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Alixandra Raymond
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An Evaluation of Prompting and Fading Procedures in Teaching Socially Significant Skills to a Student with Autism

A Thesis Presented

by

Alixandra Raymond

The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirement for the degree of

Master of Science

in the field of

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Bouvé College of Health Sciences Graduate School

Thesis Title: An Evaluation of Prompting and Fading Procedures in Teaching Socially Significant Skills to a Student with Autism

Author: Alixandra Raymond

Department: Counseling and Applied Educational Psychology

Approved for Thesis Requirements of Master of Science Degree

_____ _____

(Jason Bourret, PhD, BCBA) Date

_____ _____

(Susan Langer, MA, BCBA) Date

_____ _____

(Cammarie Johnson, MA, LMHC, BCBA) Date

An Evaluation of Prompting and Fading Procedures in Teaching Socially Significant Skills to a Student with Autism

by

Alixandra Raymond

Submitted in partial fulfillment of the requirements for the degree of Master of Science in Applied Behavior Analysis in the Bouvé College of Health Sciences Graduate School of Northeastern University, August 2011

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Abstract

This study compared three methods of prompting and three methods of fading procedures in teaching one student with autism to successfully build plastic building block constructs, fold pants, and fold a shirt. Three experiments were conducted. Experiment 1 compared verbal, model, and manual guidance prompts to determine the prompt with which the participant acquired the behavioral chain most rapidly. Experiment 2 used these prompt type results to compare most-to-least, least-to-most, and time delay fading procedures to determine with which method the participant acquired the chain most rapidly. Experiment 3 used the most and least effective prompt type and fading procedure to teach pants and shirt folding to the participant. Results showed that the participant learned to fold pants using the most effective method, and did not learn shirt folding until the most effective method was applied.

Individuals with developmental disabilities, specifically autism, acquire skills differently than typically-developing individuals. Various methods are used to teach individuals life skills including stimulus prompts (Steege, Wacher, & McMahon, 1987; Touchette, 1971) and response prompts. Response prompts are supplementary antecedent stimuli used to occasion a correct response in the presence of a discriminative stimulus that will eventually control the response (Cooper, Heron, & Heward, 2007). Types of response prompts, including verbal, model, and manual guidance, can be used to train a variety of skills (Cuvo, Leaf, & Borakove, 1978; Egel, Richman, & Koegel, 1981; Krantz & McClannahan, 1998). These prompts are gradually removed to promote independence, transferring control to the naturally occurring stimulus by a method called prompt fading. Prompt fading methods include most-to-least (MTL) fading (Jerome, Frantino, & Sturmey, 2007), least-to-most (LTM) fading (Horner & Keilitz, 1975) and time delay fading (Touchette, 1971).

The combination of response prompts and fading procedures has been used to teach many skills to individuals with intellectual disabilities. Using a combination of verbal instruction, modeling, and physical guidance, Cuvo et al. (1978) trained a sequence of janitorial skills consisting of 181 steps to 11 adolescents. Six subtasks consisting of 181 steps were developed to teach participants how to clean a restroom. Twenty of the 181 steps were determined to be more difficult than the others and required a different prompting procedure than the other 161 steps. A MTL prompting hierarchy (i.e., verbal instruction plus modeling, verbal instruction plus graduated physical guidance, verbal instruction only) was used to teach those 20 steps to the participants. Once the participant completed a step with no help one time, they advanced to the next step. If the participant did not respond at any prompt level, the previous level was applied once again. For the other 161 steps, a LTM prompting hierarchy (i.e., verbal instruction, verbal

instruction plus modeling, and verbal instruction plus graduated physical guidance) was applied. For these steps, the more intrusive step was only delivered if the participant did not respond within 5 s or responded incorrectly. Results showed that the combination of these two methods produced significant improvements in skill acquisition, with four of the six participants mastering the task in eight days, and the other two requiring one extra session. Generalization was assessed in a separate bathroom, and post checks were conducted after a short period of time, with performance remaining above criterion in both situations. The combination of these prompting and fading procedures was effective in teaching these skills to these participants; however, it is unclear whether these prompts alone (i.e., verbal, model, manual guidance) may have been effective in producing similar results instead of combining these prompts.

To evaluate the effects of errorless learning procedures and backward chaining using MTL prompting, Jerome et al. (2007) used physical guidance to teach internet skills to three individuals diagnosed with autism and mental retardation. In this study, the prompting hierarchy (i.e., hand-over-hand guidance, hand-over-wrist guidance, hand-over-elbow guidance, and hand-over-shoulder guidance) was implemented after the therapist allowed 3 s for responding to the initial discriminative stimulus (i.e., “[name], begin playing on the computer.” If the participant did not respond, then the prompting procedure was implemented until all prompts were faded and the participant performed the task independently on two consecutive trials. Using this method, one participant’s performance met criterion for all 13 steps in one 40-min teaching session, another participant met criterion after five 40-min teaching sessions, and a third participant met criterion in one 40-min teaching session.

Least-to-most prompting was implemented by Horner and Keilitz (1975) in an attempt to teach eight adolescents diagnosed with mental retardation to brush their teeth. A 15-step task

analysis (TA) was developed by the repeated viewing of video tapes of three staff members as well as three individuals with mental retardation brushing their teeth. The prompting hierarchy (i.e., allowing for independent responding; delivering a verbal instruction; delivering a verbal instruction again; delivering a verbal instruction as well as presenting a gesture and a model; repeating the verbal instruction, gesture, and model; using physical guidance plus verbal instruction, and repeating physical guidance plus verbal instruction) was then implemented for the each step of the TA. Results indicated that performance for both groups of participants markedly increased from baseline, with six of the eight participants' performances meeting mastery criterion. The other two participants made gains that allowed them to be indistinguishable from typically developing peers, even though they did not meet mastery criterion. A limitation of this study is that the study only focused on brushing teeth, and these results were not tested for generalization to other tasks.

Time delay is implemented as a prompt-fading procedure where the transfer of stimulus control occurs by delaying the response prompt. This method can be implemented by itself or in conjunction with MTL and LTM prompting. Touchette (1971) implemented a time delay procedure to measure the moment of transfer of control to the naturally-occurring stimulus. Three adolescent boys diagnosed with severe mental retardation participated in this study and were previously taught to press a red key while a white key was present. The letter E with the legs pointing down (S+) and the letter E with the legs pointing up (S-) were initially superimposed on the red and white keys, respectively. As trials progressed, a progressive time delay was added, with the immediate presentation of the letter, and then if 0.5 seconds elapsed before the participant pressed the correct key, the color was added back to the letters. An additional 0.5 seconds was added for each correct response, or removed for each incorrect

response, until the participant demonstrated independent responding, which occurred at 6.5 seconds for two of the participants and 4.5 seconds for the third participant, indicating that time delay was effective in 14 trials or less. Errors remained low throughout the study.

Although many studies exist demonstrating the use of each type of prompting and fading procedure, there are few studies comparing them within participants. Repp, Karsh, and Lenz (1990) compared the task demonstration model (TDM) and a standard prompting hierarchy (SPH) when teaching two or three digit numbers to eight individuals diagnosed with moderate or severe retardation. The TDM was based on a stimulus fading procedure where the incorrect stimulus was gradually made more like the correct stimulus, while the SPH was a LTM prompting procedure. These two methods were compared not only in baseline and training sessions, but in two different locations as well as six months after training. Results of this study showed that the TDM was more effective in training for all participants as well as for six of the eight participants during generalization in other locations. However, no other tasks were evaluated using these procedures, therefore, it is unsure whether the TDM would still be more effective for these participants when applied to other tasks.

To compare MTL and LTM prompting strategies, Libby, Weiss, Bancroft, and Ahearn (2008) taught various Lego© constructs to four children diagnosed with autism and one child diagnosed with pervasive developmental delay. Two experiments were conducted, with the first using MTL and LTM prompting strategies to teach the Lego© constructs. Results showed that three of the children acquired the chain more quickly using LTM prompting while two of the children acquired the chain more quickly using MTL prompting. For the participants who acquired the chain more rapidly using LTM prompting, more errors were recorded with LTM prompting, but the MTL procedure took the participants longer to acquire the chain which may

have been due to the nature of the fading procedure. In the second experiment, a third condition with MTL with a delay (MTLD) was added to attempt to allow independent responding with fewer errors. Results of this study showed that MTLD was more effective and produced fewer errors for two of the three participants than LTM or MTL. However, these results were not applied to any other skills, so it is unknown as to whether the most effective procedure for each participant would generalize to other activities.

The purpose of the current study was to extend previous research on prompting strategies by using Lego© constructs to determine the most effective teaching procedures for a student diagnosed with autism. Three experiments were conducted. Experiment 1 determined the most effective prompting procedure, Experiment 2 used that prompt to determine the most effective fading procedure, and Experiment 3 used the most and least effective prompting and fading procedures to teach socially significant skills to one student with autism.

Method

Participants

One participant was included in this study. Dan was a 7-year-old male student in a residential school for children with autism. He had a diagnosis of autism, had never been exposed to this type of study, and communicated primarily with a picture exchange communication system, along with the use of some manual signs and vocal-verbal approximations.

Materials and Setting

An alternating treatments design was implemented in this study. Sessions took place in Dan’s classroom during school hours with other students and staff in the classroom three to four times a week for a duration of 5-20 m each session. One to four sessions were conducted per day,

depending on the participant's availability and the Experiment that was being conducted that day. Each area that Dan worked in was six feet by six feet with partitions forming a box with one opening. The therapist was positioned next to the participant to allow for proper physical prompting. For Experiments 1 and 2, materials consisted of a table, a 3-ring binder with data sheets, a pen, high-preferred edible reinforcers, and three separate sets of plastic building blocks each in a separate resealable plastic bag. For Experiment 3, the plastic building blocks were replaced by a short sleeved shirt and pants.

A preference assessment was first conducted to determine a highly preferred edible item for the participant. This assessment was conducted based on the procedures described by Fisher et al. (1992). Results of the assessment showed that Vanilla Tootsie Rolls and Rice Krispie Treats were the highest preferred edible items. Both items were selected on an equal number of trials, and when paired against each other, were also equally chosen. Vanilla Tootsie Rolls were then chosen to be used due to the therapist's availability to the items.

Data sheets were designed for building block constructs consisting of eight pieces. These constructs were designed to be identical in difficulty and were randomly assigned to one of the three prompting procedures. Three different color bases, of identical shape and size, were used. The area where the first piece was to be placed was shaded in with permanent marker.

Response Measurement and Interobserver Agreement

Data were collected on the prompt type and response accuracy using a pen and data sheets in a 3-ring binder either within session or by videotape. Interobserver agreement was collected either within session or later via video recordings by a teacher trained in data collection for task analyses. Interobserver agreement was collected for 36.28% of sessions with a mean of

98.58 %agreement (range, 80-100%). Data were input into a spreadsheet showing the number of correct independent steps, the number of errors per trial, and the total trials to mastery.

Procedure

Using similar procedures to Libby et al. (2008), three experiments were conducted. In Experiment 1, the experimenter trained three plastic building block constructs using verbal plus gestural prompting (VG), model prompting, and physical prompting (MG). In Experiment 2, the experimenter trained three different block constructs using the most effective prompt (determined in Experiment 1), paired with least-to-most (LTM), most-to-least (MTL), or a progressive time delay fading procedure. In Experiment 3, the experimenter trained two novel behavioral chains, which were similar in difficulty, using the most and least effective methods (prompt and fading procedure) as determined by Experiments 1 and 2. The purpose of Experiment 3 was to assess the validity of these finding by replicating the results using socially significant tasks.

Experiment 1

Experiment 1 examined three prompting modalities: VG, model, and MG. Each prompt type was associated with two sets (initial and replication) of plastic building blocks of different shapes and sizes. When training the construct with MG, the red base was used, when training the construct using model prompts, the yellow construct was used, and when training the construct using VG, the green construct was used. The top row of Figure 1 shows the constructs used for the initial tasks and the bottom row of pictures shows the constructs used for replication tasks. The starting point of the construct was marked with permanent marker. Complete breakdowns of the prompting hierarchies are shown in Table 1. Table 2 shows the behavior required of the participant to successfully complete the chains. When the participant mastered a construct using

one of these prompts, the rest of the constructs were discontinued after an equal number of sessions had been conducted to ensure an equal number of sessions for each modality. Once the construct was mastered, replication was conducted using a different construct but the same methods.

The participant sat at a desk with the experimenter who placed all the plastic block pieces in front of him or her. Baseline procedures were conducted by then stating, “Let’s build Legos©!” to the participant. The participant was then allowed to complete the construct independently, and the session was discontinued once the participant made an error. The first step that was not completed independently during baseline was the first step that was participant trained on. Baseline was only conducted once for each modality, prior to training, and was not conducted for each subsequent session. During training, a progressive time delay procedure was used with each prompt type. At first each prompt was delivered immediately, but then was delayed for successively longer periods to allow for independent responding. Once the participant responded independently, the next step was introduced. If the participant made an error, the trial was immediately discontinued. If the participant made two consecutive errors on a previously mastered step, that step was retrained. Once a participant mastered a construct using one of the three procedures, sessions were continued with each prompt type until there was an even number of sessions conducted for each modality. The same procedures were then used for replication construct.

Results and Discussion

Baseline data for the initial construct indicated that Dan completed 0 steps of the TA independently for all three of the constructs. Across 16 sessions shown in Figure 2, Dan acquired all eight steps of the TA with MG prompts, four steps of the TA with model prompts, and two

steps of the TA with VG prompts. Baseline data for the replication construct indicated that Dan completed one step of the TA independently for all constructs. Across 14 sessions, Dan acquired all eight steps of the TA with MG, six steps of the TA using model prompts, and 1 step of the TA using VG prompts. Therefore, MG was determined to be the most effective and VG the least effect prompt for Dan.

Experiment 2

Procedures used in Experiment 2 were identical to Experiment 1, except this experiment evaluated MG with three different fading procedures (i.e., MTL, LTM, and time delay). Each fading procedure was associated with a different novel plastic block constructs (see Figure 3). MTL faded the location of the physical prompt from the hand, to the forearm, to the upper arm, to a light touch on the upper arm, to no prompt. LTM consisted the of the experimenter allowing 3 s for independent responding, then if there was no response, more intrusive prompts were applied (light touch, MG upper arm, MG forearm, MG hand). Table 3 shows the complete breakdown of these fading strategies. Replication trials were conducted after the participant mastered an initial construct with one of the fading procedures.

Results and Discussion

Results of Experiment 2 are shown in Figure 4. Baseline data indicated that Dan completed one step independently in the MTL and time delay conditions and two steps independently in the LTM condition. In 11 sessions, Dan acquired all eight steps of the TA with LTM fading, six steps of the TA with MTL fading, and five steps of the TA with time delay. Results of the replication indicated that in nine sessions, Dan acquired all eight steps of the TA with LTM fading, four steps using time, and seven steps of the TA using MTL fading. Therefore,

the most effective fading procedure was determined to be LTM fading, and the least effective fading procedure was determined to be time delay.

Experiment 3

In Experiment 3, two novel behavior chains were trained: pants and shirt folding. One chain was trained using the best modality as determined by which constructs the participant acquired the quickest. The other chain was trained using the worst modality, as determined by which modality the participant acquired the construct with the slowest. Once the participant acquired all eight steps of the chain using the best modality, the procedure used to train the other chain was then changed to the best modality so that the participant could successfully complete both tasks. Using the combination of verbal plus gestural prompting and delay fading, shown to be the least effective combination, a shirt folding TA was trained. The combination of manual guidance prompting plus least-to-most fading, shown to be the more effective combination, was used to train a pant folding TA. Baseline procedures were conducted once before training each TA. Steps for these task analyses are shown in Tables 4, 5, and 6. Due to a lack of progress by the participant when folding the shirt, the chain was altered to follow the way in which Dan was folding the shirt. The pants folding TA taught the participant to fold one leg of the pants all the way to the other side, but in the shirt folding TA he was supposed to fold the shirt sleeves to the middle. Accounting for his errors, Dan would instead fold the sleeve the entire way to the other side of the shirt. This could have been due to the learning history during pants folding, and this skill was then generalized to shirt folding. Since shirt folding was being trained using least-to-most guidance, Dan emitted this incorrect behavior before the experimenter was able to deliver a prompt. Therefore, the shirt-folding TA was revised to more closely follow the pants folding TA (see Table 6).

Results and Discussion

Results are shown in Figure 5. Baseline data indicated that Dan completed no steps of either the pants or shirt folding TAs independently. Dan completed all eight steps of the pants folding TA and three steps of the shirt folding TA in 19 sessions. When the most effective teaching procedure, MG with LTM, was then applied to the shirt folding TA, 14 sessions were conducted before it was determined that the participant was not making progress, as he was still only completing three steps of the TA independently. Once the chain was altered, the least effective teaching procedure, VG with time delay was then reinstated for 11 sessions with the new TA; Dan never completed more than four steps of the chain independently. The most effective procedure, MG with LTM, was then applied to the revised TA and Dan independently completed all eight steps of the TA within 10 sessions.

General Discussion

This study shows that an assessment protocol that determines effective prompts and fading strategies for teaching one skill can inform the most efficacious teaching procedures for teaching other socially significant skills. Overall results of this study indicate that for this participant, manual guidance prompting combined with least-to-most fading was the most effective method in teaching various block constructs as well as socially significant skills. While manual guidance prompting produced the fewest errors and was the most effective prompt for Dan, LTM fading produced the most errors even though it was the most effective fading procedure. Total errors for each experiment and procedure are shown in Table 7. Previous research has indicated that when participants make errors they are more likely to make the same error in the future, even on a previously mastered skill (Terrace, 1963b). MTL fading has been found to require more training sessions than other fading strategies, therefore the use of MTL

plus a delay has been added in previous research (Libby et al., 2008). In the current study, only a progressive time delay was evaluated to determine the effects of a time delay alone and not in conjunction with a MTL fading procedure.

A limitation of the current research was the potential confound of a fading procedure combined with the prompt assessment in Experiment 1. Exposure to time delay in Experiment 1 may have altered the results of Experiment 2, which specifically assessed different prompt fading protocols. Because of potential confound of the fading procedures used in Experiment 1's prompt assessment, we evaluated post-hoc the extent to which the participant responded correctly when each prompt was delivered in Experiment 1. Results, shown in Figures 6 and 7, indicate the percent of correct responding when each prompt type was delivered. With an immediate MG prompt, the participant always responded correctly, which may have led to more rapid acquisition. With an immediate model prompt, the participant sometimes responded correctly until step five, and then failed to respond correctly after that, or was not given the chance because he mastered the other chain with manual guidance and the trials were discontinued. When a verbal prompt was delivered, Dan responded correctly less than 50 percent of the time and never responded correctly on steps 3 or above. Replication data were similar: Dan always responded correctly with MG, between 60 and 100 percent of the time on seven of the eight steps with a model prompt, and only responded correctly on step two less than 60 percent of the time when an immediate verbal prompt was delivered. Implications of these data suggest that the entirety of the chain may not need to be trained if the immediate prompt does not always occasion the correct response. Future research should use this revised assessment protocol.

Another potential limitation was that prerequisite skills were not assessed, such as the participant's baseline ability to follow verbal directives or imitate a model. For instance, if spoken color names had no stimulus control over the participant's performance, then VG prompts that named the block color to pick up would not be expected to be effective. With the VG prompting, the participant may not have known names of colors of the blocks; therefore, the prompt would have been useless. Another limitation of the current study is that maintenance probes were not conducted, so it is unknown whether the participant maintained the skills and whether errors would be prevalent. Also, all sessions were conducted with one therapist and in one setting, so it is unknown as to whether the skills would generalize to a novel therapist or setting.

Further research should not use a fading procedure as used in Experiment 1, but rather, as these data suggest, test for which prompt occasions correct responding by delivering the most intrusive verbal, model and manual guidance prompt. Future research may also concentrate on the comparison of forward, backward, and total task chaining procedures, as few comparison studies have been conducted (Walls, Zane, & Ellis, 1981). Other studies have compared only forward and backward chaining, resulting in mixed data. Weiss (1978) compared forward and backward chaining procedures using ten first-year psychology students with results indicating forward chaining was superior to backward chaining, producing significantly fewer errors. However, more current research conducted by Batra and Batra (2005) indicated that when comparing forward and backward chaining, more physical prompts were required with forward chaining, more reinforcement was delivered with backward chaining, and the number of errors and verbal prompts required were almost equal.

Also, methods of chain completion such as manually guiding the participant through the rest of the chain after the training step, discontinuing the trial after the training step, and having the therapist completing the rest of the chain should be evaluated for effectiveness. Bancroft, Weiss, Libby, and Ahearn (in press) compared manual guidance, trainer completion, and no completion of untrained steps. Results indicate that three of the four participants acquired the chain more rapidly using manual guidance completion, and one participant acquired the chain more rapidly using teacher completion. Given the results of this study, MG prompting with LTM fading was successful in teaching one participant to successfully complete block constructs, and generalized to socially significant skills. This experiment should be replicated with more participants, as well as with the same participant in teaching different skill sets.

References

Bancroft, S. L., Weiss, J. S., Libby, M. E., and Ahearn, W. H. (in press). A comparison of procedural variations in training behavior chains: Manual guidance, trainer completion, and no completion of untrained steps. *Journal of Applied Behavior Analysis.*

Batra, M., and Batra, V. (2005). Comparison between forward chaining and backward chaining techniques in children with mental retardation. *The Indian Journal of Occupational Therapy, 37*, 57-63.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Cuvo, A. J., Leaf, R. B., Borakove, L. S. (1978). Teaching janitorial skills to the mentally retarded: Acquisition, generalization, and maintenance. *Journal of Applied Behavior Analysis, 11,* 345-355.

Egel, A. L., Richman, G. S., & Koegel, R. L. (1981). Normal peer models and autistic children's learning. *Journal of Applied Behavior Analysis*, 14, 3-12.

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owen, J. C., and Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25,* 491-498.

Horner, R. D., and Keilitz, I. (1975) Training mentally retarded adolescents to brush their teeth. *Journal of Applied Behavior Analysis*, 8, 301-309.

Jerome, J., Frantino, E. P., and Sturmey, P. (2007). The effects of errorless learning and backward chaining on the acquisition of internet skills in adults with developmental disabilities. *Journal of Applied Behavior Analysis, 40,* 185-189.

Krantz, P. J., & McClannahan, L. E. (1998). Social interaction skills for children with autism: A script-fading procedure for beginning readers. Journal of Applied Behavior Analysis, 31, 191-202.

Libby, M. E., Weiss, J. S., Bancroft, S., and Ahearn, W. H. (2008). A comparison of most-to-least and least-to-most prompting on the acquisition of solitary play skills. *Behavior Analysis in Practice*, 1, 37-43.

Repp, A. C., Karsh, K. G., and Lenz, M. W. (1990). Discrimination training for persons with developmental disabilities: A comparison of the task demonstration model and the standard prompting hierarchy. *Journal of Applied Behavior Analysis, 23,* 43-52.

Steege, M. W., Wacher, D. P., and McMahon, C. M. (1987). Evaluation of the effectiveness and efficiency of two stimulus prompt strategies with severely handicapped students. *Journal of Applied Behavior Analysis, 20,* 293-299.

Terrace, H. S. (1963b). Errorless transfer of a discrimination across two continua. *Journal of Applied Behavior Analysis, 6,* 223-232.

Touchette, P. E. (1971). Transfer of stimulus control: Measuring the moment of transfer. *Journal of the Experiment Analysis of Behavior, 15,* 347-354.

Walls, R. T., Zane, T., and Ellis, W. D. (1981). Forward and backward chaining, and whole task methods: Training assembly tasks in vocational rehabilitation. *Behavior Modification, 5,* 61-74.

Weiss, K. M. (1978). A comparison of forward and backward procedures for the acquisition of response chains in humans. *Journal of the Experimental Analysis of Behavior, 29,* 255-259.

Table 1

Prompting procedure for Experiment 1

Verbal + Gestural	**Model**	**MG**
0 s delay to a Verbal plus Gesture Prompt	0 s delay to a Teacher Model	0 s delay to Hand over Hand
1 s delay to a Verbal plus Gesture Prompt	1 s delay to a Teacher Model	1 s delay to Hand over Hand
2 s delay to a Verbal plus Gesture Prompt	2 s delay to a Teacher Model	2 s delay to Hand over Hand
4 s delay to a Verbal plus Gesture Prompt	4 s delay to a Teacher Model	4 s delay to Hand over Hand
Independent	Independent	Independent

Table 2

Steps for plastic block construct TA for both Experiments 1 and 2

Step 1	Pick up first piece and place in front of them
Step 2	Pick up second piece and place in designated area
Step 3	Pick up third piece and place in designated area
Step 4	Pick up fourth piece and place in designated area
Step 5	Pick up fifth piece and place in designated area
Step 6	Pick up sixth piece and place in designated area
Step 7	Pick up seventh piece and place in designated area
Step 8	Pick up eighth piece and place in designated area

Table 3

Fading procedure for Experiment 2

Least-to-most	**Delay**	**Most to Least**
Independent	0 s delay to Hand over Hand	Hand over Hand
Light Touch/shadow	1 s delay to Hand over Hand	MG at forearm
MG at upper arm	2 s delay to Hand over Hand	MG at upper arm
MF at forearm	4 s delay to Hand over Hand	Light touch/shadow
Hand over Hand	Independent	Independent

Table 4

Steps for the pants folding TA

Step 1	Lay pants across the table facing person
Step 2	Hold L top corner and L bottom of pant leg
Step 3	Fold L pant leg to other pant leg
Step 4	Hold both sides of bottom pant legs
Step 5	Fold to top of pants
Step 6	Hold both sides of bottom again
Step 7	Fold toward top of pants
Step 8	Place folded pants in designated area

Table 5

Original steps for the shirt folding TA

Step 1	Pick up shirt
Step 2	Lay shirt flat on table
Step 3	Hold left sleeve and bottom left of shirt
Step 4	Fold to middle of shirt
Step 5	Hold right sleeve and right bottom of shirt
Step 6	Fold to middle of shirt
Step 7	Lift bottom of shirt and fold in half to neckline
Step 8	Place folded shirt in designated area

Table 6

Revised steps for the shirt folding TA

Step 1	Pick up shirt
Step 2	Lay shirt flat on table
Step 3	Hold left sleeve and bottom left of shirt
Step 4	Fold in half to other side of shirt
Step 5	Hold top and bottom of both sleeves
Step 6	Fold sleeves to middle of shirt
Step 7	Lift bottom of shirt and fold in half to neckline
Step 8	Place folded shirt in designated area.

Table 7

Total errors in all experiments

	Experiment 1			**Experiment 1 Replication**		
Procedure	Verbal	Model	MG	Verbal	Model	MG
Total Errors	110	81	40	99	49	35

	Experiment 2			**Experiment 2 Replication**		
Procedure	LTM	MTL	MTLD	LTM	MTL	MTLD
Total Errors	29	18	27	25	16	20

	Experiment 3	
Procedure	MG+LTM	VG+Delay
Total Errors	141	258

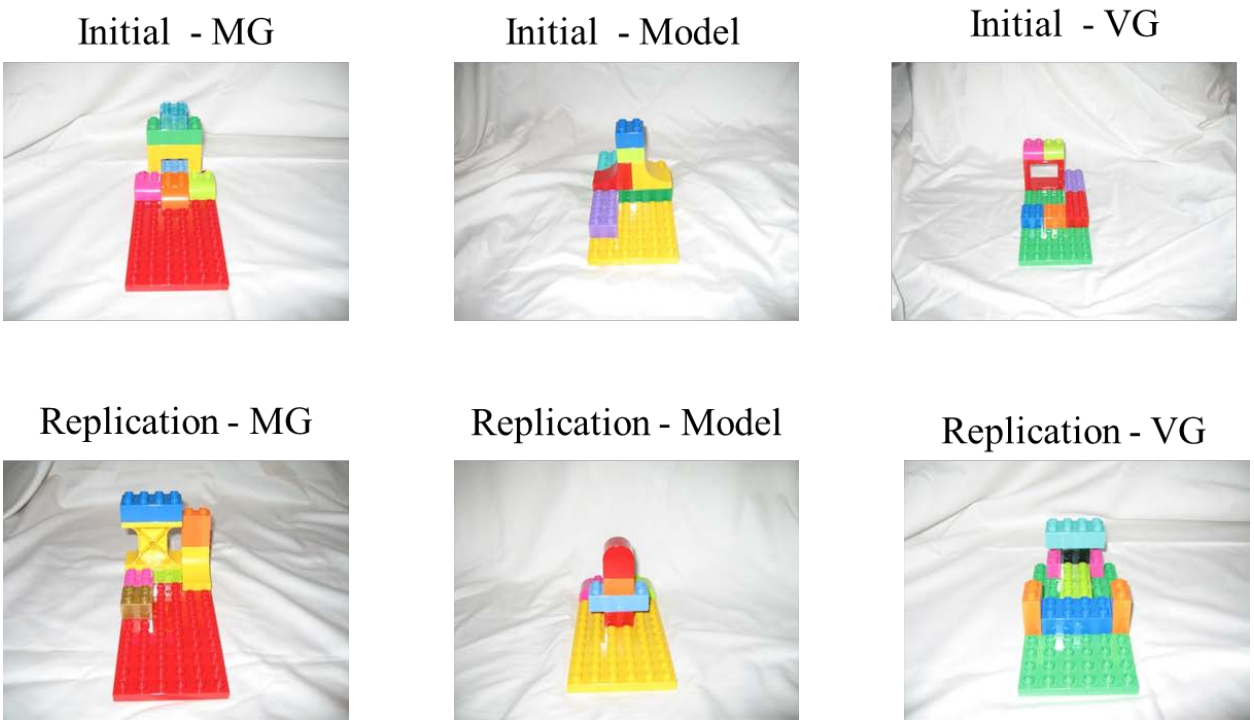

Figure 1. Constructs for Experiment 1's initial and replication trials. Red base was used for MG, yellow base was used for model, and green base was used for VG.

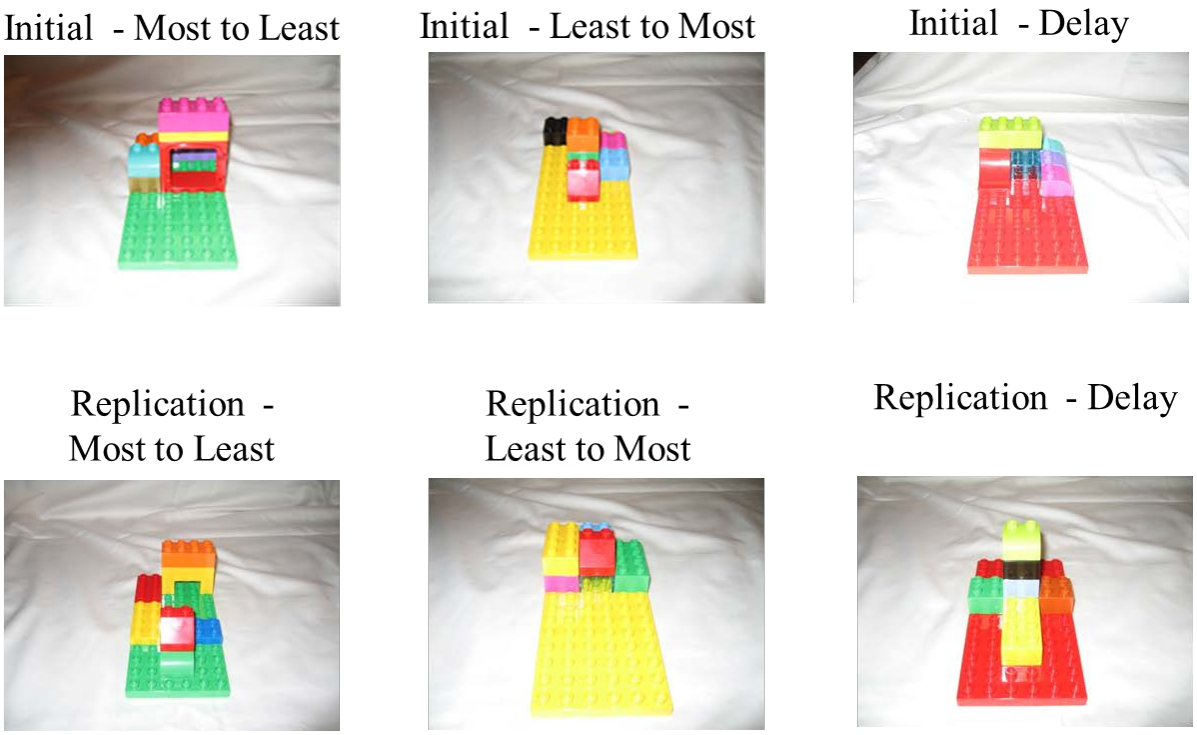

Figure 2. Constructs for Experiment 2's initial and replication trials. Green base was used for MTL, yellow base was used for LTM, and red base was used for delay.

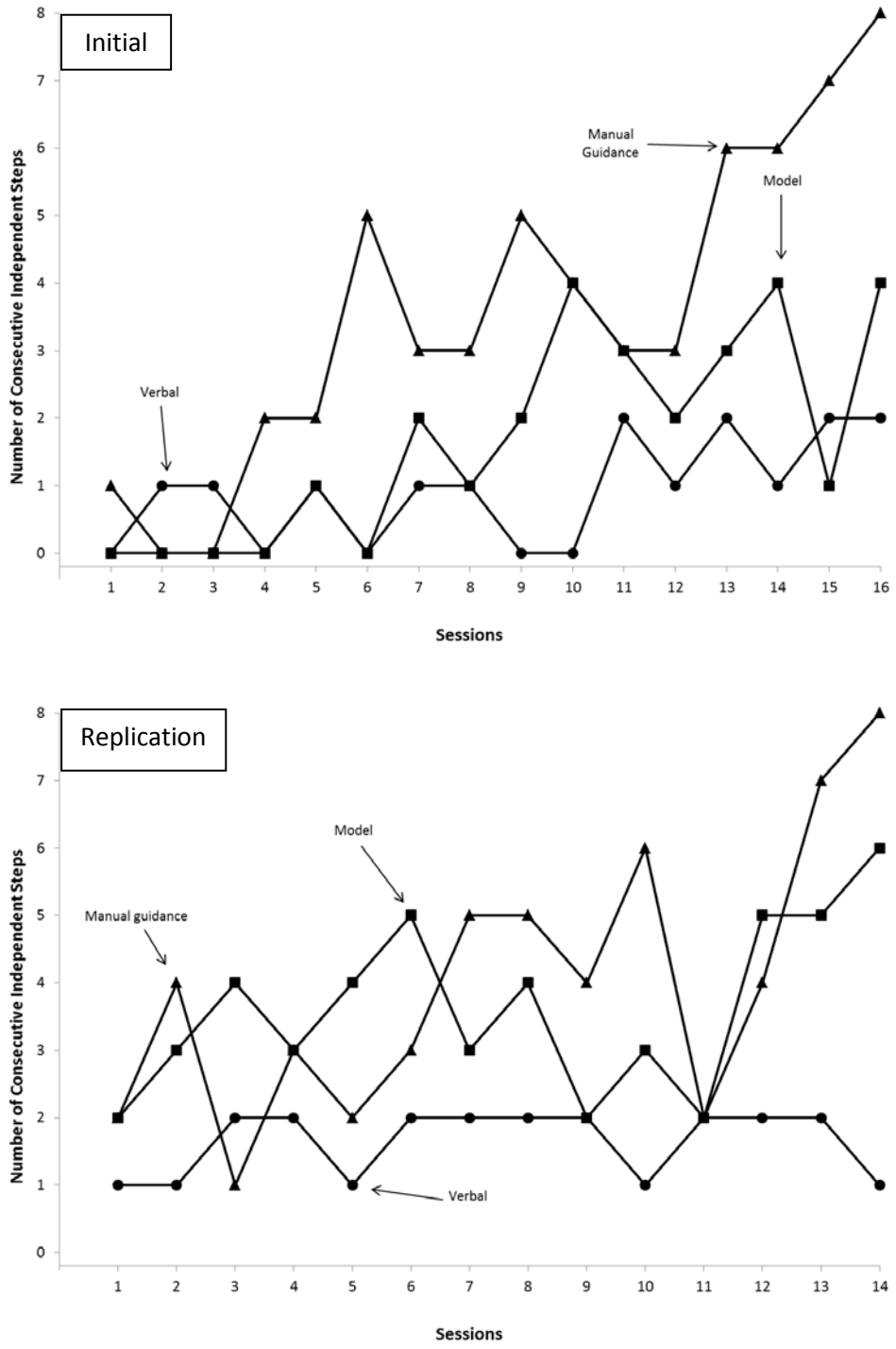

Figure 3. Results from Experiment 1's initial and replication constructs, depicted as the number of consecutive independent steps in the last trial of each session.

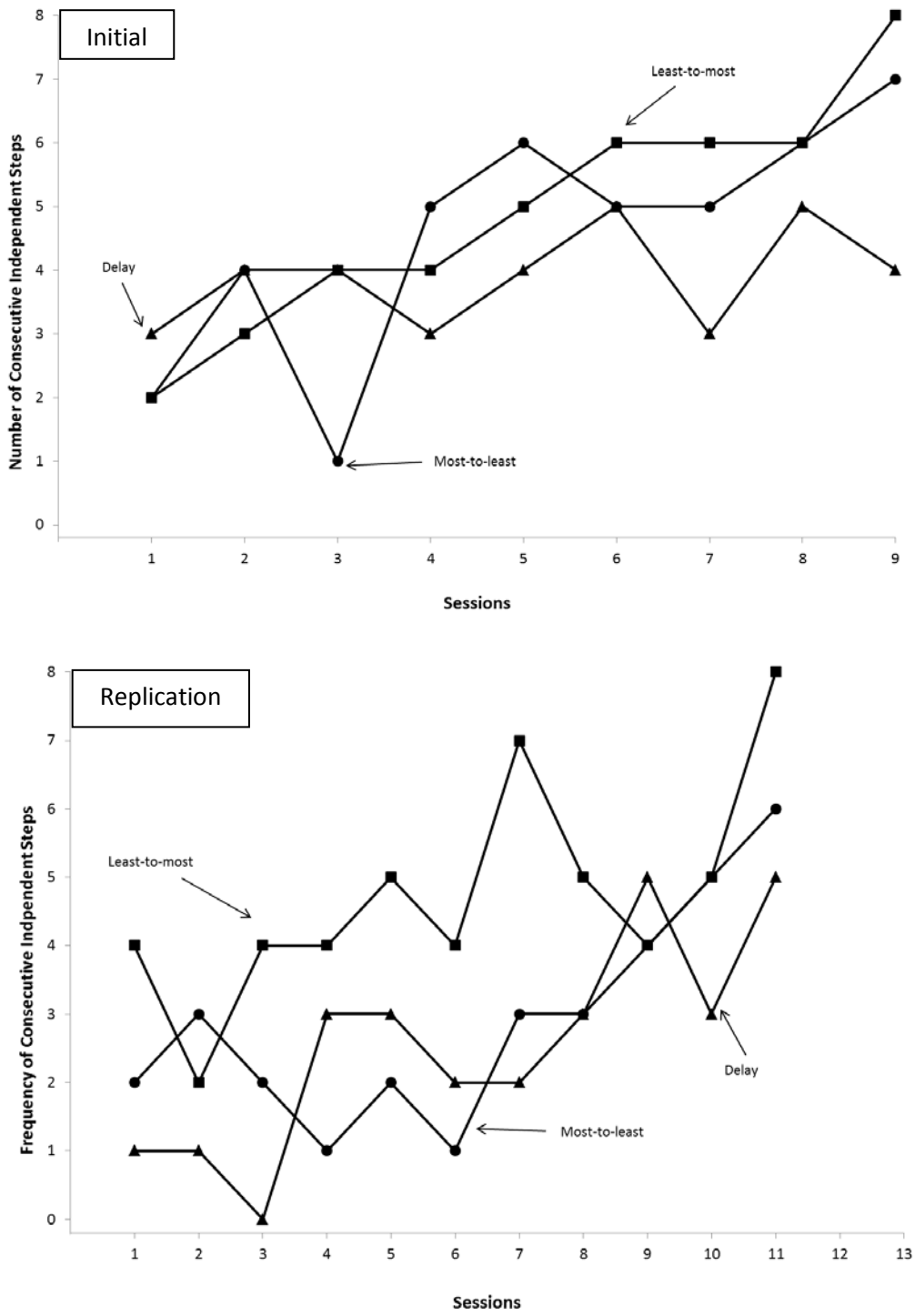

Figure 4. Results from Experiment 2's initial and replication constructs, depicted as the number of consecutive independent steps in the last trial of each session.

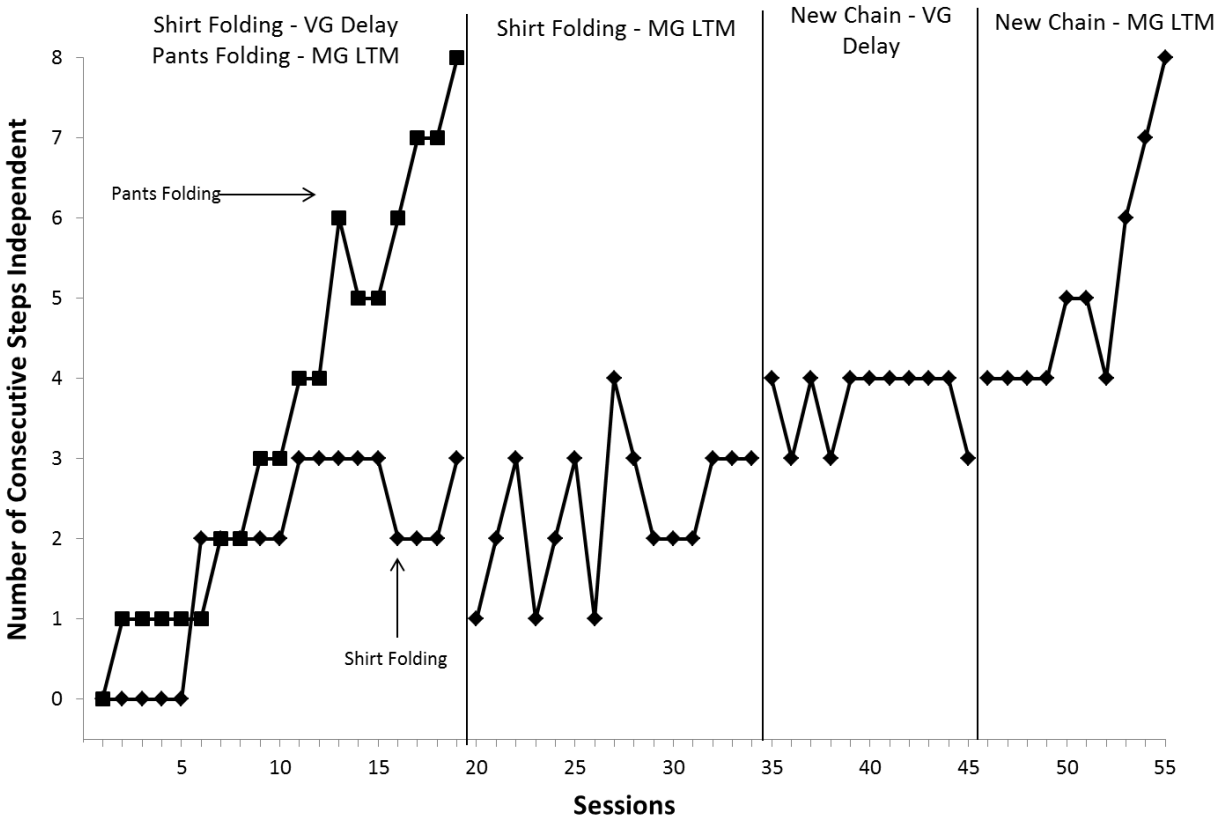

Figure 5. Results of experiment three. The first phase indicates shirt folding and pants folding using the least and most effective methods. Phase two indicates shirt folding when switched to the most effective method. Phase three indicates a change in the shirt folding chain, and using the least effective method. The final phase was when the most effective method was implemented with the new chain.

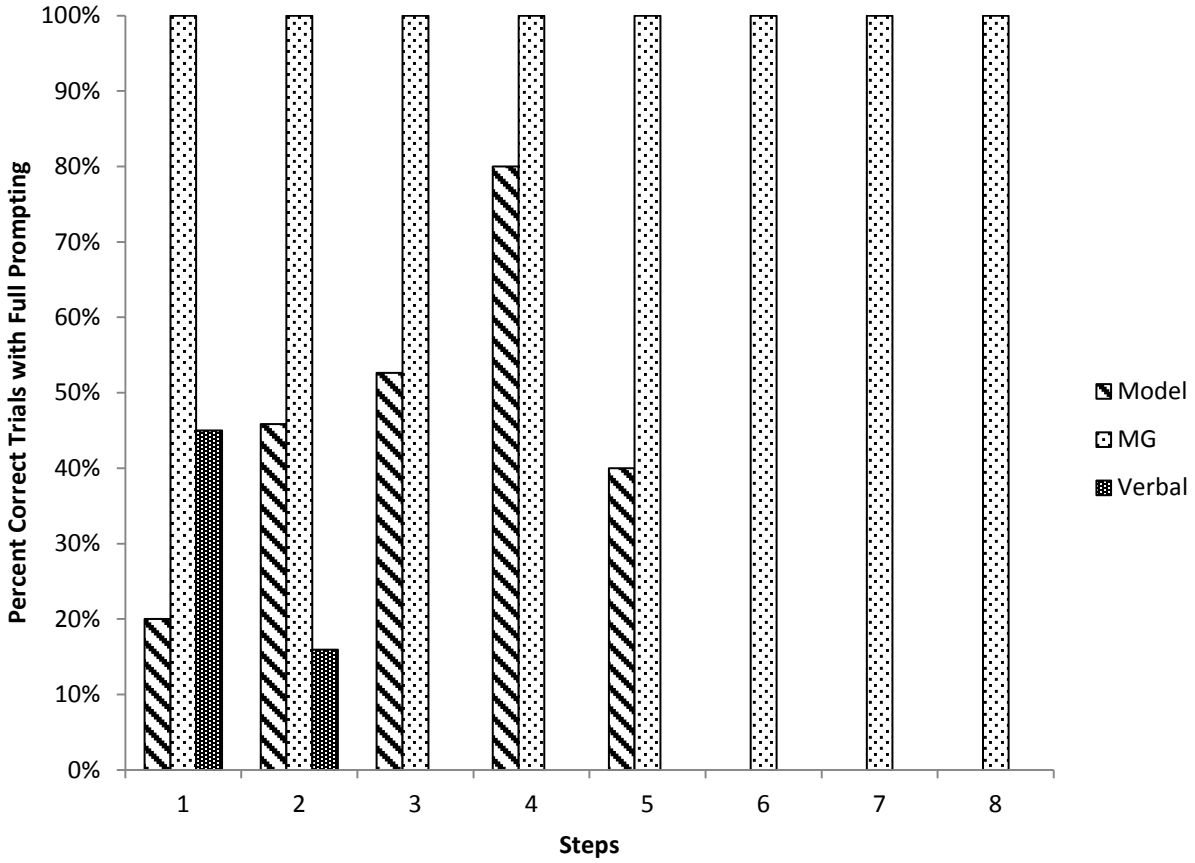

Figure 6. The percent of correct trials with full prompting for the initial trials of Experiment 1.

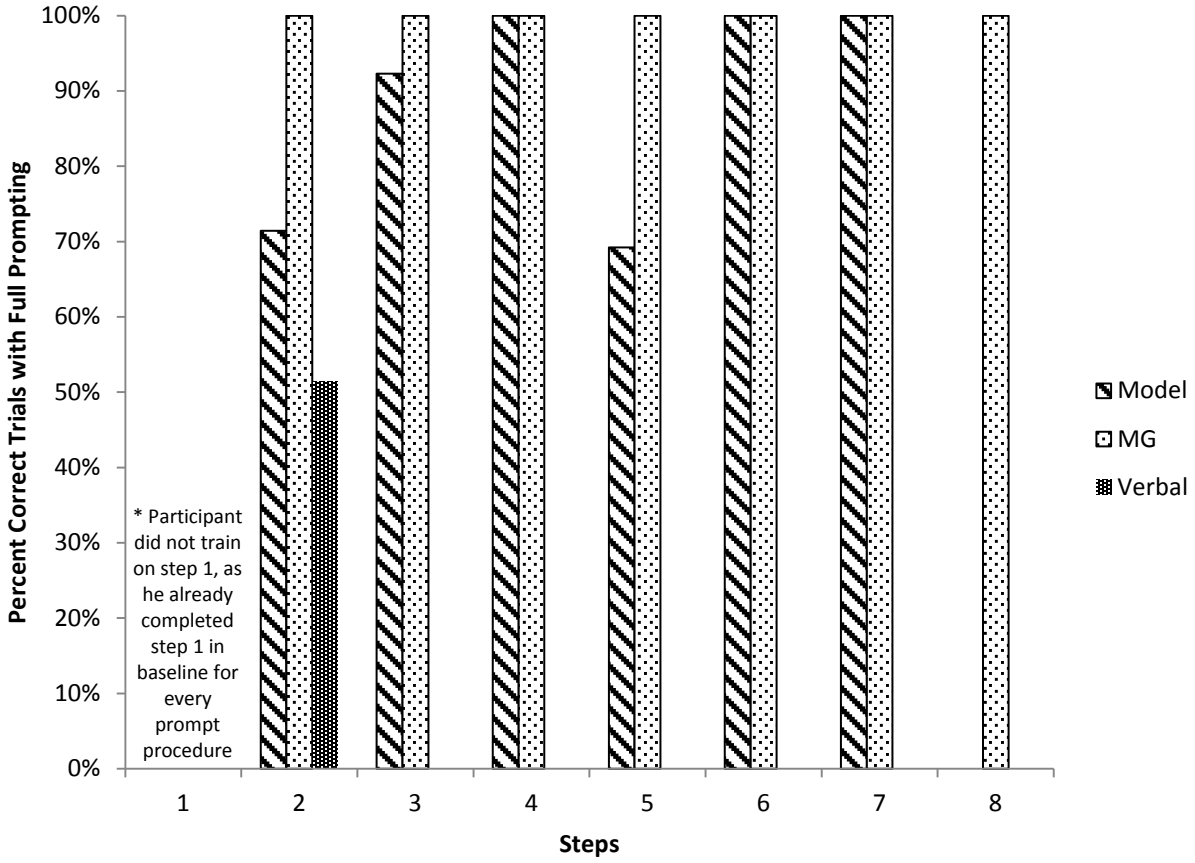

Figure 7. The percent of correct trials with full prompting for the replication trials of Experiment 1.