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Comparing effectiveness and efficiency of skill acquisition using In vivo modeling and video modeling techniques

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Comparing Effectiveness and Efficiency of Skill Acquisition Using In Vivo Modeling and Video Modeling Techniques

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Abstract

Teaching new behaviors or skills to children with autism can be slow and difficult. Therefore, it is important to identify the most effective and efficient procedures for establishing new skills. Modeling techniques have been demonstrated to be effective for teaching children with autism a variety of skills. More recent literature has indicated that video modeling techniques may be easier and more cost effective than in vivo modeling, and video modeling may result in high rates of success in establishment and maintenance of new skills. The present study assessed the effectiveness and efficiency of in vivo and video modeling to establish short play-skill chains. Results of this study indicate that video modeling procedures were more efficient for teaching a child with autism to build a Lego® toy construct.

Comparing Effectiveness and Efficiency of Skill Acquisition Using In Vivo Modeling and Video Modeling Techniques

The acquisition of new skills has been observed to be difficult for many individuals with autism. Areas of notable deficit for children diagnosed with autism include delays in speech development (e.g., Charlop, Schreibman, & Thibodeau, 1985), daily living skills (e.g., Pierce & Schreibman, 1994), social skills (e.g., Charlop & Milstein, 1989) and reciprocal play skills (e.g., Nikopoulos & Keenan, 2004). To date, there are a variety of clinically prescribed best practice methods used to enhance learning of such skills. Response prompting, which involves providing "supplementary antecedent stimuli used to occasion a correct response in the presence of a discriminative stimulus that will eventually control the behavior" (Cooper, Heron, & Heward, 2007, p. 401), is one method that has been successful in teaching new skills to individuals with autism. Three common forms of response prompts include: verbal instruction, physical guidance, and modeling. Although prompting strategies are a useful teaching tool, it is necessary to transfer the stimulus control from the prompt to a naturally occurring stimulus. In order to do so, several prompt-fading strategies exist to aid in this transition. Common prompt-fading strategies include least-to-most, most-to-least, and time delay strategies.

Least-to-most (L-M) prompt hierarchies provide an opportunity for the learner to respond independently before a prompt from an instructor, as a prompt is not introduced until a given time has elapsed or an error by the learner is made or anticipated by the instructor (Cooper et al., 2007). Prompts are then introduced from the least to the most intrusive. This method is also known as “self-fading”.

Most-to-least (M-L) prompting requires that, “…the analyst physically guides the participant through the entire performance sequence, then gradually reduces the amount of physical assistance provided as training progresses from trial to trial and session to session” (Cooper et al., 2007, p. 403). Graduated guidance is a prompt method that is similar to M-L prompting with the difference that the prompt can be faded within a single trial.

The time delay procedure is yet another method of transferring stimulus control from the prompt to a naturally occurring stimulus (Touchette, MacDonald, & Langer, 1985). Time delays can be either progressive or constant and typically begin with a 0-s delay, that is, the prompt is provided immediately upon presenting the learner with the opportunity to emit the target response (the “naturally-occurring stimuli”). In a progressive delay, the amount of time between the naturally occurring stimuli and the prompt is gradually increased and thereby provides the learner with an opportunity to initiate a correct response without a prompt. In a constant delay, an interval is selected and blocks of trials are presented at that interval during the course of a single training session.

The time delay procedure can easily be used with imitative behaviors often learned by modeling. For example, time delay and peer modeling have been used to successfully increase spontaneous verbalizations in children with autism (e.g., Charlop, Schreibman, & Thibodeau, 1985; Charlop & Walsh, 1986). While some individuals with autism have been acknowledged to have a limited imitative repertoire or be lacking an imitative repertoire entirely, it has been demonstrated that imitative behaviors can be taught (e.g., Bear, Peterson, & Sherman, 1967). Once generalized imitation (i.e., the imitation of novel models in the absence of any explicit history of reinforcement) is in the learner's repertoire, imitation and modeling can become an effective means of teaching new skills to individuals with autism (e.g., Ingersoll & Schreibman, 2006; Werts, Caldwell, & Wolery, 1996).

Video modeling is a teaching procedure that arose as an extension of the modeling literature. In video modeling a desired set of behaviors is videotaped and the learner is expected to imitate the model after watching the video (LeBlanc et al., 2003). Video modeling has shown promise as a prompting method to establish chains of behavior, and much of the recent literature involves providing the participant with the video model as the sole means of instruction. That is, the behavior is learned – and in many cases, maintained – without any other means of prompting or reinforcement. While there has been much success in skill acquisition observed through video modeling, it remains unclear if *video* modeling is more effective or efficient than *in vivo* modeling.

In Vivo Modeling

In vivo modeling has long been demonstrated to be an effective means of teaching new skills. In a landmark study conducted by Bandura, Ross, and Ross (1961), typically developing preschool-aged children were observed to imitate the aggressive actions of an adult model towards a toy. The children would also imitate the nonaggressive verbal responses of the model. From these results, Bandura et al. concluded that social imitation may be more rapid than shaping when teaching new behaviors.

Much research has focused on identifying strategies to assist children with developmental delays to transition into general education settings. The passage of federal legislation that required "public education in the least restrictive environment" (Egel, Richman, & Koegel, 1981, p. 3) spurred research in procedures to teach classroom skills to children with developmental delays, such as autism. In typical classrooms, children are frequently taught in large groups by one individual. Instructions are given to the group as a whole and if a child in the classroom has difficulties following verbal instructions, being able to imitate a peer can be a vital skill. By observing his or her peers, the individual is able to do as the other students are doing, such as retrieving his or her backpack to go home.

To assess if peer imitation skills could be acquired, Egel et al. (1981) conducted a study to determine if children with autism could perform discrimination tasks by observing peer models. Four children with autism, age 4 to 7, participated in this study along with 4 typically developing peers, age 6 to 9. Sessions were 5 to 15 min in length and were conducted in a small area in the special education classroom where the children with autism attended school. Two sessions occurred per day with 10 to 40 trials occurring within each session. One discrimination task was assigned to each participant based on the individual school curriculum for each child. An example task included color discrimination in which the child would give the therapist a crayon based on what color name was stated.

During baseline procedures, no modeling occurred. In the modeling condition, a peer model was seated across from the participant and was instructed to complete the discrimination task in the same manner as the participant. The therapist then gave the participant the materials and presented identical instructions. No-model trials were then conducted following acquisition of the discrimination task.

Results from the study indicated that during the baseline condition, all four participants had very low correct responding and criteria for acquisition were never met. Substantial increases in correct responding were observed in the modeling condition. In the follow-up no-model condition, all of the participants maintained high levels of correct responding.

Possible explanations for these results included the similarity of the model to the learner; the models provided a novel situation for the learner, an intrinsically reinforcing quality; and the participants in this study, although they were reported to have "serious learning impairments, were not among the most severe of the autistic population" (Egel et al., 1981, p. 9). The implications of this research, however, are that children with autism can benefit from the observational learning of classroom peers in typical classroom situations.

The Egel et al. (1981) study demonstrated that children with autism could learn discrimination tasks by observing peer models. Other studies have shown that individuals with autism can learn a variety of tasks through peer observation, however, in these studies the peer model was always instructed by a therapist (e.g., Schoen & Sivil, 1989). It had not been investigated if children with autism could imitate a peer model performing a response chain independent of therapist instruction. Werts et al. (1996) determined that children with developmental disabilities were able to imitate the peer models that performed accurate chains of behavior.

Three children with developmental disabilities, age 7 to 8, participated in the Werts et al. (1996) study along with 12 elementary school students. The 15 children included in the study were all enrolled in the same general education classroom, where sessions occurred. The chained tasks in the study included spelling a name with letter tiles, playing an audiotape, using a calculator, sharpening a pencil, sequencing numbers, and using a computer program. A multiple probe design was used to assess the effect of peer modeling.

During the instructional conditions, the peer model was brought to the instructional area and performed the chain while describing the task. The participant was then given the opportunity to perform the chain on probe trials. Criterion for mastery included 100% correct responding on the first probe in 2 out of 3 days. The process was repeated with three chains for each participant.

Results indicated that none of the participants were able to complete any of the steps of the chains prior to peer modeling. Following the peer model of the chain, criterion level responding was met for all chains by all 3 participants. Outcomes of this study demonstrated the importance of children with disabilities being integrated into typical classrooms. Typically developing peers were shown to be effective models for their classmates with disabilities and as different peer models were used throughout the study, the participants were shown to generalize the imitative behavior across different models. It is important for children with delays to have these appropriate models available and findings such as those reported by Werts et al. (1996) further support the necessity for integration and the use of modeling as a tool for establishing new behaviors.

While imitation skills emerge during infancy in typically developing children, this is often not the case for individuals with autism. Imitation skills often emerge later or may never emerge without formal training. It has been hypothesized that imitation deficits may be the underlying cause of other behaviors characteristic of individuals with autism (e.g., Ingersoll & Schreibman, 2006). Previous studies of imitation training in children with developmental disabilities had many limitations (Ingersoll and Schreibman, 2006). For example, the imitation training did not occur in natural environments or with naturally occurring reinforcers; setting generalization did not occur nor did generalization across therapists; and imitation may have been under the control of a verbal S^D, such as “do this”. Therefore, Ingersoll and Schreibman attempted to use a naturalistic approach to increase the generalization of imitative behaviors to “…lead to collateral changes in the children’s language, pretend play, and joint attention behaviors.” (p. 489).

Five children with autism, age 29 to 41 months, participated in the study. All of the participants had deficits in imitation and performed fewer than 10% of imitations in a baseline measure. Training sessions occurred in a treatment room and generalization sessions occurred in one of two larger rooms. All rooms were located in a preschool. Sessions were 20 min in length and occurred eight times per week. During baseline, the children engaged in free play with a therapist. Every minute, the therapist modeled a behavior and no feedback was provided based on the child's response. The treatment sessions occurred in five phases, each phase lasting 2 weeks:

> In Phase I, no actions were modeled. In Phase II, only familiar actions were modeled with the same toy. In Phase III, familiar and novel actions were modeled with the same toy. In Phase IV, familiar and novel actions were modeled with the same toy and familiar actions were modeled with a different toy. In Phase V, familiar and novel actions were modeled with the same and different toys (p. 490).

Actions were modeled, on average, once every minute as in baseline, and praise was provided for spontaneous imitation. If no imitation occurred after the third model, the child was physically prompted to complete the action and praise was given. Post-treatment sessions, in which no treatment occurred, were then conducted. At 1-month after treatment, follow-up generalization sessions occurred in the generalization settings. No contingent praise was given if imitation occurred.

Results indicated that low to moderate rates of imitation occurred across all participants in baseline. Dramatic increases in rates of imitation were observed once the treatment phases were introduced. This level of responding was then maintained throughout each phase, even as the difficulty level of imitative behaviors increased.

In post-treatment sessions, 4 of the 5 participants maintained similarly high rates of imitative responses. In the 1-month follow-up, all 5 participants maintained rates of imitation higher than those observed during initial baseline.

In addition to object imitation, the authors also measured rates of spontaneous and imitative language, spontaneous pretend play, and joint attention. Results for imitative language indicated that significant increases occurred in all 5 children and spontaneous language increased for 2 of the 3 verbal children. Pretend play increased during treatment phases, was maintained during post-treatment, and successfully generalized to novel situations. Joint attention increased for all participants once treatment phases were implemented, and during post-treatment, joint attention responding remained high and was observed to generalize to novel situations for three of the participants.

The Ingersoll and Schreibman (2006) study includes some important implications for the generalization of imitative behavior to novel settings, materials, and people. Compared to prior studies in which imitation training was conducted in highly contrived settings and generalization did not always occur, the Ingersoll and Schreibman study provides compelling evidence for future research in imitation training, particularly in the acquisition of new or novel behaviors and tasks.

Video Modeling

Video modeling is a teaching technique that emerged from the growing literature surrounding the positive effects of in vivo modeling on skill acquisition of novel behaviors. As mentioned above, video modeling procedures require the learner to observe a videotaped model of an action or behavior to be imitated (LeBlanc et al., 2003). While video modeling assumes the same topography that an in vivo model provides, there are arguable benefits to the method. Banda, Matuszny, and Turkan (2007) argue the following: children with autism have been shown to learn through visual modes; watching television may be highly reinforcing to children with autism; video modeling is non-aversive; video modeling is an accepted intervention by caregivers; and caregivers have control of the model, via editing procedures. Bellini and Akullian (2007) add that children with autism may exhibit problems over expected social interactions with caregivers and prefer the video model because that expectation is no longer there. Also, many individuals with autism have the tendency to attend to only limited aspects of their environment ("overselect") and with the editing modes of a video model, the video is able to emphasize the relevant aspects of the model, increasing the likelihood that the learner will attend to those aspects.

As with in vivo modeling, video modeling has been effective for teaching a variety of skills to individuals with developmental delays. Various play and socialization skills, (e.g., Charlop & Milstein, 1989; Nikopoulos & Keenan, 2003; Nikopoulos & Keenan, 2004; MacDonald, Clark, Garrigan, & Vangala, 2005; Hine & Wolery, 2006; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009), and daily living skills, such as purchasing items in community stores (Haring, Kennedy, Adams, & Pitts-Conway, 1987) have been successfully taught using video modeling.

Additionally, video modeling has been successful in numerous school-based interventions (Hitchcock, Dowrick, & Prater, 2003).

Haring et al. (1987) extended the video modeling research to teaching individuals with autism outside the school environment. Although modeling had proven successful in teaching individuals with autism new skills, training functional skills that occurred outside the home or school environment had been met with greater difficulty. Haring et al. used video modeling procedures to teach purchasing skills and generalization of these skills to individuals with autism.

Three individuals with autism, each 20 years old, participated in the study. Each of the participants received training on purchasing techniques in the school cafeteria or in a nearby convenience store. Generalization training using video modeling occurred for two participants in the school library and in home for the other participant. Probes were conducted with all participants in three generalization settings.

The video models were presented on VHS videotapes. Each videotape contained four “episodes”, each ranging from 1.5 to 3.0 min. Each episode presented slight variations of a purchasing sequence. A task analysis was developed to outline both social responses and operational responses. Familiar, typically developing peers performed the behaviors on the videotape.

During baseline, the participants were taken to both the training and generalization settings. Their performance of the steps of the task analysis was scored but they were not provided with feedback or reinforcement. During shopping training, the baseline procedures were followed with the addition that correct independent responding was verbally praised. One session occurred each day.

Once 90% correct and independent responding had occurred across three consecutive days, generalization training began. This involved the participants viewing the videotapes while the instructor asked questions about the video and behaviors being performed. Praise was given for correct responding. Generalization probes then occurred, which were conducted in a manner consistent with baseline sessions. Once 90% correct and independent responding was achieved across three consecutive days, the use of videotapes was discontinued. Maintenance probes then occurred after one and two weeks.

Results from the study indicated that during baseline, the social responses occurred at near-zero rates and the operational responses occurred at higher rates, ranging from 40-80% across the participants. Once training occurred, social responses immediately increased for 2 of the participants while the third participant required two weeks of training before showing a rapid increase of social responses. When video modeling was introduced, all of the participants demonstrated rapid increases in both social and operational responses during probe sessions. During probe sessions occurring in novel settings, successful purchasing behaviors were observed in 5 of 6 occasions.

Haring et al. (1987) concluded that video modeling can be time- and cost-effective. Generalization of purchasing skills to different community settings occurred for the participants in this study without the necessity of training the behaviors in each specific setting.

Charlop and Milstein (1989) successfully used video modeling to teach conversational speech to 3 young children with autism, aged 6 to 7. The participants were reported to rarely ask questions, hold a conversation, or demonstrate spontaneous speech. After being trained with video models of short conversations (approximately 45 s) about familiar toys, (performed by familiar adults), each child was reported to have acquired conversational speech. In probe sessions conducted at a 15-month follow-up, maintenance of the conversational skills occurred.

Video modeling has also been effective for teaching more abstract skills, such as perspective-taking behavior, to children with autism (Charlop-Christy & Daneshvar, 2003). Using tasks similar to the Sally-Ann task, videotapes of a Barney™ and Bugs Bunny™ were presented to each of the participants. Participants were then asked perspective-taking questions during a pretest condition. During pretests, none of the participants demonstrated any perspective-taking behaviors. Following video modeling training utilizing various perspective-taking tasks, posttests were administered using the same Barney™ and Bugs Bunny™ tasks. Two participants passed the posttest and demonstrated maintenance of the skills. The third participant did not pass the posttest and maintenance varied.

Social initiations by children with autism have also been shown to improve through the use of video modeling. Nikopoulos and Keenan (2004) used video modeling to increase the play behavior and social initiations of 3 children with autism, age 7 to 9. During baseline conditions, none of the participants demonstrated any social initiations. With the implementation of video modeling, latency to social initiations decreased and time spent engaging in reciprocal play increased. At the one-month follow-up, results remained similar to those in the test conditions and at the three-month follow-up there was an observed increase in time spent in reciprocal play.

While interacting with peers is recognized to be deficient in children with autism, these children also have notable deficits in play skills (e.g., MacDonald et al., 2005). In an effort to teach pretend play skills to children with autism, MacDonald et al. used video models of pretend play scripts. These scripts were developed after the authors observed typically developing children play.

Two boys with autism, age 4 and 7, participated in this study. Three play sets were utilized in the study with three individualized play scripts generated for each. The play sets included a commercially available town, ship, and house. The scripts were recorded onto VHS videotapes.

MacDonald et al. (2005) recorded scripted verbalizations, scripted play actions, and unscripted play actions. The scripted verbalization and play actions included the child emitting responses that matched the responses on the video models. The unscripted play actions were those that were contextually appropriate to the particular toy but had not appeared in the video model.

During baseline, the child was seated at a table with the toy set and instructed to play with the toy. The child was required to sit for 4 min during which an observer provided no instructions, prompts, or reinforcement. During video modeling training sessions, the child was seated in front of a TV/VCR and shown the videotape twice. Procedures were identical to baseline sessions, as no reinforcement or prompts were provided and sessions were 4 min in length. Training sessions occurred until 80% accuracy on all scripted actions and verbalizations was achieved. Following mastery of the play sets with the video models, mastery probe sessions were conducted in an identical fashion to the baseline procedure. Follow-up probes were also conducted.

Results indicated that both participants acquired the pretend play skills for three play sets by use of a video modeling procedure. Lengthy pretend play sequences were learned and the scripted verbalizations and actions increased with the procedure and were maintained over time. One limitation to this study is the low frequency of unscripted behaviors that occurred. The participants were able to demonstrate acquisition of the scripts presented in the video models but were not able to generate spontaneous or unscripted actions or verbalizations that were relevant to the target play set. Video modeling, though clearly an effective means of teaching children with autism new skills and behaviors has limitations. Specifically, video modeling may lead to less generalization than in vivo modeling.

In Vivo Modeling versus Video Modeling

Both video modeling and in vivo modeling have shown to be effective at teaching new skills to individuals with autism. Recent literature, however, has determined that video modeling has several advantages over in vivo modeling. Charlop-Christy, Le, and Freeman (2000) compared both video modeling and in vivo techniques to increase target behaviors in children with autism based on each child's school curriculum. The effects of the techniques were assessed across different tasks, generalization was measured, and time and cost efficiency were compared.

Five children with autism, age 7 to 11, participated in the study. Tasks were chosen based on individual curricula and balance for task difficulty. One task was assigned to the in vivo modeling condition and a second task was assigned to the video modeling condition. The conditions were identical in procedure and differed only in presentation medium. The models were presented in a "slow, exaggerated pace and children were reminded to pay attention or to respond whenever necessary" (p. 541). The models for both conditions were adults who were familiar to the children and were trained in the modeling procedures. Sessions occurred in the after-school program that the participants attended.

During baseline conditions, prompting and reinforcement were used but they were removed during training conditions. This was included to assess if the participants were able to learn the tasks involving traditional training procedures. During training conditions, only prompts for on-task behavior were provided. In the video modeling conditions, the participant was seated in front of the video screen and instructed to watch the video. The video was presented twice and the participant was instructed, "Let's do the same, just like on TV" (p. 543). In the in vivo conditions, the procedure was identical to the video modeling condition with the exception that a live model performed the task twice. Testing began when the participant was instructed, “Let’s do the same, just like they did” (p. 543). No prompts or reinforcement were provided in generalization probes.

Time and cost efficiency measures included the following: time to train models, time each model used to perform the model for each condition, hourly wage to pay each model based on amount of time spent involved in the conditions, and cost of videotapes.

Results of the study demonstrated that the video modeling procedure was more effective across all measures than the in vivo modeling procedure. The video modeling procedure allowed for more rapid acquisition of the tasks across all participants and results indicated that generalization occurred in tasks taught through video modeling but did not for those taught through in vivo modeling. Video modeling also surpassed in vivo modeling with respect to cost and time efficiency. Charlop-Christy et al. (2000) argued the case for video modeling being the superior method for skill acquisition for individuals with autism. Gena, Couloura, and Kymissis (2005) also found similar results, in that both video modeling and in vivo modeling were effective means to acquiring new behaviors. This research was conducted in follow up to an earlier study by Gena, Krantz, McClannahan, and Poulson (1996), wherein an in vivo modeling technique was utilized and found to be an effective means to teach a new behavior to individuals with autism; although it was time consuming and reported to be difficult to implement. The Gena et al.

(2005) research demonstrated that a video modeling technique could be implemented with results just as promising as an effective in vivo technique.

Summary and Research Question

There are many considerations to be made when deciding to implement a skill acquisition program for a child with autism. Curricula should be individualized based on skill and functioning levels. If a method such as video modeling can be demonstrated to be an effective means to teach new skills, it would be an extremely beneficial tool to teachers and caregivers as it could reduce the amount of time spent in one-to-one teaching sessions across different tasks and situations. One advantage of video modeling is that it can be implemented as a lone intervention; that is, literature has shown that children with autism are able to learn tasks through the video model without the use of reinforcement or prompting (e.g., MacDonald et al., 2005). While video modeling has been shown to be effective, it has also been demonstrated to have a significant limitation. This limitation is the lack of response generalization that can occur when compared with other teaching procedures. The video modeling literature states that a disadvantage of in vivo modeling is the lack of uniformity of models, as it is nearly impossible for a person to identically replicate a model 100% of the time. This variation in human responding, however, may be advantageous in teaching children with autism to generalize their skills learned via modeling. This result has implications in regards to the integration of students into general education classrooms, as scripted behavior is rarely observed in such a setting. In a classroom environment, the skills required to engage in spontaneous conversation, play, and social reciprocity are a necessary classroom survival skill.

The purpose of this study was to compare the effectiveness and efficiency of video modeling and in-vivo modeling on the skill acquisition of a toy construct with a child diagnosed with autism.

Method

Participant, Settings and Materials

Mohammad was a 4-year-old male with autism who attended a day program for children with autism. He communicated using a picture exchange communication book and vocal approximations. Mohammad exhibited a range of aberrant behavior including self-injury, aggression, flopping, loud vocalizations, screaming, environmental destruction, and non-compliance. He was able to reliably follow one- and two-step directives and demonstrated generalized imitation skills.

Sessions were conducted in the participant's individual work cubicle during the school day. The cubicle contained a small table, two chairs, a plastic storage container used to hold work and leisure materials, as well as a covered box in one corner of the cubicle to obstruct flopping underneath the table. Generalization probe sessions were conducted at a table located in the participant's classroom. Materials used included; a laptop computer during video modeling sessions, four Lego® constructs including constructs A and C, taught using in vivo modeling and constructs B and D, taught using video modeling, a digital video camera for recording sessions, a pen and a binder for data collection. The communication book was also within reach of the student.

Dependent Variable and Response Definition

The dependent variable measured was the number of independent steps completed by the participant following presentation of the model. Independent steps were defined as correctly completing a step in the same order and arrangement as presented by the model. Sessions to mastery, as well as percentage of errors made, for each construction were calculated. Mastery of a construct was achieved when the participant completed three consecutive sessions of a construct with 100% accuracy and independence. Of these three mastery sessions, one session required the participant to complete the construction in the absence of either the in-vivo or video model. Percentage of errors was calculated by dividing the total number of errors or no responses (NR) that occurred by the total number of possible responses across all training sessions.

Measurement Method and Interobserver Agreement

The participant received a score of +, a score of –, or NR for each step of the construct. A + indicated that the step was completed independently and in the correct order by the participant. A – was recorded if the participant did not perform the step correctly or in the correct order. An NR was scored if the participant did not complete the step, defined as not reaching for the block or placing it on the construct base. For each construct, data were recorded as the number of steps completed independently out of the total number of steps within the construct in a given session.

All sessions were videotaped and interobserver agreement (IOA) was determined by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100%. All in vivo modeling sessions were videotaped for procedural integrity purposes.

The independent observer was a second teacher in the classroom. She observed the videotaped sessions and collected procedural integrity data by scoring sessions utilizing the same methods as the experimenter. She scored a randomized selection of 33% of all sessions for both IOA and procedural integrity. Procedural integrity for the in vivo constructs, A and C, was 100%. Across all constructs, IOA was 100%.

Experimental Design

An alternating treatments design was used to establish experimental control. Following baseline of each of the two constructs, in vivo modeling conditions and video modeling conditions were alternated across days to determine the effectiveness of each teaching method.

Procedure

Baseline. During this condition, the materials for one of the two constructs were presented to the participant with the instruction, “Build the Legos®”. No model, prompts or reinforcement were provided. The session was discontinued at the first error or once 2 min had elapsed.

In vivo modeling. Sessions in this condition were identical to baseline with the exception that prior to giving the instruction, “Build the Legos®”, the experimenter stated, “watch me” and proceeded to complete the 8-step construction in a specific order. After modeling the construction two times, the experimenter placed the materials in front of the participant and stated, “Build the Legos®”. No prompting or reinforcement was provided during the training session. A timer was set for 2 min and the session was stopped at the end of the interval, regardless of progress. There were no programmed consequences if the participant completed the construction prior to the end of the 2 min interval and the session continued until the interval ended. At the end of each session, verbal praise was provided by the experimenter by stating “nice job playing”.

Video modeling. Sessions in this condition were identical to the in vivo model condition with the following exception: prior to presenting the materials to the participant, a laptop computer was presented in front of the participant and the experimenter stated, “Watch the video” and played a video of the construct being completed two times.

Generalization. Generalization sessions for both in vivo modeling and video modeling procedures were identical to the training sessions with the exceptions that the sessions were performed in a second setting by a second experimenter and with no model being presented.

Maintenance. Maintenance probes were conducted with constructs A and B one month following the date of mastery. Maintenance probes were identical to the generalization probes with the exception that the probe sessions were conducted by the lead experimenter.

Replication. Following training with constructs A and B, the procedures were replicated with constructs C and D in an attempt to control for any difference in difficulty of the constructs.

Results

Figure 1 depicts the results for constructs A and B, using in vivo modeling and video modeling training, respectively. During baseline, Mohammed performed only the first step of construct A independently. Mohammed was not able to complete any of the steps of construct B independently during the baseline probe. Upon implementation of the in vivo modeling and video modeling procedures, Mohammed achieved criteria for mastery for construct B, taught with the video model, more rapidly than construct A. Construct B required 10 training sessions before mastery of the construct was demonstrated with three consecutive sessions with 100% accurate and independent completion of the construct, the final session being performed with 100% accuracy and independence with no model presented. Construct A required 17 training sessions before mastery was demonstrated. Mohammed demonstrated 100% accuracy and independence for constructs A and B in the generalization probes. One month following the mastery of each construct, a maintenance probe was conducted. During the probe, Mohammed completed construct B with 100% accuracy and independence. For construct A, Mohammed independently and accurately completed 3 out of the 8 steps of the construct.

Figure 2 depicts results for the replication with constructs C and D, taught using in vivo modeling and video modeling procedures, respectively. A baseline probe indicated that Mohammed was unable to complete any steps of construct C independently. Mohammed was able to complete two steps of construct D independently in the baseline probe. Upon implementation of the training procedures, Mohammed achieved criteria for mastery for construct D, taught using the video model, in 14 sessions. Construct C, taught using the in vivo modeling procedure, required 19 trials to achieve mastery criteria. Generalization probes for both constructs were conducted by a second experimenter in a second setting and both probes indicated that Mohammed maintained independence in completing constructs C and D. One month following mastery of each construct, a maintenance probe was conducted. Mohammed completed construct D with 100% accuracy and independence. For construct A, Mohammed independently and accurately completed 6 out of the 8 steps of the construct.

Discussion

Results of the current study support previous findings that video modeling training procedures are a rapid means of teaching new skills to children with autism (e.g., Charlop-Christy et al., 2000). Mohammed was able to master the toy constructs (B and D) taught using the video modeling procedures more rapidly than toy constructs (A and C) taught with in-vivo modeling procedures. In one-month maintenance probes of constructs A and B, Mohammed completed the toy construct taught using video modeling (B) with 100% accuracy. With the construct taught using in vivo modeling procedures, Mohammed was only able to complete 3 of the 8 steps independently in the one-month probe session.

In the video modeling sessions, Mohammed made more errors than in the in vivo conditions. With the constructs taught using video modeling, Mohammed made errors in 36% and 26% of all training steps for constructs B and D, respectively. In the in vivo conditions, Mohammed made errors in 30% and 19% of all training steps for constructs A and C, respectively. Anecdotally, a least-to-most prompting hierarchy might have been beneficial for Mohammed, because in numerous training sessions he would make several requests for "help" when unable to properly fit a block into a specific location. When the requests for "help" were ignored, as the protocol necessitated, Mohammed frequently engaged in disruptive behavior, such as aggression, self-injury, crying, screaming, or environmental destruction. There were also training sessions in which Mohammed made no attempt to complete the construct; a prompting hierarchy may have helped during these sessions as well. Future research could include utilizing a least-to-most prompt hierarchy (e.g., Murzynski & Bourret, 2007) in attempt to reduce the number of errors made throughout the course of training to determine whether results would remain consistent with the use of video modeling.

During the training sessions for constructs A and B, the procedures were altered due to disruptive behavior that occurred during the second presentation of the in vivo model. In early sessions when two models were presented, Mohammed frequently engaged in aggressive and self-injurious behavior following presentation of the first model. This occurred when the experimenter blocked Mohammed's hands to prevent him from completing the model prior to watching the experimenter construct the model a second time. Beginning in session 20, the in vivo modeling procedure was changed to include only one presentation of the model per training session. This change would have also applied to the video modeling sessions, but Mohammed had already reached mastery criteria for construct B and no longer required any training sessions. During the replication (constructs C and D), all sessions included only one in vivo model presentation and one video modeling presentation.

In addition to the protocol requiring all requests for "help" being denied, another limitation to this study could include the novelty of the toy constructs. The constructs were novel, 8-step block constructions and were not intended to represent anything specific. While such a basic structure might be a beneficial starting-point for teaching a young child with autism who has previously never demonstrated structured play skills, it may have been too basic or simple for this participant who has previously used video modeling and task analysis training to learn specific toy constructs (such as a toy mouse and a block house). Future research could include the use of more complex toy constructions or play sequences to compare the two teaching techniques. Using more complex play sequences could also be used to further demonstrate the emergence of spontaneous play. The novel constructs did not resemble any familiar structures. Mohammed would sometimes manipulate the completed construct until the 2 min session had concluded. At times, he would simply spin the construct on the table top or hold it close to his face, but at other times he would move his hands about the construction in a way that resembled his typical manner of toy manipulation. With a complex play sequence or toy construct, spontaneous, untrained play behavior might emerge and this behavior may differ based on the training method used.

In summary, the present study demonstrated that video modeling was a more effective procedure for establishing play skills in a child with autism. The results are consistent with previous research and provide further support for the use of the video modeling procedure to teach a variety of skills.

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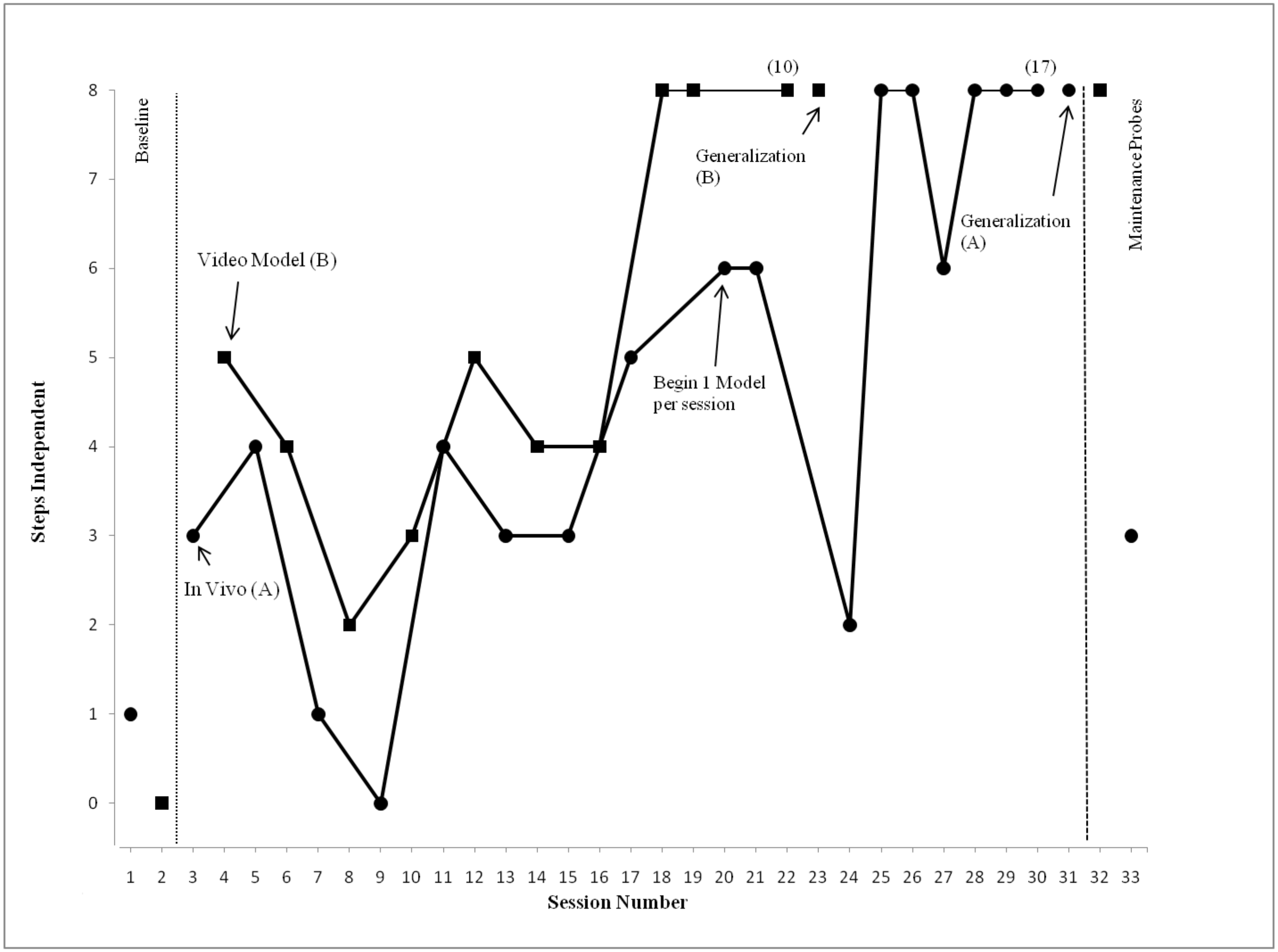
Figure Captions

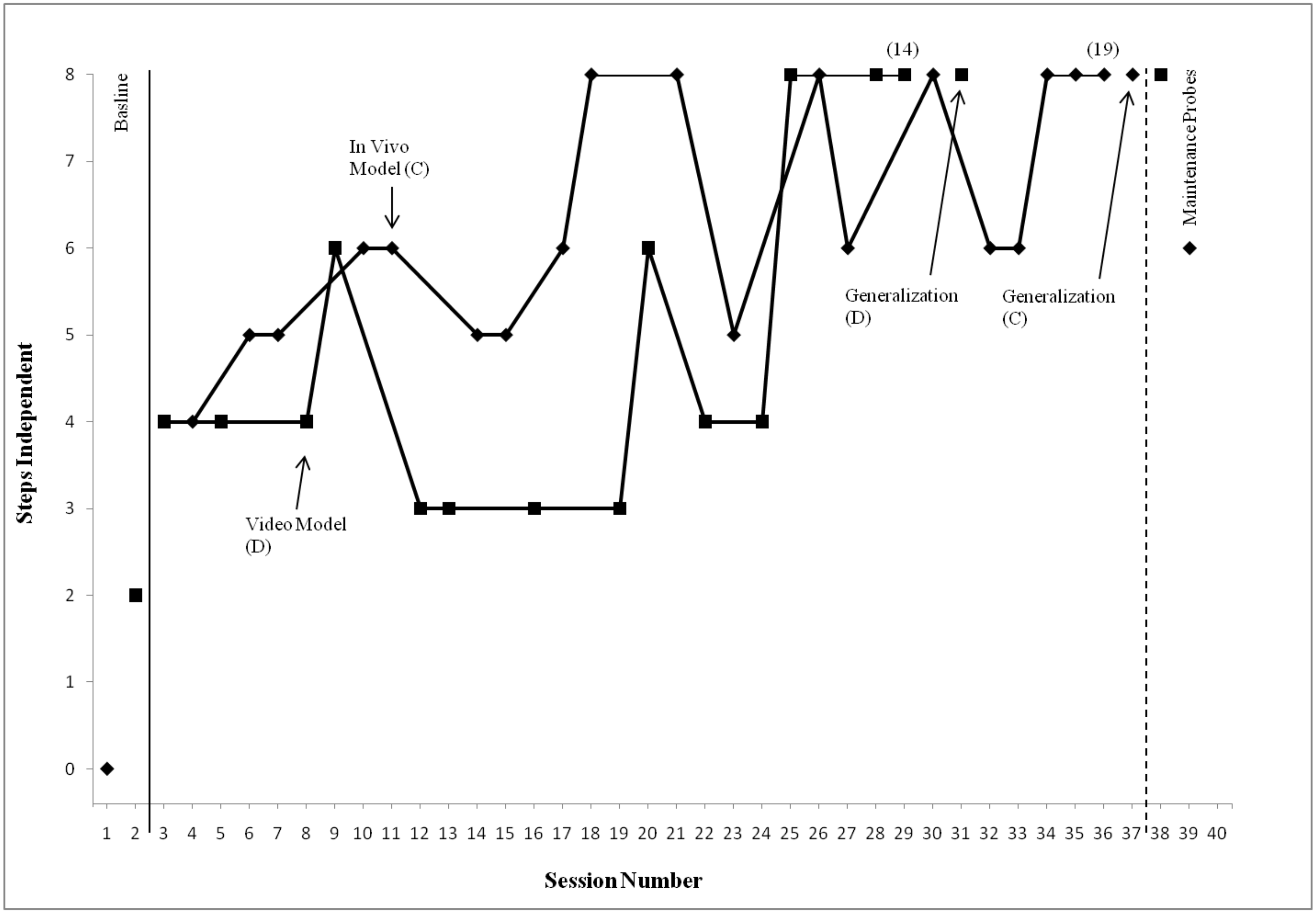
Figure 1. Results for construct A (in vivo model) and construct B (video model) sessions.

Figure 2. Results for construct C (in vivo model) and construct D (video model) sessions.



Steps Independent
Session Number
Baseline
Video Model (B)
In Vivo (A)
Begin 1 Model
per session
Generalization
(B)
(10)
(17)
Generalization
(A)
Maintenance Probes

Figure 1



Steps Independent
0
1
2
3
4
5
6
7
8
Basline
In Vivo
Model (C)
Video Model
(D)
(14)
(19)
Generalization
(D)
Generalization
(C)
Maintenance Probes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Session Number

Figure 2