table within arms reach of the experimenter and participant; the experimenter waited for attending, stated, “do this,” then demonstrated an action with an object; and attending was defined as Kate placing her hands in her lap while making eye contact with the experimenter. If Kate was not attending prior to a trial, the experimenter modeled appropriate session behavior (sitting up straight with hands in own lap) and waited for Kate to attend.

Each baseline session consisted of eight trials from a single stimulus set (2 trials of each of four trial types in that stimulus set). All object-action combinations designated for testing and teaching (for all stimulus sets) were presented at least two times in the baseline condition, and one to four sessions were run per day.

Training. The training condition was identical to the baseline condition except: (a) when the video clip or in-vivo model ended, a most-to-least prompting hierarchy was used to prompt the participant to complete the task, (b) only the trial types designated on the matrix for teaching

were presented during the training condition, (c) one session consisted of 8 trials (each of the two teaching trial types were presented 4 times in a session) and (d) two to six sessions were run per day.

Trial types and prompting. Four stimulus sets were trained. See Table 1 for a list of the stimuli and definitions of correct responses. See Figure 1 for a display of stimulus sets and object-action combinations to be trained and tested. Stimulus sets 1 and 2 were trained first. Once the mastery criteria were met for sets 1 and 2, stimulus sets 3 and 4 were trained. Sets 1 and 3 were trained using in-vivo modeling and sets 2 and 4 were trained using video modeling.

A most-to-least prompting hierarchy was used; this hierarchy was selected based on prior use in home-based therapy. The prompting hierarchy consisted of three prompt types: immediate full manual guidance, immediate light physical guidance, and immediate shadow. Full manual guidance consisted of the experimenter placing their hand(s) directly over Kate's hand(s) to prompt Kate to complete the task; light physical guidance consisted of the experimenter prompting Kate, at her forearm, to complete the task; and a shadow prompt consisted of the experimenter placing their hands near Kate's hands and moving their hands (without touching Kate) in the manner necessary to complete the task. Every seventh and eighth trial in a session were probe trials – on these trials a shadow prompt was used. If Kate began to respond incorrectly, the experimenter provided the minimally intrusive prompt necessary to have Kate complete the task and recorded an incorrect response. The criterion to reduce prompt intrusiveness was two sets of 6/6 correct responses at the current prescribed prompt level. Prompt intrusiveness also was reduced if both probe trials were correct (with shadow prompt). The criterion to increase prompt intrusiveness was two consecutive incorrect responses or three incorrect responses in a session (not including probe trials). Praise and an edible item were

delivered after each correct response. After incorrect responses, the materials were removed for 1 to 5s and the next trial was presented. In-vivo and video modeling sessions alternated. The first session of each day was usually a different type from the first session of the previous day (i.e. if the first session on Tuesday was video modeling, then the first session on Wednesday was in-vivo). A stimulus set was tested for mastery after two consecutive sessions with 7/8 or more correct responses at the shadow prompt level. Mastery criteria were met when the participant responded independently in at least 7/8 trials for two consecutive sessions.

Recombinative-generalization probes. Once mastery criteria were met for each stimulus set, probes for recombinative generalization were conducted. For each set, the two untrained actions with objects from the matrix were presented a total of eight times each (across two sessions of 8 trials). No prompting was delivered, and verbal praise and edibles were delivered for correct responses.

Stimulus-generalization probes. After the teaching trials in all four stimulus sets were mastered and all recombinative-generalization probes were completed, probes for stimulus (model modality) generalization were conducted. Stimulus sets which were taught using video modeling (1 and 3) were tested using in-vivo modeling, and stimulus sets which were taught using in-vivo modeling (2 and 4) were tested using video modeling. No prompting was delivered, and verbal praise and edibles were delivered for correct responses.

Maintenance probes. Maintenance probes were conducted following recombinative- and the first set of stimulus-generalization probes. For these probes, the previously mastered stimulus sets were re-presented to test for maintenance.

Interobserver Agreement

Forty four percent of sessions were video-taped. Two observers separately and independently scored the tapes for interobserver agreement (IOA). IOA was calculated by dividing the number of agreements by the sum of the agreements and disagreements, then multiplying by 100. IOA was scored for 44% of all sessions with an agreement of 95% (range of 93% - 100%). Sessions scored for IOA were distributed across the four stimulus sets and included 61% of baseline sessions(100% agreement), 43% of training sessions (93% agreement), and 40% of probe sessions (stimulus-generalization probes, maintenance probes, and recombinative-generalization probes; 97% agreement).

Results

Results are displayed in Figure 2. The top panel of Figure 2 shows the number of independent correct responses during baseline and training for stimulus sets 1 and 2. All baseline sessions included both model modalities. The diamonds display the data from in-vivo modeling sessions (set 1 and 3) and the circles display the data from video modeling sessions (set 2 and 4). The white circles and squares represent the baseline sessions run with recombinative generalization stimuli. Accuracy was low in baseline sessions. The types of errors that occurred included not responding and placing an item on top of another item. For set 1 accuracy was 0/8 and 0/8 for the object-action combinations to be trained and 0/8 and 0/8 for the recombinative generalization stimuli. For set 2 accuracy was 1/8 and 1/8 for the object-action combinations to be trained and 1/8 and 0/8 with the recombinative generalization stimuli.

In the training condition for stimulus sets 1 and 2, Kate met the mastery criteria in the in-vivo modeling condition in seven sessions and in the video modeling condition in eight sessions. When recombinative-generalization probes were conducted, Kate responded independently in

4/8 and 4/8 trials in the video modeling condition compared to 8/8 and 7/8 trials in the in-vivo condition. Maintenance probes (video modeling: 6/8, in-vivo modeling: 8/8) were followed by probes for stimulus generalization. For stimulus sets 1 and 2, Kate responded independently in 1/8 and 2/8 trials in the video modeling condition (taught with video modeling and tested with in-vivo modeling) and 2/8 and 1/8 in the in-vivo modeling condition (taught with in-vivo modeling and tested with video modeling). Due to low accuracy in stimulus generalization probes, maintenance probes were conducted to test for maintenance. Accuracy was high in the second set of maintenance probes (video modeling: 8/8 and 8/8, in-vivo modeling: 7/8 and 8/8). The stimulus generalization probes were conducted a second time, and accuracy was high (video modeling: 7/8 and 8/8, in-vivo modeling: 8/8 and 7/8).

The bottom panel of Figure 2 shows the number of independent responses during baseline and training for stimulus sets 3 and 4. Accuracy was low in baseline sessions. For set 3 Kate had an accuracy of 0/8, 0/8, 0/8, and 0/8 for object-action combinations to be trained and 0/8 and 0/8 for with the recombinative generalization stimuli. For set 4 she had an accuracy of 0/4, 0/4, 0/8, and 0/8 for the object-action combinations to be trained and 0/8 and 0/8 with the recombinative generalization stimuli. All baseline sessions included both model modalities. Initially in set 4, accuracy was higher with a put in box action. The action was replaced with a different action (cover with cloth); baseline data displayed in Figure 2 represent only the object-action combinations trained.

In the training condition for stimulus set 3 and 4, rate of acquisition was more rapid with the video-modeling condition. Kate met the mastery criterion in the in-vivo modeling condition in 24 sessions and the video modeling condition in 16 sessions. When recombinative-

generalization probes were conducted, Kate responded independently in 7/8 and 8/8 trials in the video modeling condition and 7/8 and 5/8 in the in-vivo condition.

Probes for stimulus generalization were conducted for stimulus sets 3 and 4. For the first probes, accuracy was low across both stimulus sets. For stimulus sets 3 and 4, Kate responded independently in 4/8 and 2/8 trials in the video modeling condition (taught with video modeling and tested with in-vivo modeling) and 3/8 and 6/8 in the in-vivo modeling condition (taught with in-vivo modeling and tested with video modeling). Then, maintenance probes were conducted (video modeling: 4/8 and 7/8, in-vivo modeling: 8/8 and 8/8). Following maintenance probes, probes for stimulus generalization were conducted a second time. The mastery criterion was met for both stimulus sets (video modeling: 8/8 and 7/8, in-vivo modeling: 7/8, 8/8).

Discussion

Children with ASDs show deficits in imitation, a skill that plays an important role in the development of social skills, cognitive skills, and language (Ingersoll & Schreibman, 2006; Youn et al.). Because deficits in imitation may be the root of difficulties with social learning, it is important to find the best strategy for teaching imitation. This study extended work on video modeling and matrix training – two instructional strategies that have proven effective in teaching skills and concepts to children with ASDs – to explore this issue.

In the present study both video modeling and in-vivo modeling were effective instructional approaches for teaching imitation of actions with objects to children with ASDs. In-vivo modeling led to quicker acquisition when the first two stimulus sets were trained, and video modeling led to quicker acquisition when the second two stimulus sets were trained. As displayed in Figure 3, the results also varied during probe trials: in stimulus sets 1 and 2 Kate showed better recombinative generalization with in-vivo modeling and in stimulus sets 3 and 4

she showed better recombinative generalization with video modeling. Following recombinative-generalization probes for all stimulus sets, stimulus-generalization probes were conducted. Kate responded with low accuracy in all four sets at first, and maintenance probes were conducted to ensure that she still would perform the actions taught in the training trials of previously mastered stimulus sets. Mastery criteria were met in these maintenance probes; and when the probes for stimulus generalization were conducted again, the mastery criteria were met. Further replication is required for determining what, if any, difference exists in the efficacy of the two strategies.

The results from the present study contribute to previous research in the area of video modeling, which has never been used as an instructional strategy for teaching imitation. For Kate, both video modeling and in-vivo modeling were effective instructional strategies for teaching imitation of actions with objects. These results differed from the results of Charlop-Christy et al. (2000), where video modeling led to faster acquisition for the majority of participants. The results may differ because the present study used prompting and reinforcement (whereas the former did not).

In contrast with Charlop-Christy et al. (2000), which found video modeling to be superior to in-vivo modeling for teaching new skills to young children with ASDs, in the current study, no consistent differences were found in the effectiveness of these two types of models. One possibility is that the two approaches were equally effective in teaching imitation of actions with objects to this participant. Another reason there was not one strategy that was consistently superior may be that there were differences across stimulus sets in the difficulty or complexity in the object-action combinations. For stimulus sets 1 and 2 the object-action combinations only required one hand to complete the tasks, and for stimulus sets 3 and 4 two of the object-action combinations required two hands. The object-action combinations requiring two hands (tap

Lego[®] and animal together and tap car and animal together) are displayed in Table 1. Tap Lego[®] and animal together was taught with in-vivo modeling and tap car and animal together was tested for generalization. It is possible that this slight increase in task difficulty led to slower acquisition with in-vivo modeling in stimulus set 3 (24 sessions to reach the mastery criterion compared to 16 with video modeling).

The difficulty with equating tasks may explain the differences between the two stimulus-set pairs. Murzynski and Bourret (2007) equated tasks based on number of steps in a task analysis. In the present study, however, it was more difficult to equate the tasks because one step object-action combinations were being trained. A possible solution to equating tasks can be found in a study by Libby, Weiss, Bancroft, and Ahearn (2008), where Lego[®] constructs were utilized. In an attempt to equate task difficulty and control for learning history, the Lego[®] structures constructed in the study were arbitrary and did not resemble real-life structures. The use of Lego[®] constructs could make equating tasks easier because they provide a control for difficulty and complexity. More within-subject replications are also necessary in determining the best model modality for teaching imitation of actions with objects. It would have been ideal to complete more replications in the present study, but the participant's school schedule did not allow for further replications.

The present study extends previous research on matrix training. This was the first study to utilize matrix training in teaching imitation, and it was an effective instructional strategy for teaching the skill. The results of the present study were similar to previous research in matrix training in that arranging presentations of stimuli using a matrix-training strategy resulted in recombinative generalization (Goldstein & Mousetis, 1989; Dauphin et al., 2004; Kinney et al., 2003). Kate showed recombinative generalization with actions and stimuli learned through both

video and in-vivo modeling. As displayed in Figure 1, eight relations were trained and seven relations emerged through recombinative generalization. The present study, an extension of matrix training into instruction on imitation, demonstrates that matrix training can be effectively used to teach a variety of skills, including generalized imitation.

Future research comparing the relative efficacy of video and in-vivo modeling should include multiple replications. Future research should also consider issues concerning task difficulty. Such issues could be addressed by counterbalancing across participants or equating the difficulty of the tasks as done by Libby et al. (2008). The use of a matrix training strategy to allow for the potential for the emergence of untrained performances should also be investigated. Investigating prerequisites is also important, and may identify which children will most benefit from video modeling vs. in-vivo modeling as an instructional strategy. The continuation of work by Tereshko et al. (in press) may lead to an assessment that helps clinicians decide which instructional strategy is appropriate for a particular student. Such an assessment could save time and would be superior to the arbitrary selection of an instructional strategy that may or may not be effective.

The present study extended video modeling and matrix training procedures and found video modeling, in-vivo modeling, and matrix training to be effective strategies for teaching object imitation to a young girl with an ASD. It is possible that there may be no real difference between video modeling and in-vivo modeling, or the differences may be idiosyncratic depending on the participant. Further replication of these procedures with additional students may help to clarify these inconsistent results and may lead to more efficient selection of effective teaching strategies to teach generalized imitation to young children with ASDs. As discussed earlier, children with ASDs show deficits in imitation and this may be the root of their

difficulties with social learning. Therefore, more research in the area of imitation is necessary because it is important to find the best strategy for teaching imitation.

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Table 1. Definitions of all actions with objects. All responses being taught and tested are defined.

Response	Definition
Put flag on plate	Pick up flag and place it on the plate. Response is correct if any part of the flag is on top of the plate.
Put flag in bowl	Pick up flag and place it in the bowl. Response is correct if the flag is placed in the bowl, then falls out of the bowl. (Example of incorrect response: placing the flag on the bowl)
Put ball in bowl	Pick up ball and place it in the bowl. Response is correct if ball bounces out of the bowl or falls out of the bowl after the participant places it in the bowl.
Put ball on plate	Pick up ball and place it on the plate. Response is correct if the ball rolls off of the plate after the participant places it on the plate.
Slide Little People® figurine next to book	Move figurine (with or without picking it up) in the direction of the book (Incorrect response: Slide book next to little people figurine).
Take Little People® figurine out of shoe	Take little person out of shoe (response is correct if participant takes figurine out of shoe but does not set it on the table).

Take pencil out of shoe	Remove pencil from shoe (response is correct is participant takes pencil out of shoe but does not set pencil on table).
Slide pencil next to book	Move pencil (with or without picking it up) next to the book. (Incorrect response: Slides book next to pencil).
Tap Lego® and animal together	Pick up one object in each hand and touch them together at least one time; response is correct if items are not lifted off the table.
Put Lego® under inverted cup	Place inverted cup over lego; response is correct if lego is not completely under cup (e.g. corner of lego is visible); response is correct if participant uses both hands to slide the lego under the cup or one hand to place the cup over the lego.
Tap car and animal together	Pick up one object in each hand and touch them together at least one time; response is correct if items are not lifted off the table
Put car under inverted cup	Place inverted cup over car; response is correct if car is not completely under cup (e.g. part of car is visible); response is correct if participant uses both hands to slide the car under the cup or one hand to place the cup over the car.
Cover fork with cloth	Pick up cloth and place it over fork; response is correct if any part of the fork is covered by the cloth

Push fork and spoon away

With one or both hands, push the objects any distance *away* from body. Incorrect response: participant picks up objects and throws them across the table.

Cover crayon with cloth

Picks up cloth and places it over crayon; response is correct if any part of the crayon is covered by the cloth

Push crayon and spoon away

With one or both hands, push the objects any distance *away* from body. Incorrect response: participant picks up objects and throws them across the table.

Note. A response was incorrect if the participant completed a different task before completing the imitation task or did not complete the task within 5 seconds.

Figure Captions

Figure 1. The instructional matrix describes the actions with objects to be taught and to be tested for generalization. It also shows which sets were trained using in-vivo modeling and video modeling.

Figure 2. Summary data for in-vivo and video modeling conditions. Diamonds represent sessions run with in-vivo modeling and circles represent sessions run with video modeling. Black diamonds and gray circles with outlines represent training and maintenance probe data. White diamonds and circles represent recombinative generalization (RG) probe and baseline data. Gray diamonds and squares represent stimulus generalization (SG) probe data.

Figure 3. Summary of baseline and probe data. BL represents baseline data, RG represents recombinative generalization data, MP represents maintenance probe data, and SG represents stimulus generalization data.

Figure 1.

Set 1:

	Put on	Put in
In-Vivo Model	Plate	Bowl
Flag	Teach	Test (4/4, 3/4)
Ball	Test (4/4, 4/4)	Teach

Set 2:

	Slide next to	Take out of
Video Model	Book	Shoe
Little People® Figurine	Teach	Test (4/4, 4/4)
Pencil	Test (0/4, 0/4)	Teach

Set 3:

	Tap together	Put under
In-Vivo Model	Animal	Inverted cup
Lego®	Teach	Test (3/4, 3/4)
Car	Test (4/4, 2/4)	Teach

Set 4:

	Push both away	Cover with
Video Model	Spoon	Cloth
Fork	Teach	Test (4/4, 4/4)
Crayon	Test (3/4, 4/4)	Teach

Figure 2.

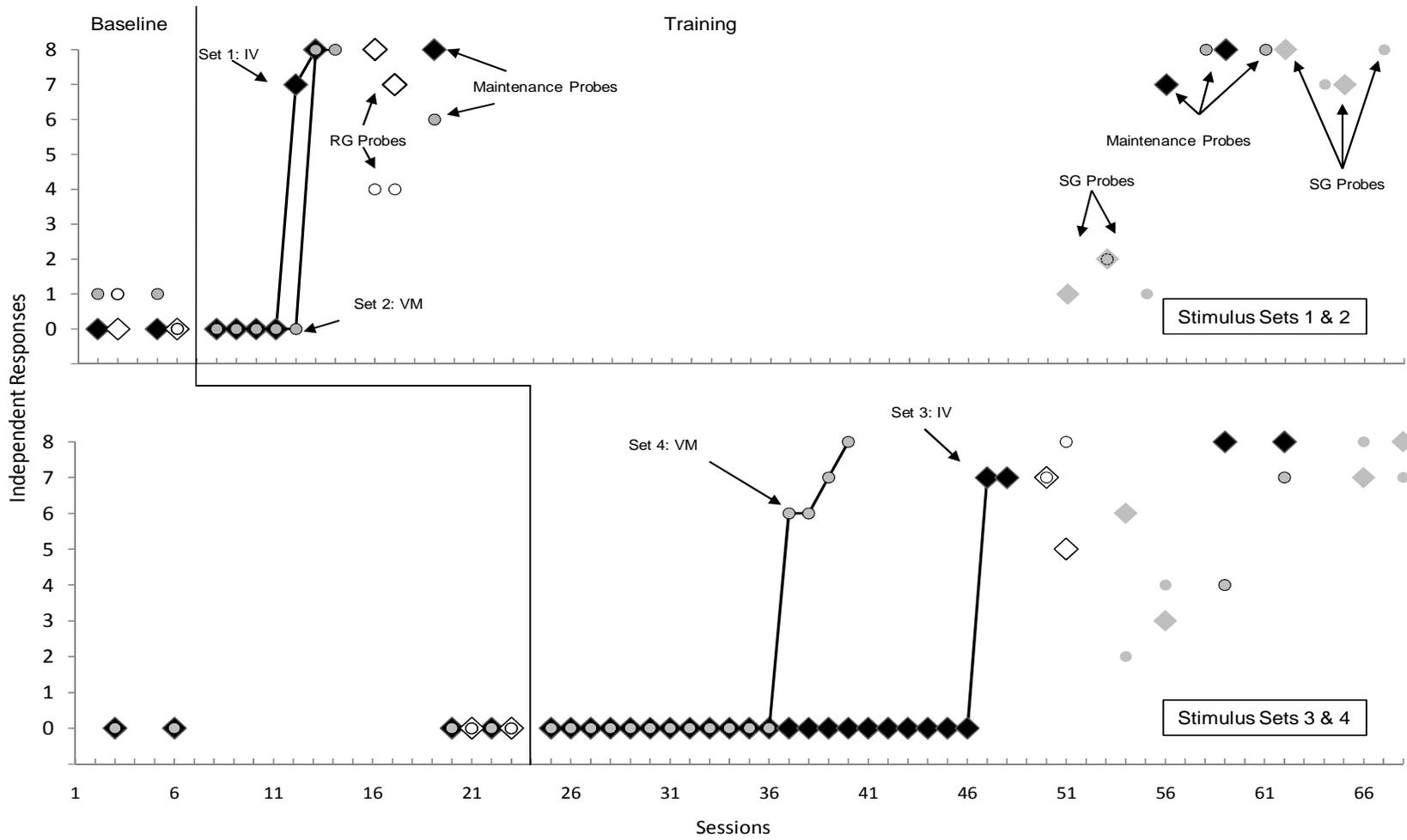


Figure 3.

