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Using a Video Modeling Treatment Package to Teach Imitation to Children with Autism

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USING A VIDEO MODELING TREATMENT PACKAGE TO TEACH IMITATION TO CHILDREN WITH AUTISM

by

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Imitation is a critical skill that allows individuals to learn through less restrictive prompting methods and may allow access to less restrictive learning environments, such as typical classrooms, where instruction is often delivered by modeling. Many individuals with autism learn to imitate with interventions that utilize live models and least-to-most prompting strategies; but, for some, these methods are not successful or efficient. While video modeling has been used to teach a variety of skills to individuals with autism, there is limited research using video modeling to teach imitation. This study investigated the effectiveness of using a video modeling treatment package to teach imitation to four children with autism who had been unsuccessful with other teaching methods. A multiple-baseline design across behaviors was used to evaluate the effectiveness of a video modeling treatment package to teach imitation. Baseline consisted of treatment-as-usual, which used live models and least-to-most prompting. The video modeling treatment package consisted of video models and most-to-least prompting faded within session. Of the four children, one acquired imitation with the original video modeling treatment package. Two of the children acquired imitation only after modifying the prompting method of the video modeling treatment package to flexible prompt fading. One child did not acquire imitation during his participation in the study.

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Sofia F. Peters

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INTRODUCTION

Imitation has been described as observing another individual's behavior and then engaging in topographically similar behavior (Baer, Peterson, & Sherman, 1967). Generalized imitation is typically used to describe the ability to imitate novel actions that have not been previously reinforced. One theory of generalized imitation is that, through imitation training, the match between the behavior of the model and the imitator becomes a conditioned reinforcer; thus, imitating the actions of others becomes automatically reinforcing (Burgess, Burgess, & Esveldt, 1970). The ability to imitate novel actions of others is a behavioral cusp, allowing an individual to acquire new skills through modeling (Rosales-Ruiz & Baer, 1997). Being able to learn from models may allow individuals to access less restrictive environments, such as a typical classroom, where instruction is often delivered by modeling. Without an imitative repertoire, the intrusive and lengthy process of physical prompting and shaping must often be used to teach skills.

Video modeling has been used to teach a variety of skills to children with autism (Bellini & Akullian, 2007; Charlop & Milstein, 1989; D'Ateno, Mangiapanello, & Taylor, 2003) and has been shown to lead to quicker acquisition of skills than live modeling (Charlop-Christy, Le, & Freeman, 2000); however, there are only a few studies that test the effectiveness of video modeling to teach imitation (Cardon, 2013; Kleeberger & Mirenda, 2010; McDowell, Gutierrez, & Bennett, 2015). This might be because it is assumed that imitation itself is a prerequisite for learning from a video model.

Cardon (2013) investigated the use of a video model, combined with physical prompts as an error correction, to teach children to imitate gross motor actions. Imitation increased for two of the three children during the intervention. Because vocal praise was the only reinforcer used during this intervention, it is possible that the praise functioned as a conditioned reinforcer for the two children who improved but did not for the child who failed to improve. Using a preference assessment to determine putative reinforcers to be used during the intervention may increase the efficacy of video modeling to teach imitation. Additionally, video modeling has been more effective than live modeling to teach functional imitation to individuals who have almost no imitative skills at the start of treatment, though live modeling worked better for those who had slightly more imitative skills (McDowell, 2015).

One potential barrier to acquiring imitation is the child's failure to attend to the live model. Video modeling may be helpful if the child is more likely to attend to a video than a live model, as is sometimes the case. In a comparison of the length of time that children with autism and typically developing children attended to a video puppet show versus a live puppet show, on average, both groups of children attended to the video show longer than the live show; and every child with autism attended longer to the videos than the live show (Cardon & Azuma, 2012). This suggests that some children may be more successful using video models if a lack of attending to the live model is a barrier.

There are other benefits to using a video model to teach imitation: It may be more efficient because the same videos can be used with multiple clients. There may also be better treatment integrity because the video model will be the same each time it is presented, while a live model may be inconsistent. Also, when teaching imitation, it is often difficult for the instructor to model and prompt the child's response simultaneously. To remedy this, two people may be needed to teach imitation with live modeling so that one can model the response while the other prompts the child. Using a video model instead of a live model would allow for a single instructor to implement the program instead of two.

Prompting is a component often used in interventions to teach imitation (Ledford & Wolery, 2011). A variety of prompting methods have proven effective in teaching many skills to children with autism and other developmental disabilities (Wolery, Ault, & Doyle, 1992). However, it is not clear which prompting method is the most effective. Studies comparing the effectiveness of prompting methods sometimes produce contrary results (Aykut, 2012; McDonell & Ferguson, 1989). Additionally, within a given study, one child may respond differently to the intervention than the others (Riesen, McDonell, Johnson, Polychronis, & Jameson, 2003; Swerden & Rosales, 2017), indicating that a prompting method may be best for most but not all. Many variables could influence the effectiveness of a particular prompting method, such as the client's history with specific prompting methods, the type and topography of the skill being taught, the pre-treatment skill level of the client, and the length of delay between the discriminative stimulus and the reinforcer delivery caused by the prompting method.

Another prompting method, flexible prompt fading (FPF), utilizes in-the-moment clinical decision-making to determine the nature of the prompt. The term was coined by Soluga et al. (2008), but the prompting method had been utilized prior to that in the UCLA Young Autism Project (Lovaas, 1987) and described in curriculum manuals (Leaf & McEachin, 1999; Lovaas, 2003). In most prompting methods, one type of prompt is identified, and the prompt-fading procedure is specified. FPF differs from those prompting strategies in that the instructor makes decisions in the moment about how to prompt the child. Any type of prompt may be used at any time. The instructor fades out the prompts as quickly as possible, while attempting to maintain 80% correct responding by the child (Leaf, Cihon, Leaf, McEachin, & Taubman, 2016). The instructor bases the prompting on a variety of factors, such as the child's responding on previous trials and history of prompt dependency (Soluga et al., 2008). FPF has been shown to be an effective teaching strategy for a variety of skills but has not been evaluated specifically for teaching imitation (Leaf, Leaf, Taubman, McEachin, & Delmolino, 2014; Leaf et al., 2016; Soluga, Leaf, Taubman, McEachin, & Leaf, 2008).

Shaping has also been used to establish an imitative repertoire. Mrljak (2017) used shaping with predefined topographies of successive approximations to teach imitation to three children with autism. While all three children made progress on the initial targets with shaping, antecedent physical prompts were added to speed the acquisition of targets or to remedy other issues encountered with the shaping procedure.

The present study investigated the effectiveness of video modeling to teach imitation to children with autism who had not been successful with live modeling using least-to-most prompting. This video modeling treatment package involved most-to-least prompting faded within session or flexible prompt fading, along with shaping.

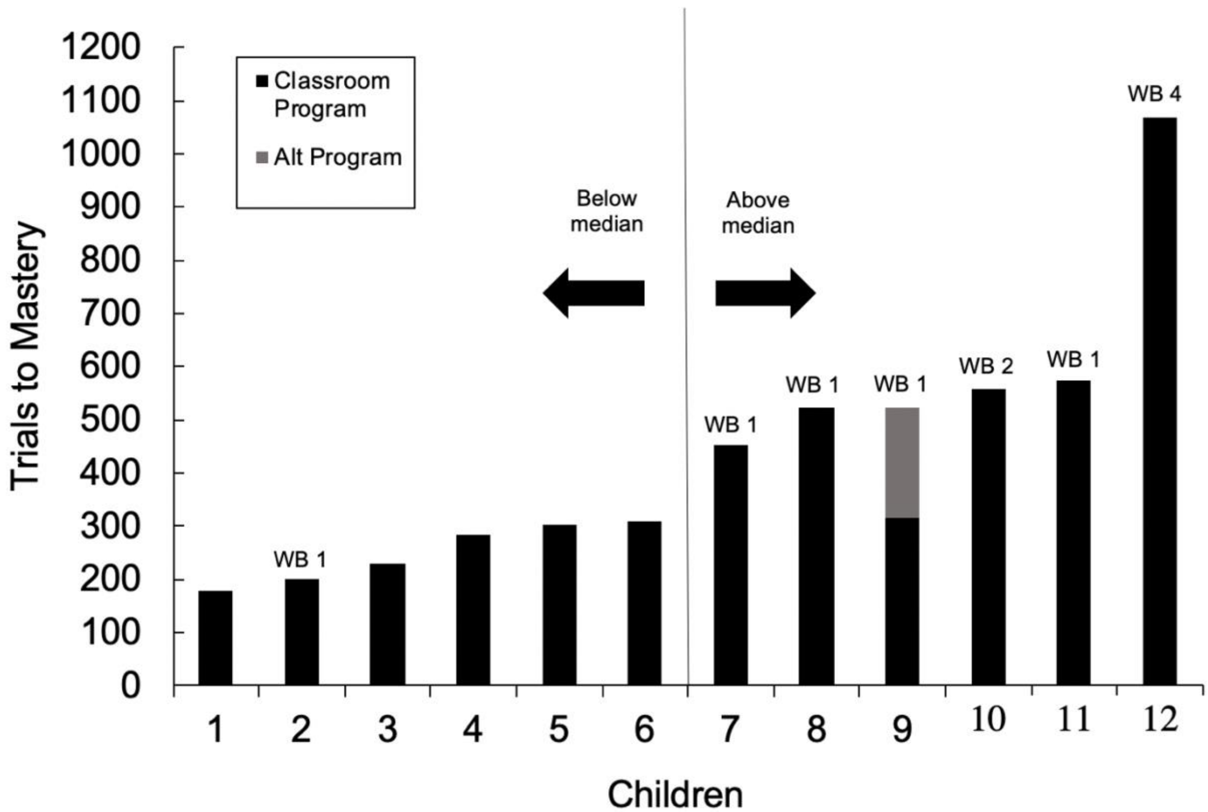
Historical Classroom Data

This study took place in an Early Childhood Special Education (ECSE) classroom of the Kalamazoo Regional Educational Service Agency (KRESA). The classroom had a curriculum of programs that prescribed the instructional methods to be used to teach a variety of skills. While the programs in the curriculum were effective for many children, sometimes a student would fail to make progress. To ensure that these struggling students were identified in a timely manner, the classroom had a standardized criterion, referred to as the “whistle-blow” criterion, which indicated when a child was not performing well within a program. The whistle-blow criterion for all programs was 20 sessions without mastering a set of targets or five consecutive sessions at or below 50% correct. Once a child met the whistle-blow criterion on a program, modifications were made to attempt to increase learning and performance.

The classroom imitation program used a least-to-most hierarchy of physical guidance for the error correction with no antecedent prompts. A reinforcer was only delivered if the child imitated independently. Typical modifications for the imitation program included using most-to-least prompting, a progressive time-delay with prompting, changing the target responses, or a combination of these. Even after these changes, some children did not learn to imitate or took a very long time to do so.

Imitation data from the KRESA ECSE classroom between January 2016 to June 2018 were compiled and reviewed as preliminary research for the current study. During this 30-month period, 42 children began the imitation program. Twenty-one children performed at 80% correct or above in the first two sessions of the program, so they were presumed to be already able to imitate prior to implementation of the program and were removed from the data set. Two more children were removed from the data set because they started with an alternative program instead of the classroom program. Finally, seven children were excluded because they failed to master the program. Two of these seven moved schools before mastering the program, while the others had the program removed from their schedule (data for these children are reported in Appendix A). Twelve children mastered the program (Figure 1). The minimum number of trials to master the program was 178, and the maximum was 1068. The median number of trials to mastery was 380, with a mean of 433.33.

Of the children who mastered the program in fewer than the median number of trials to mastery, only one met whistle-blow criterion at some point during the intervention. All of the children who required more than the median number of trials to master the program met the whistle-blow criterion at least once during the intervention, while the child who had the most trials to mastery met the criterion four times throughout the intervention. This suggests that the classroom's whistle-blow criterion may be a good indicator that the child may not be successful with the standard classroom program or, at least, may take a very long time to acquire the skill, and, thus, modifications should be made to the intervention.



Note. The number of times the child met whistle-blow criterion during the intervention is indicated above the bar.

Figure 1. Historical Classroom Imitation Data

METHOD

Setting

This study took place in a special education preschool classroom through a partnership with Kalamazoo RESA. Children in this classroom received one-on-one discrete-trial training from undergraduate practicum students. Each child in the classroom had a team that consisted of a doctoral-student Board Certified Behavior Analyst, a master's student from the behavior analysis program, and the classroom special education teacher. These teams worked collaboratively on the programming for the children in the classroom. During the present study, all sessions took place in the child's typical workspace used for one-on-one teaching.

Participants

Children who had the classroom physical imitation program and had met the whistle-blow criterion were considered for inclusion in this study. Four children with autism participated. Pete was 2 years and 9 months, Toby was 3 years and 4 months, Sana was 3 years and 5 months, and Randy was 3 years and 1 month old at the start of the study. Data collected on the children's imitation prior to their participating in the present study were used as baseline data.

Independent and Dependent Variables

The independent variable was a video modeling treatment package (VMTP) that included video models combined with most-to-least prompting faded within session; and for children for whom within-session prompt fading was not effective, flexible prompt fading (FPF) was used. The dependent variable was independent imitative responses. In addition, problem behavior was recorded during both baseline trials and intervention trials.

Interobserver Agreement

Trial-by-trial interobserver-agreement (IOA) data were collected for Pete, Toby, Sana, and Randy for 54%, 28%, 26%, and 34% of the sessions, respectively, either during the session or from a video of the session. Mean agreement scores were 96% (range, 50% to 100%), 97%

(range, 90% to 100%), 97% (range, 50% to 100%), and 98% (range, 93% to 100%) for Pete, Toby, Sana, and Randy, respectively.

IOA data were collected for all sessions of live model, generalized imitation, and maintenance probes for all of the children, and mean agreement scores were 100% for all probes for each child. IOA data were not collected during flexible prompt fading due to the clinical judgement utilized in that intervention.

Treatment Integrity

Treatment integrity data were collected for Pete, Toby, Sana, and Randy for 24%, 15%, 14%, and 16% of the sessions that utilized the classroom imitation program, respectively. For the video modeling treatment package that used most-to-least prompting faded within session, treatment integrity data were collected for 15%, 27%, 30%, and 20% for Pete, Toby, Sana, and Randy, respectively.

Mean agreement scores for the classroom imitation program were 98% (range, 95% to 100%), 100%, 100%, and 99% (range, 98% to 100%) for Pete, Toby, Sana, and Randy, respectively. For the video modeling treatment package, mean agreement scores for Pete, Toby, Sana, and Randy were 100%, 100%, 98% (range, 95% to 100%), and 100%, respectively.

A treatment integrity data sheet was used to score the percentage of correct responses by the instructor for both the classroom program and the video modeling treatment package either during the session or from a video of the session. Treatment integrity was not collected during flexible prompt fading due to the clinical judgement utilized in that intervention.

Video Models

The video models were recorded using an iPhone 8 Plus. They consisted of an adult seated at a table with a neutral background. In each video the adult said, “Do this,” and modeled one target behavior for 20 s. To control for differences across instructors, the same instructor was used as the live model and video model for a particular child. An adult was used as the model instead of a peer because adults are often the models during instruction in a typical classroom. A 2018 Apple iPad was used to play the video models during the intervention.

Research Design

A multiple-baseline design across behaviors was used (Baer, Wolf, & Risely, 1968). The baseline consisted of data from the classroom imitation program. The VMTP was implemented with one target response, and the classroom program was continued with the other response(s). Once the target response taught using the VMTP was mastered, the VMTP was implemented with the other target response. If the child mastered the target during baseline with the classroom imitation program prior to mastering the target with the VMTP, the VMTP was discontinued, and all targets were taught with the classroom imitation program.

Procedures

Attending to Live Models vs. Video Models

Prior to the intervention with the VMTP, durations of attending to a live model and a video model were measured in blocks of five trials. The child was not instructed, prompted, or required to make a response. To decrease the likelihood of problem behavior, the instructor presented previously mastered instructions from programs not involving imitation so that correct responses could be reinforced in between the presentation of the models. The same person was used for the live model and the video model. The instructor waited until the child looked at her or at the video before modeling the response or playing the video of the modeled response. A researcher recorded the number of seconds the child’s eyes were continuously oriented toward the model.

Preference Assessment

A multiple-stimulus without replacement (DeLeon & Iwata, 1996) or a paired-stimulus preference assessment (Fisher et al., 1992) was completed with each child, prior to the intervention, to identify putative reinforcers. Throughout each session, informal preference assessments were completed, intermittently, by presenting preferred items and allowing the child to select one.

Classroom Program

The classroom program used a live model; and for the error correction, it used a least-to-most hierarchy of physical guidance with no antecedent prompts. The instructor presented the model while saying, "Do this." The child was given 3 s to respond independently before the instructor provided the error correction. But if the child responded correctly within 3 s of the start of the model, the instructor provided a reinforcer. If the child did not respond correctly within 3 s of the start of the model, the instructor provided a partial-physical prompt (e.g., a nudge at the elbow). If the child did not respond correctly to the partial-physical prompt, a full-physical prompt was provided. No reinforcers were provided for prompted responses. Each prompt level for each target was operationally defined to increase the likelihood of consistent presentations of the prompts. The mastery criterion was 80% or greater correct for three consecutive sessions or 90% or greater correct for two consecutive sessions.

Video Modeling Treatment Package

The VMTP used a video model and most-to-least physical guidance as antecedent prompts. The instructor played the video model and allowed the child 3 s to respond independently. If the child responded correctly within 3 s of the start of the model, they received a reinforcer. If the child did not respond correctly within 3 s of the start of the model, the instructor provided the appropriate prompt, beginning with a full-physical prompt. If the child responded correctly with the initial prompt presented, a reinforcer was provided. If the child did not respond correctly at the prompt level presented, the instructor moved up the prompt hierarchy until the child made the correct response. However, a reinforcer was not provided if the child did not respond correctly at the initial prompt level. Prompts were faded within session based on the child's responding. Two consecutive correct responses at the current prompt level resulted in a less intrusive prompt in the next trial, and two consecutive incorrect responses at the current prompt level resulted in a more intrusive prompt in the next trial. The mastery criterion was 80% or greater independent responses for three consecutive sessions or 90% or greater independent responses for two consecutive sessions.

For three of the children, flexible prompt fading (FPF) (Soluga et al., 2008) was implemented with the VMTP after little progress had been made using most-to-least prompting faded within session. In contrast to the most-to-least prompting faded within session, which specifies exactly which prompt is to be used for each trial and how to systematically move up and down the prompt hierarchy, with flexible prompt fading, the instructor used clinical judgement to make in-the-moment decisions about which prompt to use, how to prompt, and how to fade the prompt. The instructor used a generally most-to-least style of prompting, while attempting to maintain 80% correct responding.

Generalization Probes

After mastery of two targets with the VMTP, probes for generalization to live models were conducted. Novel targets were also probed with live models to test for a generalized imitative repertoire with both a familiar and novel instructor. Incorrect responses were corrected with least-to-most prompting but not reinforced. If the child did not display a generalized imitative repertoire after the acquisition of two target responses, another set of target responses was introduced, and the generalization probes were conducted again after mastery of those targets.

RESULTS AND DISCUSSION

The original VMTP (video model and most-to-least prompting faded within session) was more effective at teaching imitation to Pete than the classroom imitation program (live model and least-to-most prompting). However, Sana and Toby did not make progress in the VMTP until the prompting was changed to flexible prompt fading. Randy was the only child who mastered a target with the classroom imitation program. However, he left the classroom before he was able to acquire a generalized imitative repertoire.

There did not seem to be a substantial difference in the children's problem behavior during each condition, with the exception of Pete, who rarely displayed problem behavior during the VMTP but regularly engaged in problem behavior during the classroom imitation program.

Attending to Live Models vs. Video Models

Three of the four children (Pete, Sana, and Randy) watched the video models longer than the live models during the test of attending to live models vs. video models. Only Pete watched the video models for substantially longer than the live models (Figure 2). During four out of the five presentations of the video, Pete watched the video for the entire 20 s that it played. Toby was the only child who tended to watch the live models longer than the video models, although there was only a 2 s difference in the means. However, with the last three presentations of the video model, he not only attended to but also imitated the model within 4-5 s. These responses were reinforced, and the video models were stopped, which may have resulted in a shorter time recorded for the duration of attending to the video model on those trials. Sana also imitated during the test; however, she did so during two presentations of the live model, not the video model. When this occurred, the responses were reinforced and the presentation of the model ceased, which may have also resulted in a shorter duration recorded for attending to the live model during those trials.

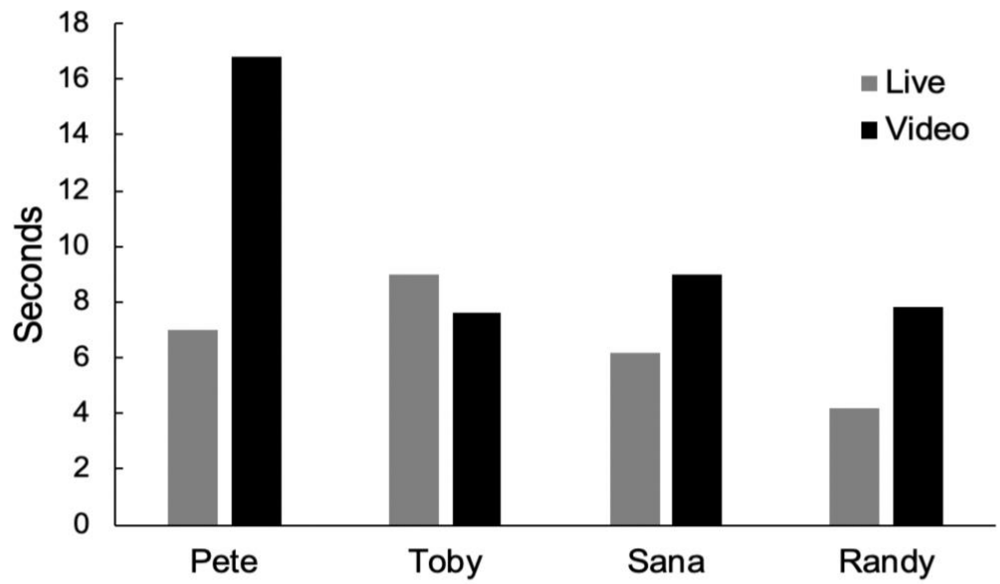


Figure 2. Mean Duration of Attending to Live Models and Video Models

Pete

Imitation

Targeted responses for Pete were “touch nose” and “clap.” Both started with the classroom program. After six sessions of baseline with the classroom program, “touch nose” was moved to the VMTP condition, where he met the mastery criterion for that response after 22 sessions. “Clap” was in baseline for 29 sessions. Once he met the mastery criterion for “touch nose,” “clap” was moved to the VMTP condition. He met mastery criterion for “clap” after 14 sessions of the VMTP. When both targets were mastered, a live-model probe was conducted with "touch nose "and "clap," and he imitated both responses with 100% accuracy (Figure 3). Then a generalized imitation probe was conducted, with 10 novel targets, using both a familiar instructor and a novel instructor, and he responded with 70% accuracy with both instructors (Appendix B). Pete responded with 80% accuracy on a maintenance probe that was conducted seven months after the intervention, using the same targets from the generalized imitation probe.

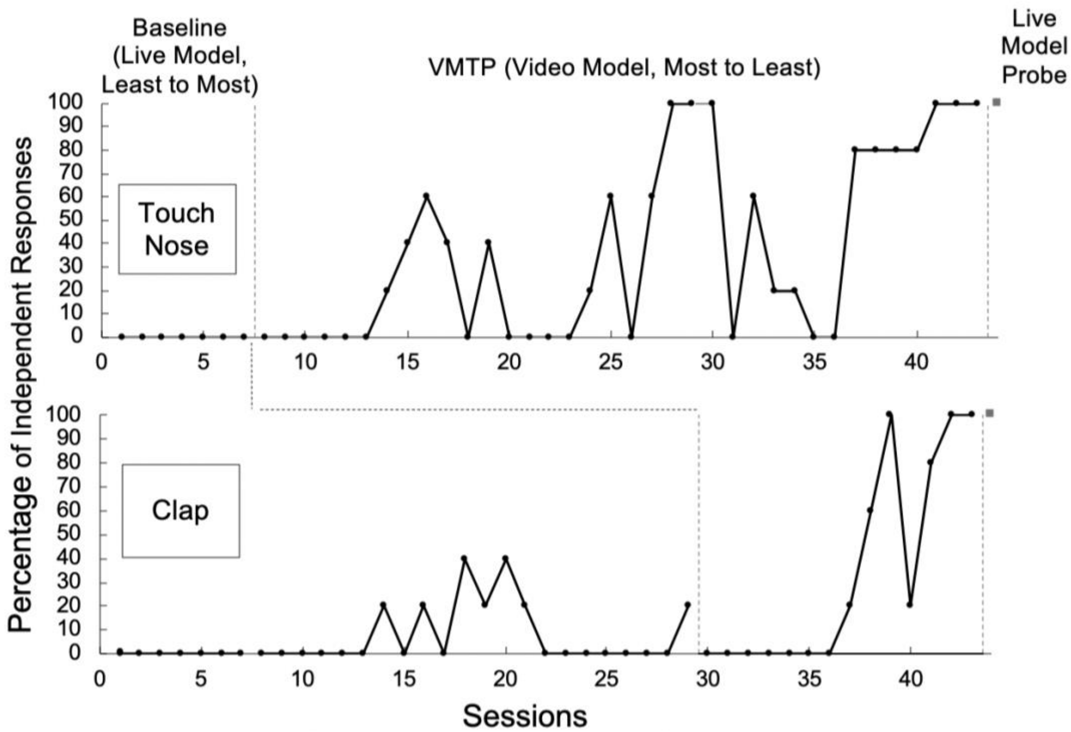


Figure 3. Pete's Independent Imitation Responses

Problem Behavior

Prior to participation in this study, Pete's instructors reported that, during the classroom imitation program, he typically cried, hit the instructor, and attempted to interrupt the modeling by pulling the instructor's hands down when she presented the targets. This was also observed by the researcher during an observation session prior to this study. After 22 sessions in the present study, both targets were in the VMTP condition. The mean percentage of trials with problem behavior during the baseline condition (live model with least-to-most prompting) was 23.66% with a range of 0 to 100%, and the mean percentage of trials with problem behavior during the VMTP condition was only 1.14% with a range of 0 to 40% (Figure 4).

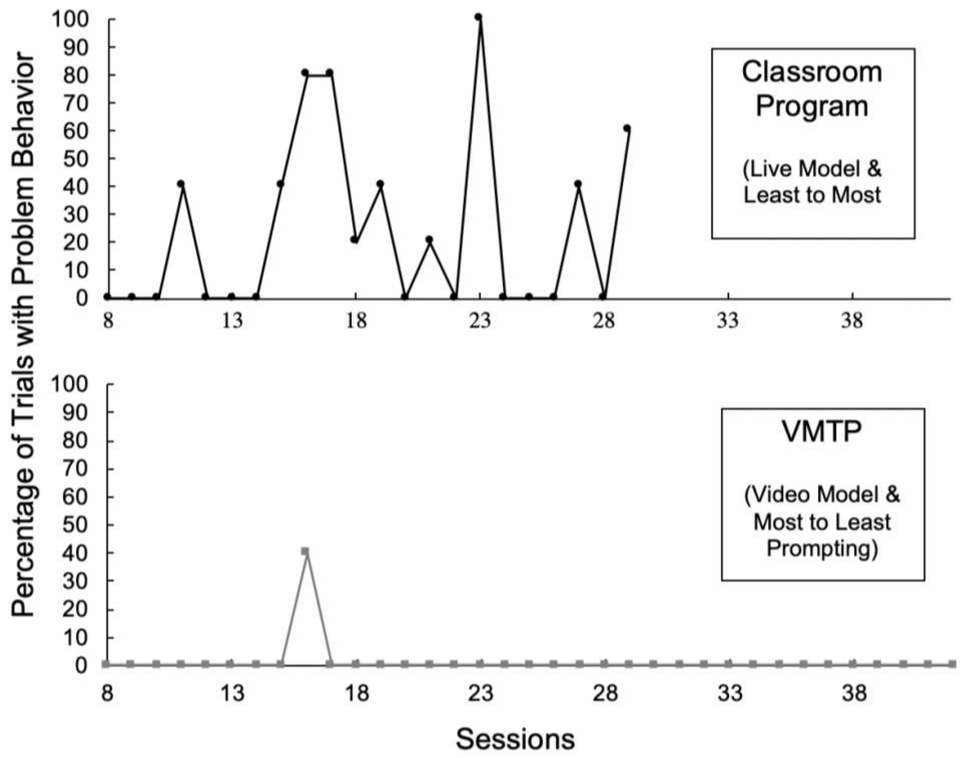


Figure 4. Pete's Problem Behavior During Treatments

Toby

Imitation

Prior to participation in the current study, Toby initially had a modified classroom imitation program with most-to-least prompting instead of the typical least-to-most. During this time, the original targeted responses were "touch nose" and "clap;" however, prompting him to touch his nose appeared to be aversive, so “wave” was used in place of “touch nose” after the first session. After seven sessions, the intervention was changed to the typical classroom program that used a live model with least-to-most prompting. During this time, he made little progress with either targeted response. After 27 sessions with his regular classroom instructors, he joined the present study. While “clap” stayed in the baseline condition, continuing with the classroom program with least-to-most prompting, “wave” was taught using the VMTP. After 23 sessions on the target “wave” with little progress using the VMTP, the prompting was changed from most-to-least prompting faded within session to flexible prompt fading (FPF). This resulted in an increase in independent responses, with mastery of “wave” after 17 sessions with FPF. After mastery of the first target, “clap” was also targeted with the VMTP using FPF, which resulted in mastery after eight sessions.

When both targets were mastered, a live-model generalization probe was conducted, resulting in 60% accuracy with “wave” and 100% accuracy with “clap.” After reviewing the session video, it was clear that, on some of the trials for “wave,” Toby began clapping as soon as the instructor said, “Do this,” before he observed the action that she was modeling (Figure 5).

A generalized imitation probe with 10 novel targets was conducted with his familiar instructor and a novel instructor (Appendix C). He responded with 60% accuracy with the familiar instructor and 70% accuracy with the unfamiliar instructor. During the generalized imitation probe, Toby responded on all trials, although some were inaccurate (e.g., tapping knees instead of tapping tummy).

Toby responded with 90% accuracy on a maintenance probe that was conducted four months after the intervention using the same targets from the generalized imitation probe (Appendix E).

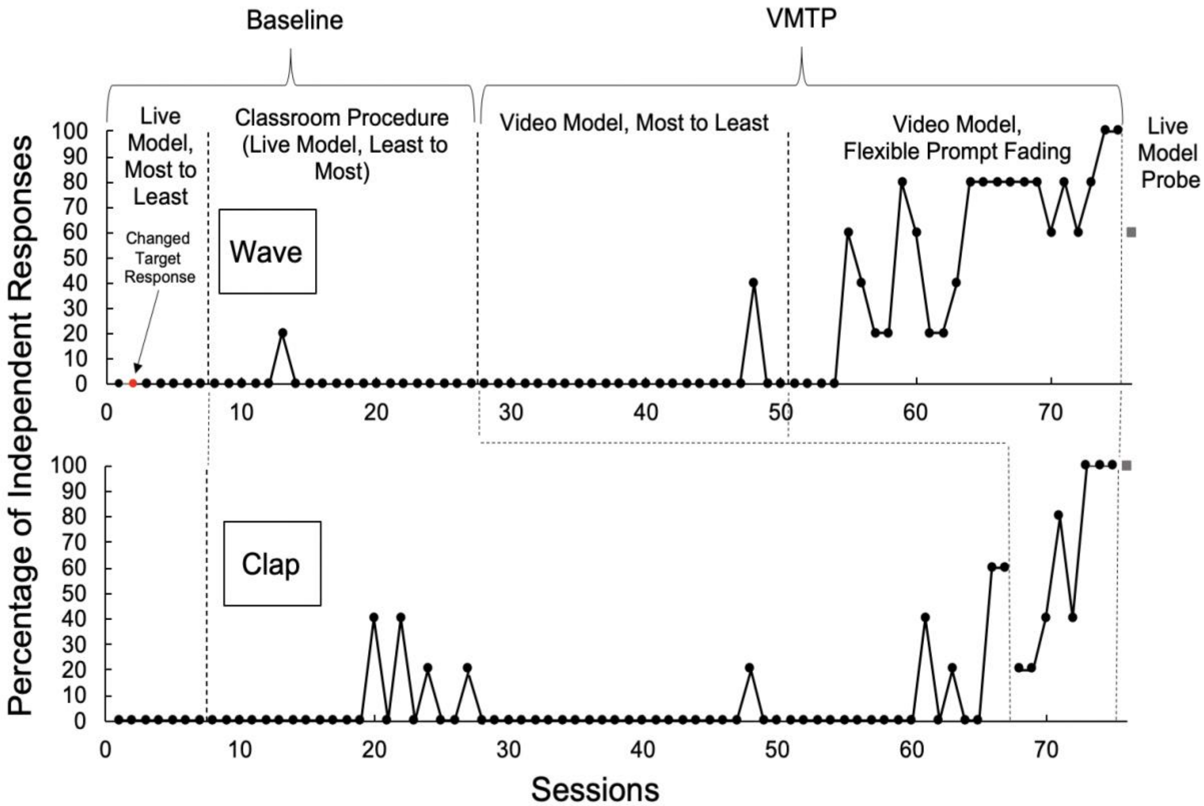


Figure 5. Toby's Independent Imitative Responses

Problem Behavior

Toby sometimes cried and whined during the interventions (Figure 6). After he entered the present study (sessions 28 to 30), there was a steep increasing trend of problem behavior. Toby's problem behavior had also increased during his other sessions and programming outside of the study, which was impeding his skill acquisition. Because the frequency and intensity of problem behavior was interfering with his learning, we took a break from conducting imitation sessions that lasted approximately seven weeks, until his problem behavior during his other programming in the classroom was at a manageable level. After the break, the occurrence of problem behavior was variable, and many sessions occurred with no problem behavior.

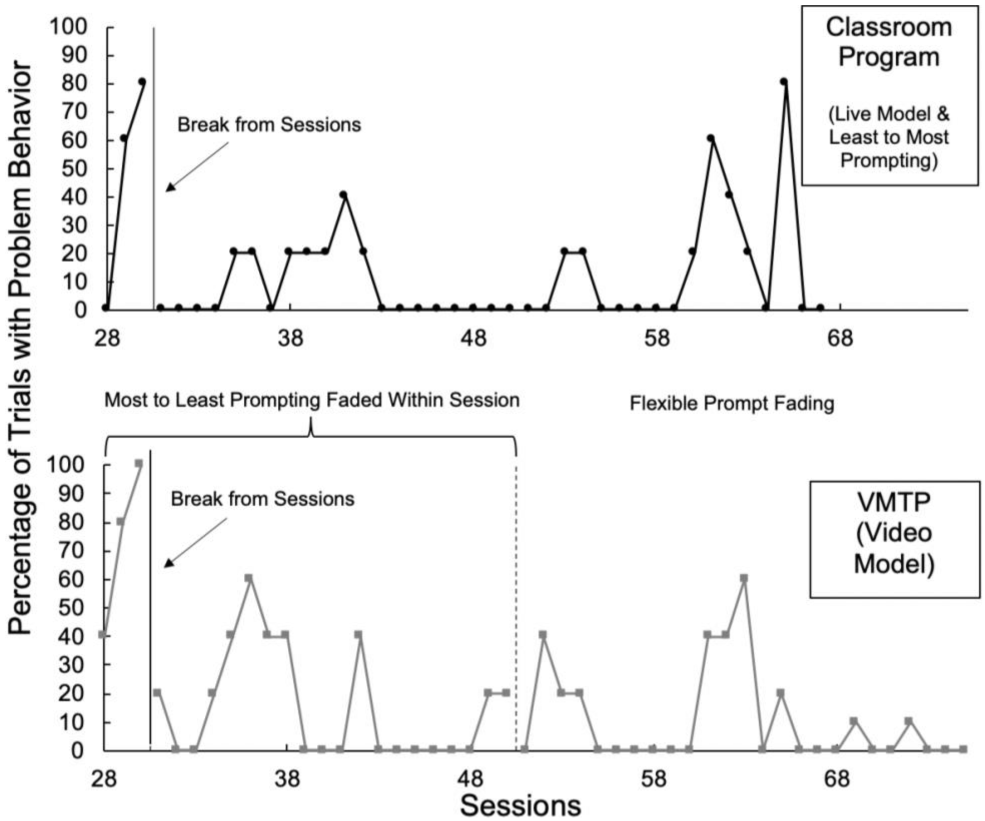


Figure 6. Toby's Problem Behavior During Treatments

The mean percentage of trials with problem behavior during the baseline condition (live model with least-to-most prompting) was 14% with a range of 0 to 80%. Starting with session 68, both targets were in the VMTP condition. The percentage of trials with problem behavior during the VMTP condition was 16.25% with a range of 0 to 100%. There were two prompting methods used in the VMTP: most-to-least prompting faded within session and flexible prompt fading. The mean percentage of trials with problem behavior during the intervention that used most-to-least prompting faded within session was 22.6% with a range of 0 to 100%. The mean percentage of trials with problem behavior during the intervention that used flexible prompt fading was 10.4% with a range of 0 to 60%.

Sana

Imitation

Prior to inclusion in this study, Sana began the typical classroom program with least-to-most prompting. The first targets were “touch nose” and “clap.” After six sessions, they were changed to “tap desk” and “arms up.” At session 41, the intervention was changed, and a full physical prompt was immediately provided and continued until Sana oriented to the model. After she oriented to the model, she received a reinforcer. Thus, there were no opportunities for independent responses in sessions 40 through 62. After session 62, she was included in this study. The VMTP was implemented with the target “tap desk,” and the typical classroom program was again used to teach the target “raise arm.” After 38 sessions and little progress with the VMTP, the prompting was changed from most-to-least prompting faded within session to flexible prompt fading (FPF). After 19 sessions with “tap desk” using the VMTP with FPF and “raise arm” using the classroom program, they were simultaneously mastered.

When both targets were mastered, a generalization test was conducted with “tap desk” and “raise arm” to assess Sana’s ability to imitate a live model. She imitated both targets with 100% accuracy (Figure 7). A generalized imitation test with 10 novel targets was conducted with her familiar instructor and a novel instructor (Appendix D). She imitated the familiar and novel instructors with 100% accuracy.

Throughout the study, it was difficult to identify items to use as reinforcers for Sana, as she appeared to be only mildly interested in them or would quickly lose interest in them. At times it was difficult to evoke even low-effort, mastered responses, such as a “high five.” This was something that her treatment team noted was a difficulty across all of her programming.

Sana was on a school break for one week before the day sessions 118 and 119 were conducted; and, on that day, she was in a group classroom in which she did not receive any one-on-one discrete-trial sessions and had very little access to the reinforcers used in those sessions. It is possible that deprivation of those reinforcers acted as an establishing operation contributing to her greatly improved performance in sessions 118 and 119.

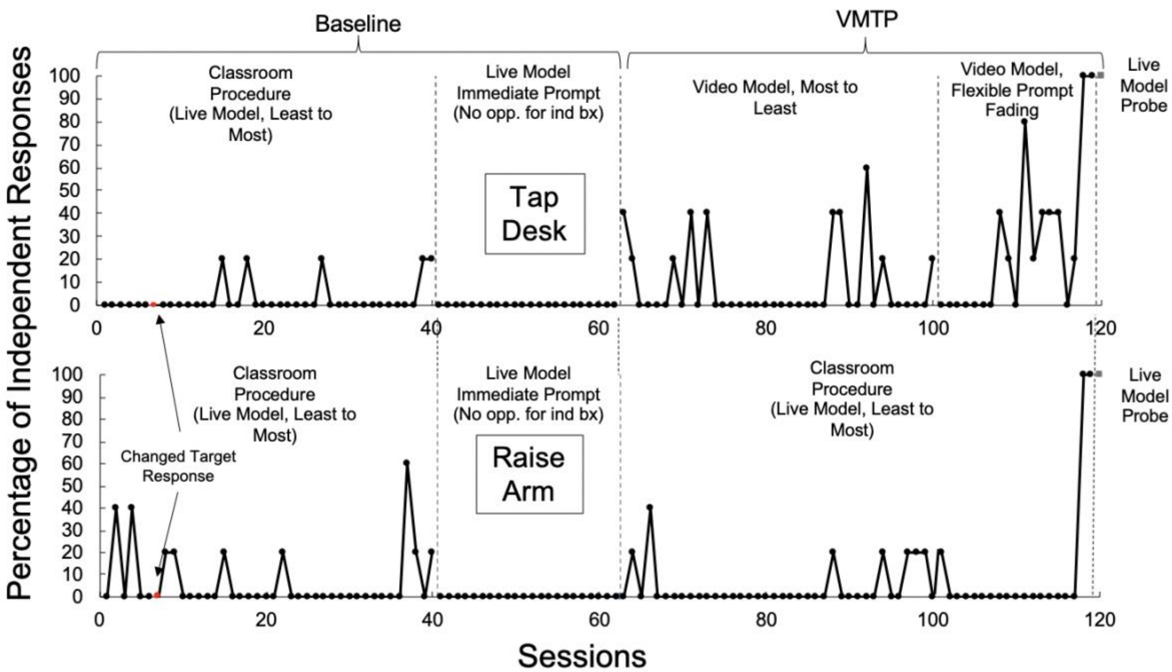


Figure 7. Sana's Independent Imitative Responses

Problem Behavior

Problem behavior data (crying and whining) are displayed in Figure 8. These behaviors only occurred in one session of the baseline condition (live model with least-to-most prompting) for 40% of the trials. Two prompting methods were used in the VMTP: most-to-least prompting faded within session and flexible prompt fading. No problem behavior occurred for trials that used most-to-least prompting faded within session and only occurred during one session of FPF for 20% of the trials. In other words, there was essentially no problem behavior under either condition.

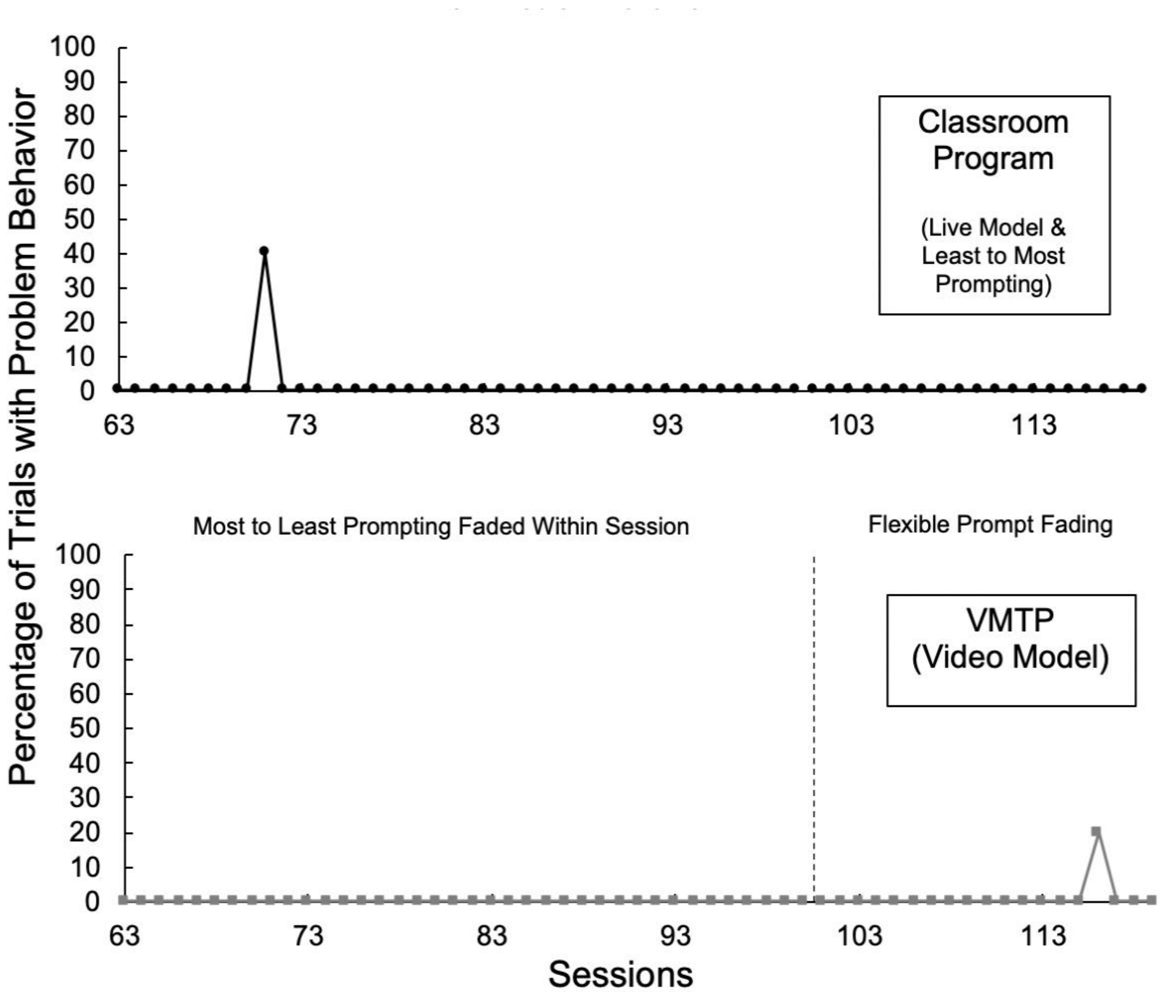


Figure 8. Sana's Problem Behavior During Treatments

Randy

Imitation

Randy began with a revised version of the classroom imitation program that started with three target responses instead of two. Targeted responses were "tap table," "tap wall," and "wave." After nine sessions of baseline with the classroom imitation program, "wave" was moved to the VMTP condition, while the other two targets remained in baseline. In contrast to the other children, Randy did not master the target in the VMTP condition, and, instead, mastered “tap wall” after 45 sessions and “tap table” after 50 sessions, using the classroom imitation program. A probe for generalization to a live model was not necessary because the classroom program used live models. On the generalized imitation probe, he responded correctly on 10% of the trials with the familiar instructor, and 0% with the unfamiliar instructor. Because he did not have a generalized imitative repertoire, two new targets were going to be taught, with maintenance probes conducted on the previously mastered targets; however, he responded correctly on 0% of the maintenance probes for both mastered targets, so those targets were reintroduced instead.

Following the reintroduction of the previously mastered targets, there was variable responding with the target “tap wall” and no independent responses with “tap table” (Figure 9). After 10 sessions with no progress, the researcher paused imitation sessions and considered removing Randy from the study to allow for other interventions that might be effective. During implementation of his typical programming in the classroom, the researcher noticed that the behavior technician was using a novel item as a reinforcer for Randy, and he was responding particularly well to her instructions. The researcher asked the behavior technician to conduct an informal probe of the imitation targets, to which he responded correctly for all three. A few days later, he unexpectedly moved schools and, thus, was no longer able to participate in this study.

Problem Behavior

Randy occasionally engaged in crying and whining during the interventions (Figure 10). This occurred slightly more often during the VMTP (mean, 10.5%; range, 0% to 40%) than with the classroom imitation program (mean, 3.3%; range, 0% to 40%). Because only one target was in the VMTP and two were in the baseline condition, there were only five trials of the VMTP and 10 trials of the classroom imitation program each session. This may have skewed the data slightly. Maintenance probes were conducted in session 57, but problem behavior data were not collected during that session.

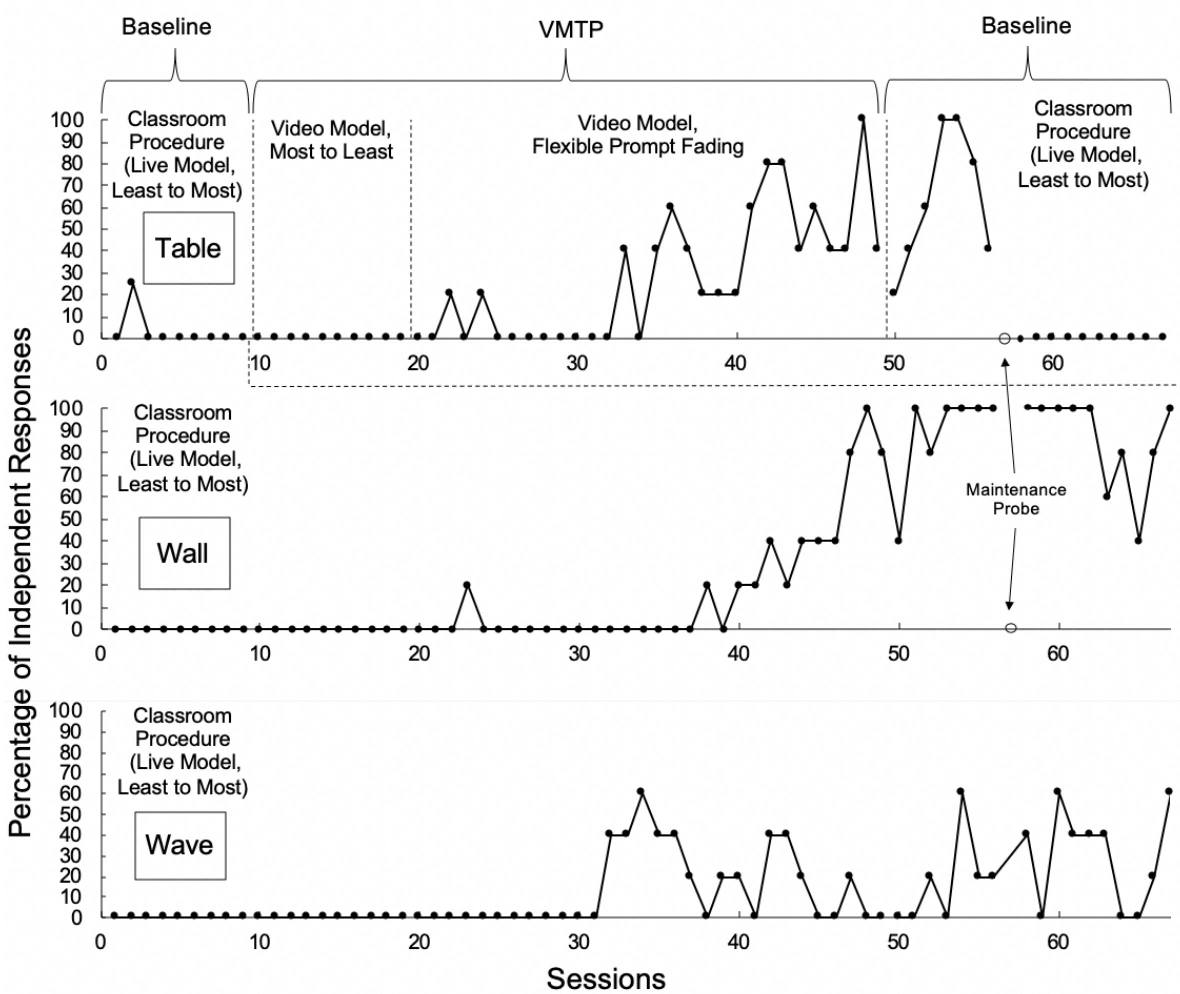


Figure 9. Randy’s Independent Imitative Responses

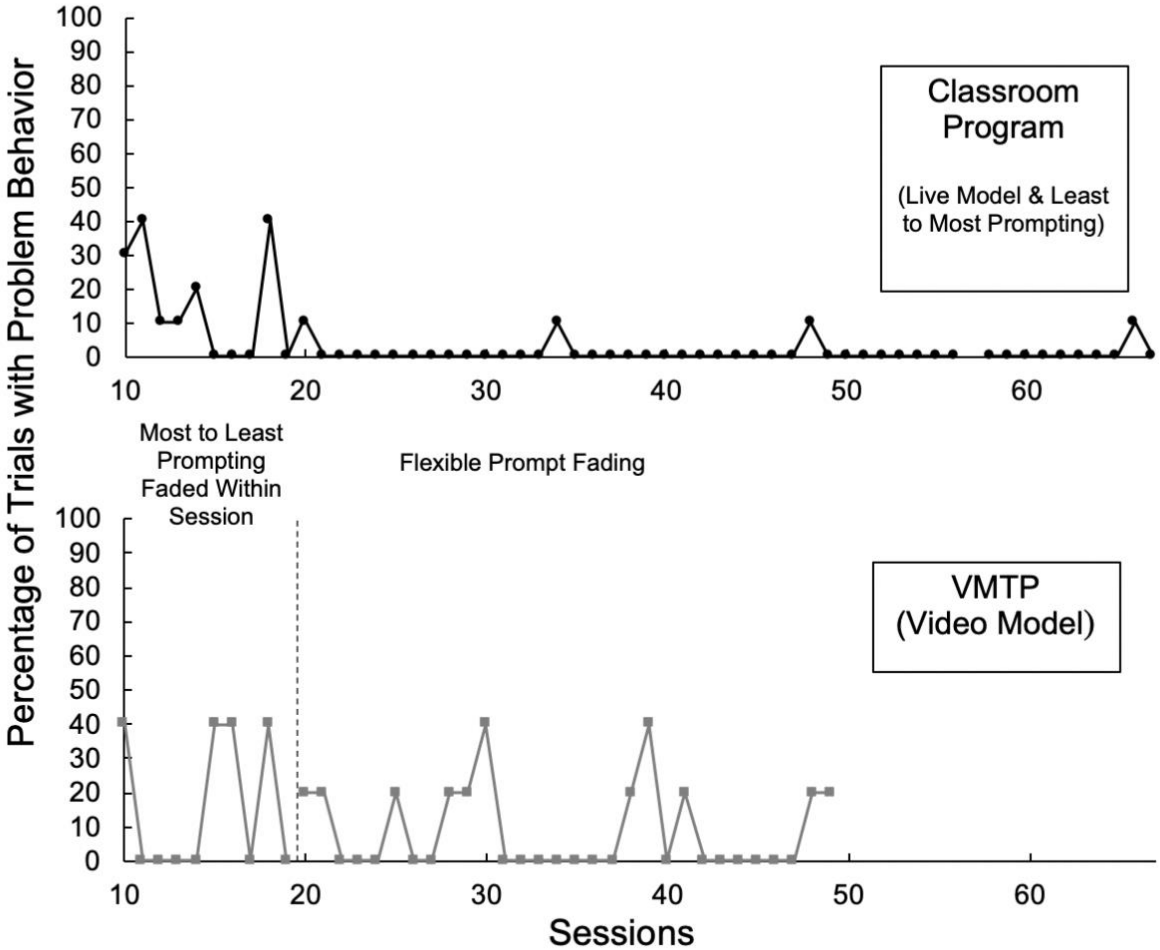


Figure 10. Randy's Problem Behavior During Treatments

Summary

Overall, the video modeling treatment package (VMTP) was more successful than the classroom program for three of the four children; however, only Pete mastered the targets with the initial VMTP that used most-to-least prompting faded within session. He was also the child who watched the video models for the longest time during the pre-testing of attending to live models vs. video models. Therefore, it is possible that the original VMTP was successful with him because he attended more to the video models than the other children; however, attending to the video models was not measured during the intervention. Sana and Toby learned to imitate with the VMTP but only after flexible prompt fading (FPF) was introduced. Randy was the only child who mastered a target in the classroom imitation program condition before mastering one in the VMTP condition, but then he performed poorly when all of the targets were placed in the classroom program condition.

Video Modeling

While it is unclear if video modeling was an essential component of the VMTP, it may be a logical choice to use to teach imitation for children who have difficulty with eye contact or attending to instructors, especially if orienting to videos is reinforcing.

There is a risk that faulty stimulus control could occur when using a video model, and the target response may be controlled by the presentation of the iPad (or another device used to display the video model) rather than by the model in the video. Both Pete and Toby continued to emit the first target taught with the video model after the second target was introduced with the video model. This is likely due to the iPad having gained some stimulus control over the original target response. Both children often began to respond before the person in the video modeled the action. This was remedied by blocking responding until the child saw the person in the video perform the action. In practice, this could be prevented by teaching at least two targets simultaneously with the video model from the start.

Another potential issue that could occur is a lack of generalization to a live model because the video model is exactly the same each time, and live models may vary slightly in their presentation each time. However, all of the children generalized to live models after the VMTP. One factor that could have contributed to the generalization to live models was the exposure to live models in the baseline condition. It is possible that being exposed to some intervention with live models might have aided in the responses generalizing to live models.

Prompting

Least-to-Most

Least-to-most prompting is often used in an attempt to promote independent responding, but it may not be useful if the child does not have a minimum level of the skill being prompted because, for the child who never makes a correct independent response, the behavior will never be reinforced. Both Toby and Pete began responding in the baseline condition for one target, which used least-to-most prompting; however, they both stopped responding after a few sessions and required the VMTP in order to master those targets. This may have been because they were not sufficiently skilled at imitation, so they were likely not emitting many accurate responses, resulting in attempts at responding being extinguished in the least-to-most condition due to their inaccuracy.

Most-to-Least

Most-to-least prompting faded within session was only effective for Pete. Toby and Sana required flexible prompt fading in order to master the responses. Even Randy, who did not master a response in the VMTP condition, did not make progress until flexible prompt fading was implemented. One explanation is that there may not be a sufficient number of prompt levels to effectively fade the prompts with most-to-least prompting. For example, the difference between the full physical prompt and the partial physical prompt may be too large of a gap for the child to close without a more gradual change between prompts; and, thus, the partial prompt may not evoke the correct response. While more prompt levels could be added to the most-to-least hierarchy, with flexible prompt fading, the instructor is able to add any number of prompt levels and fade them along a variety of dimensions (e.g., topography or force) in the moment in order to promote the child completing more and more of the response independently. The primary researcher provided the guidelines for FPF to the research assistants and provided examples of potential ways to prompt but emphasized that they had the freedom to make in-the-moment decisions about prompting and reinforcement based on the child's responding.

All instructors reported waiting longer before providing a prompt or increasing the prompt level during trials with FPF than in the most-to-least and least-to-most conditions. For instance, instead of just waiting 3 s before providing a prompt, they might wait 7-10 s. All instructors also reported using shaping in combination with prompts. For instance, initially the children made almost no responses, so any movement of the arm was reinforced. Additionally, the instructors provided a partial physical prompt for a longer time than typical and waited until the child made any independent movement that could be reinforced. Mrjlak (2017) demonstrated that shaping alone was not enough to effectively teach imitation, and physical prompts were required; therefore, it may be best to combine shaping and prompting.

One criticism of FPF is that it relies on the instructor's clinical judgement of how and when to prompt and reinforce and, thus, is subjective. However, there are other forms of teaching that are frequently used and accepted in the field that also rely on clinical decision-making, such as graduated guidance and shaping (Leaf, Leaf, Taubman, McEachin, & Delmolino, 2014). One explanation may be that FPF is not really subjective, but it allows the instructor's behavior to be under contingency control of the child's responding rather than controlled by the rule describing the systematic prompting method. For example, in least-to-most and most-to-least, the prompts are specified, and the method of fading the prompts is also specified. The instructor provides prompts based on the rules of the prompting method. However, this is a decision that is made a priori, not based on the subtleties of the child's responding. The rule-control of the specifications of the prompting method may interfere with the contingency control that could occur when the contingencies of the child's and instructor's responding interlock, in what Greer and McDonough (1999) have termed the "learn unit." The learn unit is an interlocking operant in which the instructor and child behaviors serve as discriminative stimuli and consequences for each other. If a particular prompt is effective at evoking a child's correct response or a closer approximation to the target response, that could serve as a reinforcer for the instructor's prompting and increase the likelihood that the instructor will use that effective prompt again.

Prompt dependency is another issue that arises when children are not making progress on an intervention using most-to-least prompting faded within session. If a child is not making any independent or partially prompted responses and is only receiving a reinforcer for fully prompted responses, no behavior is ever reinforced; the child only receives a reinforcer for not resisting the prompt. If no behavior is reinforced during an intervention, the child will not acquire the skill. This may be why FPF was more effective for the children who made almost no independent or partially prompted responses in the VMTP with most-to-least prompting faded within session. Because instructors could utilize shaping during FPF, they were able to reinforce any behavior that only slightly approximated the terminal target. Then, once responding was occurring, the instructors could work toward better approximations through prompting and shaping.

Numerous comparison studies on prompting methods have been conducted, in an attempt to find the most effective method for teaching. In many of these studies, the prompting method that works best for one child does not work best for another child (Cengher, Budd, Farrell, & Fienup, 2018). There are likely a variety of factors in a child's history that could affect how a child responds to a particular prompting method. So, it may not be reasonable to assume that one prompting method would be the most effective for all children. Seaver and Bourret (2014) evaluated an assessment of response-prompts and prompt-fading procedures that were then validated by teaching participants behavior chains utilizing the prompting methods identified in the assessment. They found that there were differences in responding to types of prompts and prompt-fading methods across participants and concluded that, instead of attempting to identify the best prompt for all, it may be most efficient to use a prompting assessment to identify the best prompting method for each individual.

Responding During Attending Pre-Tests

One unexpected occurrence was the two children's imitation of models during the attending to live models vs. video models assessment. Sana imitated the live model, and Toby imitated the video model. Reinforcers were provided following each instance, but that did not appear to increase responding during the imitation program.

Limitations

One limitation of this study is that no treatment integrity data were collected on the clinical judgement of the instructors implementing FPF. It is difficult to determine if such data would be reliable or valid if collected. The instructor may be experiencing non-observable stimuli that affect their method of prompting, such as the child's physical resistance to their prompts or the child requiring less pressure for a prompt; this would be difficult for an observer to notice if they were not implementing the prompts themselves. Therefore, it may not be possible for an independent observer to adequately assess how they would respond as the instructor if they were not actually implementing the FPF intervention themselves. Additionally, all of the instructors who implemented FPF had at least two years of experience implementing applied behavior analysis therapy. It is not known if a less experienced instructor would be as effective when implementing FPF.

Another limitation is that all of the children in this study struggled to acquire imitation using the classroom program that consisted of a live model with least-to-most prompting. Therefore, it is not clear if the VMTP or modified VMTP would be as effective for children who had not previously failed to make progress with that method of training imitation. It is possible that, for some children, the classroom program may be more effective.

Future Research

Future research should include a component analysis of the VMTP and a systematic comparison of most-to-least prompting and FPF. It may be not be necessary to use video modeling, as it is possible that a change in prompting would have produced the same results without the use of the video model. It is also possible that, for some children, a video model may provide some improvement without changing the prompting method.

Future research should also investigate the level of experience/competency needed to effectively implement FPF, as well as how to train instructors to implement it.

Additionally, the relationship between the length of time the child watches the video models during the pre-test and the effectiveness of the VMTP for that child should be investigated.

Conclusions

For the combinations of prompting (least-to-most, most-to-least, and flexible-prompt fading) and modeling (live and video) used in this study, the most effective varied from child to child, as has also been found in previous research, using various prompting and modeling methods. In other words, what is best for one child is not best for all. This is illustrated with the children who participated in the present study, children who had all failed to make any progress in learning to imitate with the typical classroom program; three of the four did master imitation when other methods of prompting and modeling were used. Combinations of these other methods of prompting and modeling may be helpful for other children who have failed to learn to imitate.

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Appendix A

Number of Trials for Children Who Did Not Master Imitation

Number of Trials for Children Who Did Not Master Imitation

Child Number	Classroom Program Trials	Alternative Program Trials	Total Trials	Reason for Non-Mastery
15	173	0	173	Moved Schools
25	193	0	193	Program Removed
27	287	0	287	Program Removed
33	159	669	828	Program Removed
37	13	863	876	Moved Schools
6	900	84	984	Program Removed

Appendix B

Pete—Generalized Imitation Probe

Pete – Generalized Imitation Probe

Target	*Familiar Instructor*	*Novel Instructor*
Tap head	+	+
Tap table	+	+
Arms up	-	+
Touch tummy	-	-
Wave	+	+
Pat knees	+	+
Stomp feet	-	-
Tap wall	+	+
Touch ear	+	-
Hug self	+	+
Percentage Correct	70	70

Appendix C

Pete—7-Month Maintenance Probe

Pete – 7-Month Maintenance Probe

Target	
Tap head	+
Tap table	+
Arms up	-
Touch tummy	+
Wave	+
Pat knees	-
Stomp feet	+
Tap wall	+
Touch ear	+
Hug self	+
Percentage Correct	80

Appendix D

Toby—Generalized Imitation Probe

Toby – Generalized Imitation Probe

Target	*Familiar Instructor*	*Novel Instructor*
Tap head	-	+
Tap table	+	-
Arms up	+	+
Touch tummy	-	+
Pat knees	+	-
Hands to cheeks	+	+
Stomp feet	+	+
Tap wall	-	-
Touch ear	-	+
Hug self	+	+
Percentage Correct	60 %	70%

Appendix E

Toby—4-Month Maintenance Probe

Toby – 4-Month Maintenance Probe

Target	
Tap head	+
Tap table	+
Arms up	+
Touch tummy	+
Pat knees	+
Hands to cheeks	+
Stomp feet	+
Tap wall	+
Touch ear	-
Hug self	+
Percentage Correct	90

Appendix F

Sana—Generalized Imitation Probe

Sana – Generalized Imitation Probe

Target	*Familiar Instructor*	*Novel Instructor*
Tap head	+	+
Wave	+	+
Touch nose	+	+
Touch tummy	+	+
Pat knees	+	+
Hands to cheeks	+	+
Stomp feet	+	+
Tap wall	+	+
Touch ear	+	+
Hug self	+	+
Percentage Correct	100 %	100%

Appendix G

HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Institutional Review Board
FWA00007042
IRB00000254

Date: August 15, 2018

To: Richard Malott, Principal Investigator
Sofia Peters, Student Investigator for thesis
Kelly Kohner, Co-Principal Investigator

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 18-08-07

This letter will serve as confirmation that your research project titled "Using Video Modeling to Teach Imitation to Children with Autism" has been **approved** under the **exempt** category of review by the Western Michigan University Institutional Review Board (IRB). The conditions and duration of this approval are specified in the policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., ***you must request a post-approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study"***). Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

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

Approval Termination: **August 14, 2019**

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