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Potential Benefits of Video Training on Fidelity of Staff Protocol Implementation

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In order for children to benefit from research-based protocols, it is necessary for professionals to implement the protocols with a high degree of fidelity. In this study, we tested the effects of reading a training manual, and a training package that included reading the manual followed by watching a training video on the fidelity of implementing the mirror protocol (e.g., Du & Greer, 2014) to induce generalized imitation. The participants were 16 first-year master's degree candidates from an applied behavior analysis program at a major university. The participants were asked to first assess generalized imitation in a preschool student and then to conduct the mirror protocol with him or her based on the instructions of the manual. Results showed that most of the participants did not follow the exact procedure as a result of reading the manual only. A pre- and postintervention design across participants was used to test the effects of the training package. After the implementation of the training package, all but 1 participant were able to conduct errorless procedures with a preschooler (the last participant also achieved criterion after a booster training in 1-to-1 setting with the experimenter). Our results suggest that video training together with reading the manual was correlated with high fidelity of implementation of the complex protocol.

Keywords: video training, generalized motor imitation, mirror protocol

Treatment integrity, which refers to "the consistent and accurate implementation of an intervention in the way it was planned" (DiGennaro-Reed, Codding, Catania, & Maguire, 2010, p. 291), is a key component of effective interventions. Higher integrity produces better intervention outcomes and benefit clients directly and when procedure integrity is faulty, the intended results may not be achieved (Collins, Higbee, & Salzberg, 2009; DiGennaro-Reed et al., 2010). Well-trained professionals increase the likelihood that interventions are implemented with a high degree of treatment integrity (e.g., C. N. Catania, Almeida, Liu-Constant, & DiGennaro Reed, 2009, p. 388).

Previous research suggests that a package including instructions, modeling, rehearsal, and feedback is an effective approach to train educational staff to implement a variety of behavioral techniques (cf. Severtson & Carr, 2012; Rosales, Gongola, & Homlitas, 2015). Factors like funding limitations, large supervisor caseloads, high demand for services, and high staff turnover rate may prevent satisfying the training needs of nonspecialist staff (Collins, Higbee, & Salzberg, 2009; Severtson & Carr, 2012). Thus, developing effective and efficient staff training methods is of critical importance (C. N. Catania et al., 2009).

A high criterion for intervention fidelity is especially critical when training multistaged complex protocols, such as the Naming Protocol to induce incidental language learning (i.e., Fiorile & Greer, 2007; Greer, Stolfi, & Pistoljevic, 2007), the Mirror Protocol to induce generalized motor imitation (Du & Greer, 2014; Miller, Rodriguez, & Rourke, 2015; Moreno, Greer, & Singer-

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Dudek, 2016), and the Auditory Matching Protocol to teach correct articulation (Choi, Greer, & Keohane, 2015; Speckman-Collins, Lee Park, & Greer, 2007). These research-based protocols typically include initial assessments to determine the presence or absence of verbal behavior cusps, accurate implementation of the protocol until mastery, reassessments, possible reintroduction of the intervention, and reassessments until the emergence of the cusps (Greer & Du, 2015; Greer & Ross, 2008).

Generalized motor imitation (GMI) is an important behavioral developmental cusp. It allows children to see a novel behavior and emit that behavior without the delivery of reinforcement by another (A. C. Catania, 2007; Gewirtz & Stingle, 1968; Rosales-Ruiz & Baer, 1997; Zentall, 2006). It has thus been studied extensively by social and cognitive researchers. Cognitive psychologists proposed that imitation is developed during the sensorimotor stage (Inhelder & Piaget, 1958) and children have to first learn to coordinate their own actions with the observation of their environment in order to imitate (Commons et al., 2008). Early research in behavior analysis suggested that GMI could be established in children who were missing it using behavioral instructional procedures (Baer & Sherman, 1964). In recent years, findings from carefully designed studies by Erjavec and colleagues, which used more stringent criteria for the presence of GMI, brought into question the findings of early research (Erjavec & Horne, 2008; Erjavec, Lovett, & Horne, 2009; Horne & Erjavec, 2007). Erjavec and colleagues could not establish GMI in young children using the procedures of Baer and Sherman despite exhaustive research.

In a recent study, Du and Greer (2014) demonstrated that it is possible to teach GMI to children with autism, and possibly to typically developing children, using a mirror during instruction of imitative responses with multiple exemplars, even when the more stringent assessment criteria of Erjavec and colleagues are used. Du and Greer matched six children according to their developmental levels, and one child from each resulting pair was randomly assigned to one of two conditions: the mirror-trained group and the nonmirror-trained group (this group was trained in a face-to-face setting). In addition, they yoked the number of training trials received by each participant in the pair. The three participants in the mirror-trained group passed probes for GMI similar to those developed by Erjavec and colleagues. In contrast, none of the participants in the nonmirror-trained group passed the same probes. Miller, Rodriguez, and Rourke (2015) provided additional evidence in favor of the use of the mirror during the teaching of imitation to children with autism. They directly compared the procedures for teaching motor imitation with and without a mirror using a multiple baseline design across imitative responses. Their results show that the responses taught with the mirror present were acquired faster and were maintained in the absence of the mirror, thus replicating the results of Du and Greer.

Moreno et al. (2016) further found that the establishment of GMI using the same mirror protocol resulted in children learning simple motor skills significantly faster after GMI was established. Since the onset of a behavioral developmental cusp results in faster learning or new learning possibilities, the findings from Moreno et al. suggest that GMI is a cusp. Thus, the establishment of this cusp allows behavior therapists and teachers to teach children objectives they could not teach before the cusp was present or teach them such that the children learn significantly faster.

Some children diagnosed with autism do not acquire GMI skills without direct instruction (e.g., Rogers & Pennington, 1991). Thus, training professional to use procedures that do work as opposed to those that did not prove effective in establishing GMI, should be disseminated widely to professionals working with individuals with autism and other developmental delays.

With the rapid advance of technology, the large variety of media-playing equipment and streaming platforms have made videos more widely available and cost efficient. Therefore, video modeling may be an inexpensive and efficient method of training staff in the implementation of behavioral procedures included in programs directed to the education and treatment of children with autism and related disorders. In a video-modeling intervention, trainees watch a video presentation where a model demonstrates how to perform correctly a given set of skills, and then the trainee is given the opportunity to implement those skills with a confederate adult in a role playing context or with a real client of behavioral services, in similar situations (C. N. Catania et al., 2009). In addition,

videos used in video modeling typically include voiceover instructions that highlight critical aspects of the procedures to be implemented, informational bullets, and other prompts.

Video modeling has shown itself to be an efficacious method for training educational professionals, often with little or no formal training, in the implementation of a variety of behavioral procedures with high levels of treatment integrity. These procedures include preference assessments (Deliperi, Vladescu, Reeve, Reeve, & DeBar, 2015; Lavie & Sturmey, 2002; Lipschultz, Vladescu, Reeve, Reeve, & Dipsey, 2015; Rosales et al., 2015; Weldy, Rapp, & Capocasa, 2014), functional assessment (Moore & Fisher, 2007), discrete-trial instruction (C. N. Catania et al., 2009; Severtson & Carr, 2012; Vladescu, Carroll, Paden, & Kodak, 2012), problem-solving intervention (Collins et al., 2009), and the treatment of problem behavior (DiGennaro-Reed et al., 2010; Macurik, O'Kane, Malanga, & Reid, 2008). In these studies, video modeling demonstrated increased treatment integrity when compared with general instructions describing the procedures to be implemented or more elaborate instructions accompanied by quizzes that ensure the comprehension of the instructions by the participants.

There are no studies, to our knowledge, that have tried to teach professionals to implement the tested effective mirror protocol for establishing GMI in children with autism and related disabilities. Moreover, there are few if any studies testing whether or not video supplements to written manuals are necessary to errorless implementation of protocols. Thus, our aim in the present research was to evaluate whether a video modeling with voiceover instructions increased the treatment integrity of professional in addition to showing mastery of reading a manual.

Method

Participants

Sixteen adults, four males and 12 females between the ages of 22 and 40, served as participants. All participants had earned an undergraduate degree prior to the onset of the study and were first-semester master's degree students enrolled in an applied behavior analysis program at a major university. The study took place in a private, publicly funded preschool that serves young children mainly with developmental delays. The preschool was a research and training facility associated with the applied behavior analysis program of the university and also served as one of the primary internship sites for the master's degree candidates. The preschool was an accredited CABAS School (www.cabasschools.org). All participants were trained as teacher assistants at the school as part of the fulfillment for their graduate program requirements. None of the participants had any previous experience with the newly created developmental intervention, the Generalized Motor Imitation Mirror Protocol (Du & Greer, 2014; Greer, Du, & Nuzzolo, 2012).

Setting

The participants first read the training manual on their initial orientation day in one of the classrooms at the preschool and had to pass a test to mastery. The training video was played on a 13.1-inch MacBook in one of the experimenters' offices. The pre- and postvideo probes were conducted in the same office. A Sony DCR-SX40 digital camera recorder was set up in the office to record videos for interobserver agreement purposes. The office contained a desk, two child-sized tables, a couple of child-sized and teacher's chairs, and a full-length mirror on the wall. Each participant arranged the set-up before starting the mirror protocol with a student.

Dependent Variable

The dependent variable consisted of measures of the fidelity of implementing the mirror protocol to induce GMI. This was done by counting the number of steps implemented correctly by the participant. Each participant was required to conduct the mirror protocol, which included (a) the GMI probe to determine if a student had generalized imitation, and (b) the imitation teaching procedure using the mirror. There were 10 steps in the GMI probe and 10 steps in the intervention using the mirror. These 20 steps were identified as the key elements to the successful implementation of the mirror protocol. The results of the task analysis of the two sections were listed in Table 1.

During the GMI probe, the participant was required to sit face-to-face with a student (count 1), in a child-sized chair (count 2) in order to maintain eye level contact with the student.

Table 1
Checklist of Teacher Performance During GMI Probe and Mirror Intervention

Count	Item
	Probe
1	Sits face to face with the student.
2	Sits on a child-sized chair.
3	Obtains the student's attention before delivery of antecedent.
4	Stops and represents if the student is not attending.
5	Delivers vocal antecedent "Do this."
6	Accepts both mirrored and non-mirrored responses as correct.
7	Follows the sequence of actions on the probe list.
8	Presents all 26 responses on the probe list.
9	Does not provide consequences for probe trials.
10	Records accurate data during instruction.
	Mirror intervention
1	Sits with the student in front of a mirror.
2	Sits slightly behind the student or side by side if necessary.
3	Selects 4 actions that are not from the probe list.
4	Obtains the student's attention before delivery of antecedent.
5	Stops and represents if the student is not attending.
6	Delivers vocal antecedent "Do this."
7	Accepts both mirrored and non-mirrored responses as correct.
8	Provides reinforcement for correct responses.
9	Provides corrections for incorrect responses.
10	Records accurate data during instruction.

Note. GMI = generalized motor imitation.

Before delivering the antecedent (i.e., "Do this"), the participant needed to ensure that the student's attention was obtained (count 3). If the student was not attending, the participant needed to stop the instruction and gain the student's attention (count 4). When attention was obtained, the participant delivered the antecedent "Do this" (count 5) together with the modeled action (i.e., right hand same shoulder). Either a mirrored response (i.e., left hand same shoulder) or a nonmirrored response (i.e., right hand same shoulder) emitted by the student was counted as a correct response (count 6) based on previous research findings showing typically developing adults emit both mirrored and nonmirrored responses during imitation tasks (Du & Greer, 2014). The participant was also required to follow the exact same sequence on the probe list without skipping or changing the order to avoid potential sequence effect (count 7) and to present all 26 actions (count 8). During the GMI probe, the participant could reinforce the student for his attending or working, but could not provide reinforcement for correct responses or correction operations for incorrect responses (count 9). The participant was also required to record the student's response immediately after each trial (count 10).

During the GMI imitation intervention using the mirror, the participant was required to sit with the student in front of a mirror (count 11). In order for the student to see both him- or herself and the participant in the mirror and also to make sure the modeled actions could only be seen through the mirror, the participant was asked to sit slightly behind the student or to the side (count 12). To ensure that the response on the probe list were untaught and novel to a particular student, the participant needed to select four actions that were not currently in the student's repertoire that were also different from the probe list (count 13) to use as the teaching set for the student. Requirements such as obtaining the student's attention (count 14), delivering the instructional antecedent again when needed (count 15), antecedent "Do this" (count 16), accepting both mirrored and nonmirrored responses (count 17), and taking data (count 20) were the same as in GMI probe. During the intervention, the participant was required to provide reinforcers identified by the student's class teacher contingent upon correct responses (count 18) and correction procedure for incorrect responses (count 19).

Independent Variable and Materials

The training package included a training manual and a training video. The manual entitled *Mirror Protocol to Induce Generalized Imitation* (Greer, Du, & Nuzzolo, 2012) consisted of six pages: two pages of double-spaced text explaining how to implement the procedure, one page with a sample data collection form, one page with a list of actions for the pre- and postintervention GMI assessment (see Table 2), one page with a sample list of actions for the intervention, and one page of references.

The training video consisted of a teacher demonstrating each step of the mirror protocol with a preschool boy with developmental delays. The video consisted of (a) the procedures to determine the presence or absence of the GMI cusp, (b) the intervention to establish the cusp, and (c) a final

Table 2
List of One-Step Movements Presented During GMI Probe (Du & Greer, 2014)

No.	Imitative action
1	Right hand cross to shoulder.
2	Left hand cross to shoulder
3	Both hands cross shoulders
4	Right hand cross to elbow
5	Right hand cross to wrist
6	Palms up bowl
7	Right hand cross to knee
8	Left hand cross to knee
9	Right hand cross to ankle
10	Left hand cross to ankle
11	Right hand cross to ear
12	Left hand cross to ear
13	Both hands cross ears
14	Right hand same shoulder
15	Left hand same shoulder
16	Both hands same shoulders
17	Left hand cross to elbow
18	Left hand cross to wrist
19	Arms crossed in front
20	Right hand same knee
21	Left hand same knee
22	Right hand same ankle
23	Left hand same ankle
24	Right hand same ear
25	Left hand same ear
26	Both hands same ears

Note. GMI = generalized motor imitation. Data are revised from the following: "Determinants of Imitation of Hand-to-Body Gestures in 2- and 3-Year-Old Children," by M. Erjavec and P. J. Horne, 2008, *Journal of the Experimental Analysis of Behavior, 89,* pp. 183–207. Copyright 2008 by John Wiley & Sons; "Do Infants Show Generalized Imitation of Gestures? II. The Effects of Skills Training and Multiple Exemplar Matching Training," by M. Erjavec, V. E. Lovett, and P. J. Horne, 2009, *Journal of the Experimental Analysis of Behavior, 91,* pp. 355–376. Copyright 2009 by John Wiley & Sons; and "Do Infants Show Generalized Imitation of Gestures?" by P. J. Horne and M. Erjavec, 2007, *Journal of the Experimental Analysis of Behavior, 87,* pp. 63–87. Copyright 2007 by John Wiley & Sons. Adapted with permission.

test to determine if the protocol worked for the child. These were done as follows: (a) a face-to-face preintervention probe to determine if the student had generalized motor imitation cusp and learning capability, (b) imitation teaching using the mirror, and (c) a face-to-face postintervention probe to determine if the student had acquired generalized imitation through the intervention. The video was 11 min long. Throughout the video, a voice-over narration, together with the texts on the screen, were used to explain the procedures step by step. The student's correct responses were coded as pluses (+) and shown on the right-hand side of the screen, and incorrect responses as minuses (−). At the end of the video, a bar graph with the total number of correct responses in GMI probes was shown on the screen. The video showed the teacher running the generalized imitation pre- and postintervention probes as well as the mirror intervention procedures with 100% accuracy. The video also demonstrated emerged GMI for the student as a result of the mirror protocol.

Design and Procedure

A delayed pre- and postintervention probe design across participants was used. The sequence of the design was as follows: (1) all 16 participants read the training manual and completed a written test to criterion, (2) the first participant was probed on the accuracy in implementing the GMI protocol with a student; (3) the first participant received the video intervention followed by the postvideo probe; (4) the second participant received the prevideo probe; (5) the second participant received the video intervention followed by the postvideo probe; and (6) next participant entered the study in the same manner until it was done with all eligible participants. The participants who performed the protocol correctly during the preintervention probe was determined to have acquired the procedure in repertoire and thus did not receive the video intervention. Two out of 16 participants demonstrated mastery level during the preintervention probe and thus did not participate in the rest of the procedure. Due to the nature of the experimental setting (in the training school for children with developmental delays), only one pre- and postintervention probe was done in attempt to complete the study in a timely manner and limit accidental exposure of relevant instruction during the participants' daily training.

Baseline preintervention (read the protocol and do it with a child). On the first day of training there were no students present in the school. All participants met with the experimenters in a classroom for staff training. They were provided with a brief explanation of the experiment and were given a training manual. The participants were then told to read the manual and they were given as much time as needed to do so. After they completed reading the man-

ual they were given a quiz which tested them on the key points of the manual more specifically implementation of the generalized imitation procedure. The quiz included 15 questions in two formats: multiple choice and filling blanks. The quiz was taken in an open-book format in which the participant was allowed to refer back to the manual as many times as necessary to meet criterion of 90% on the quiz. This allowed the participant to meet criterion with only one error on the quiz. The quiz was graded immediately following completion and if the participant achieved criterion they were told they could leave and to keep the manual in their possession. Incorrect responses resulted in reading the question to the participant and providing them with the correct response. If they did not achieve the criterion with 90% accuracy, they were told to reread the manual and given a different version of the quiz to take a second time. This procedure was repeated for all 16 participants until all had reached the criterion.

Within 1 week of taking the quiz, each participant was asked to report to one of the experimenters' offices with the training manual. They were given a pen, a data collection sheet, and all materials necessary to run the mirror protocol. The experimenters selected the students to work with the participants based on the students' prerequisite skills needed for the procedure: their level of compliance and ability to sit in a chair and make eye contact with adults. One experimenter was always present in the room with the participant and the student but had limited contact with them. Each session was videotaped for data collection purposes. The experimenter told the participants to conduct the GMI probe first and then the intervention procedure as described in the manual. They were given as much time as they needed to complete the procedures. They were allowed to refer back to the text in the manual, as needed, to run the probe and intervention. No feedback of any type was given by the experimenter. If the participant asked for help regarding the implementation of the mirror protocol, the experimenter told her to conduct the procedure to the best of her ability and they would speak afterward.

On occasions when the participants corrected themselves during the conduction the protocol, only the corrected responses were recorded and scored (i.e., indicated by their vocal statements, i.e., "Oops, I did it wrong. I will do this again"). After the participant completed the GMI probe and intervention using the mirror they were thanked and told that they would meet again with the experimenter within the week if needed. If the participant read and did the procedure or conduct the GMI probe and intervention using the mirror with 100% accuracy they were no longer required to participate in the experiment. The experimenter praised them for their skills in reading the manual and conducting the procedure with no further instruction. If the participant did not achieve 100% criterion they were asked to come back and meet with the experimenter within the week.

Video modeling (watch the video and do it with a child). Immediately after the prevideo assessment, participants who did not conduct the procedure accurately from reading the manual were asked to view the training video. After the video intervention, they were again asked to conduct the same probe and intervention for the mirror protocol to induce generalized imitation. All sessions were again videotaped for data collection purposes. For participants who still did not complete the procedures with 100% accuracy after the video modeling, an experimenter provided one-to-one booster training on the procedure, highlighting the key elements, especially the specific error(s) made by the participants in their postvideo assessment and asking them to repeat these until the performance met criterion. Only one participant required this booster training to meet criterion.

Data Collection and Interobserver Agreement

All probe sessions were recorded on a Sony DCR-SX40 digital camera recorder. Each of the 20 measured steps was counted as correct (recorded with pluses) or incorrect (recorded with minuses). The accuracy of each participant's performance in GMI probe or mirror intervention was calculated by dividing the number of correctly implemented steps into a total of 10 steps and multiplying the answer by 100%. For example, if a participant correctly completed 8 steps in GMI probe, the accuracy was 80%.

The two experimenters independently watched the recorded video sessions and recorded data on the number of correct steps implemented by the participants in each condition. The experimenters then determined the

point-to-point interobserver agreement (IOA) for each participant, calculated the percentage of agreement by dividing the number of agreements into the number of point-to-point agreements plus disagreements and multiplying the answer by 100%. IOA data were collected for 36% of the prevideo probe sessions with a mean of 99% (range, 95% to 100%) and for 36% of the postvideo probe sessions with a mean of 99% (range, 95% to 100%).

Results

During the written test, 5 of the 16 participants achieved criterion after reading the training manual one time. The other 11 participants who did not pass in the first time were given the corrections by the experimenter and took another test and met criterion the second time.

During the prevideo probes, the mean percentage correct was 78.8% (range, 60% to 100%) for the assessment for the presence or absence of the GMI cusp, and was 86.3% (range, 60% to 100%) for intervention using the mirror. During the prevideo probe, only 2 out of 16 participants performed errorless procedures from reading the written instructions. The other 14 participants emitted errors and therefore participated in the subsequent intervention using video modeling. Figure 1 displays the number of steps that participants performed correctly in preintervention probe and intervention session during baseline.

Prior to the implementation of video training, the errors that occurred most often during GMI probe sessions were from the following four areas where the trainee (1) did not accept both mirrored and nonmirrored responses as correct (6 out of 16 participants recorded nonmirrored responses to be incorrect), (2) did not sit face-to-face with the student (4 out of 16 participants sat in front of the mirror), (3) did not follow the sequence of the probe list (4 out of 16 participants), and (4) provided consequences for the probe trials when they should not have done so (4 out of 16 participants). During the mirror protocol intervention in prevideo probes, the participants emitted the most number of incorrect responses on the following behaviors: (1) Some did not provide corrections for incorrect responses (5 out of 16 participants failed to provide contingent correction procedures for incorrect responses). (2) Some directly taught the imitative actions from the probe list during intervention (3 out of 16 participants selected responses from the probe list and thus provided consequences actions that were not truly novel for their student). (3) Some failed to obtain the students' attention in the mirror (3 out of 16 participants failed to obtain student's attention before presenting the imitation instruction through the mirror). (4) Some did not provide reinforcement for correct responses (3 out of 16 participants did not deliver contingent reinforcers for all correct responses).

Following the video modeling intervention, all 14 participants demonstrated immediate and substantial increases in their fidelity of implementing the procedure (see Figure 1) in the postvideo probes. Every participant performed the procedure with 100% accuracy for GMI probes. For intervention using the mirror, 13 out of 14 participants who watched the video conducted the procedure with 100% accuracy, and one participant missed one step (she selected four imitative actions directly from the probe list). This participant eventually met criterion after the booster training with the experimenter. For the GMI probes ($N = 14$), there was a statistically significant difference between the pretest ($M = 8.29$, $SD = 1.38$) and posttest ($M = 10$, $SD = 0$), $t(13) = 4.64$, $p < .001$. Furthermore, Cohen's effect size value ($d = 1.753$) suggested a high practical significance. For the intervention using the mirror ($N = 14$), there was a statistically significant difference between the pretest ($M = 8.43$, $SD = 1.16$) and posttest ($M = 9.93$, $SD = 0.27$), $t(13) = 5.14$, $p < .001$. Furthermore, Cohen's effect size value ($d = 1.785$) suggested a high practical significance.

Discussion

Fifteen out of 16 participants were able to perform both probe and intervention procedures without errors after reading the training manual and watching the training video evaluated in the present research. These results suggest that video training together with the manual is an effective way to train new staff on the implementation of the mirror protocol for inducing GMI with the desired degree of procedural integrity. While the differences from pre- to postintervention could seem small in some cases (i.e., improved from 9 correct steps to 10),

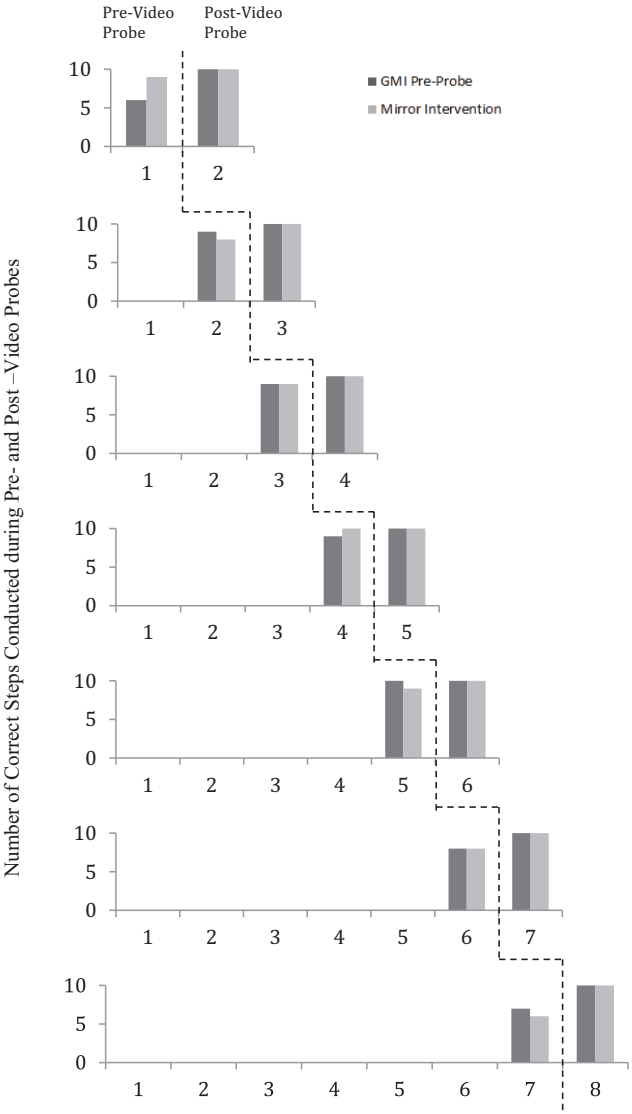

Figure 1. Number of correct steps conducted during pre- and post-video probes. GMI = generalized motor imitation.

missing any of the components could seriously jeopardize the educational outcomes for the students who received the protocol. For instance, obtaining the student's attention before delivery of an antecedent during GMI probe (missed by Participant 3), using a child-sized chair for the trainer during GMI probe (missed by Participant 4), accepting both mirrored and nonmirrored responses as correct during GMI probe (missed by Participant 8), and correcting incorrect responses during intervention presentations (missed by Participant 5 and Participant 9) are all critical components for the integrity of conducting the mirror protocol to determine and further induce the GMI cusp. Each count is important. Our count of the measures did not reflect the importance of steps, but rather the presence or absence of the steps. The data do seem to add to accumulating evidence that shows that video training can be an effective

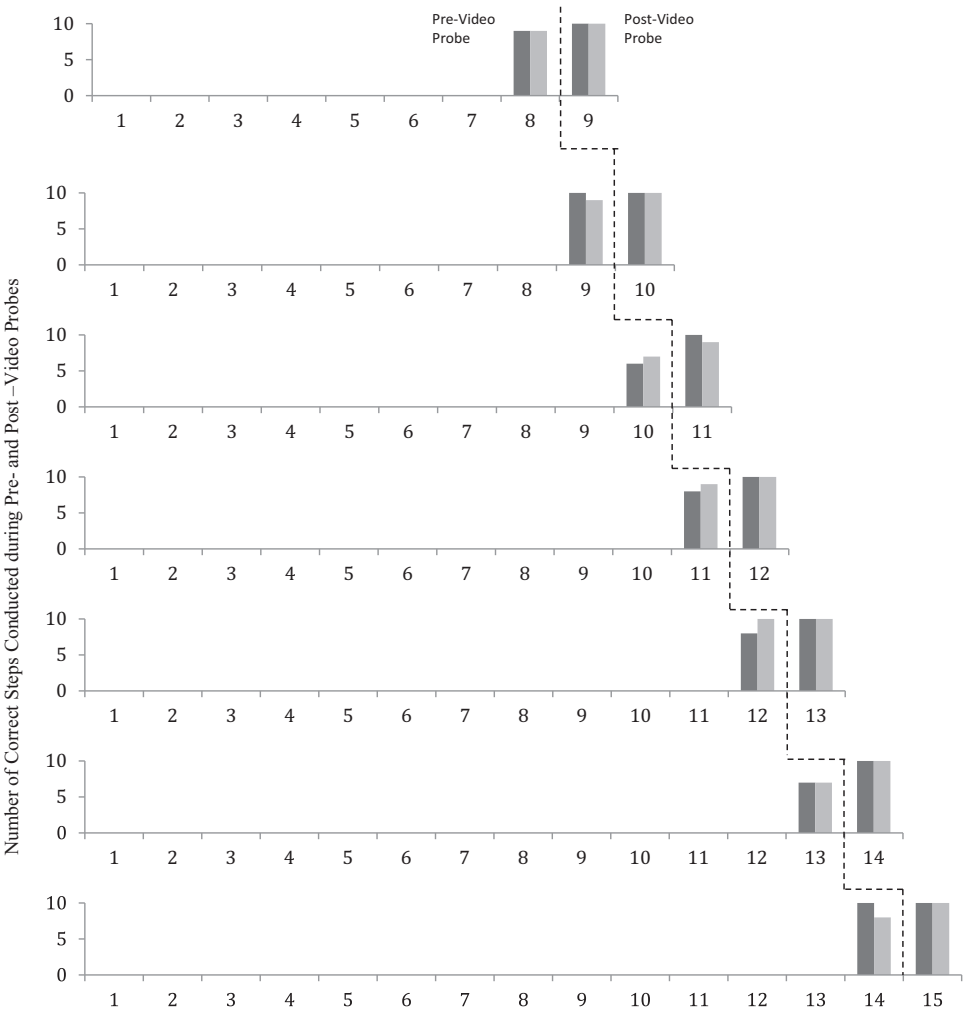

Figure 1. (*Continued*).

tool for training inexperienced staff in the implementation of behavior interventions with high procedural integrity (C. N. Catania et al., 2009; Collins et al., 2009; Deliperi et al., 2015; DiGennaro-Reed et al., 2010; Lavie & Sturmey, 2002; Lipschultz et al., 2015; Macurik et al., 2008; Rosales et al., 2015; Severtson & Carr, 2012; Vladescu et al., 2012; Weldy et al., 2014).

Two out of 16 participants who were initially selected for the present study were able to complete the mirror protocol without errors after reading the instruction manual only. There is some evidence in the literature indicating that a sufficiently detailed instruction manual followed by a quiz that ensures the adequate comprehension of the manual may be an effective way for instructing new staff, even in the absence of video training or feedback by a supervisor (e.g., Miltenberger & Fuqua, 1985; Severtson & Carr, 2012). However, this does not seem to be the case for the majority of our trainees, at least in the case of the implementation of procedures of the level of complexity as those evaluated in the present research.

One out of 14 participants required feedback by the experimenter in addition to the instruction manual and the training video in order to conduct the procedures without errors. A few participants in previous studies on the use of a video for training staff to implement behavioral

interventions also required feedback in addition to video training in order to implement the intervention trained with the desired degree of procedural integrity (e.g., C. N. Catania et al., 2009; DiGennaro-Reed et al., 2010; Lipschultz et al., 2015; Severtson & Carr, 2012). However, it should be noted that only a few participants required feedback after video training in the present and in past studies. In addition, the accuracy of these participants increased substantially after the video training and probably reduced the amount of subsequent feedback they would require in future monitoring.

In contrast with some previous studies on staff video training, the 13 participants of the present research who achieved full procedural integrity after watching the training video did so in only one session, while in the referred previous studies participants typically required several sessions before achieving full procedural integrity (e.g., C. N. Catania et al., 2009; Collins et al., 2009; Deliperi et al., 2015; DiGennaro-Reed et al., 2010; Lipschultz et al., 2015; Macurik et al., 2008; Moore & Fisher, 2007; Rosales et al., 2015; Severtson & Carr, 2012; Vladescu et al., 2012; Weldy et al., 2014). This is a limitation of such studies because being asked to conduct additional video training sessions could have served as feedback for the participants (see Rosales et al., 2015, p. 213). Thus improvements in accuracy in such studies could be due at least to some extent to feedback rather than to video training. The present study is thus a more conclusive demonstration of the effects of video training on procedural integrity.

However, it would be invalid to conclude that video training alone was sufficient for training the participants to implement the mirror protocol due to the use of a detailed instruction manual prior to the video training. This remains a question for future research. For that purpose, a possible methodological strategy already used in previous studies on video training would be comparing the effects of video training with a baseline phase implemented after participants read a general description of the procedures to be implemented, and no questions about these procedures were asked. As a result, the performance of the participants during the baseline would probably be low and the effects of video training could be more evident (e.g., DiGennaro-Reed et al., 2010; Lavie & Sturmey, 2002).

In contrast with previous studies, the present study did not include a phase of practice with confederate adults in a role playing context as a previous step before implementing the procedures under study with actual consumers of behavioral services (e.g., C. N. Catania et al., 2009; Collins et al., 2009; Deliperi et al., 2015; Lipschultz et al., 2015; Moore & Fisher, 2007; Severtson & Carr, 2012; Vladescu et al., 2012). Therefore, the present research adds to the evidence that shows that video training may be an effective method to teach to inexperienced staff how to conduct behavioral interventions with actual staff of behavioral services without previous practice in a role play context (e.g., DiGennaro-Reed et al., 2010; Lavie & Sturmey, 2002; Macurik et al., 2008; Weldy et al., 2014). This is a relevant aspect because the requirement of previous practice in a role play context following video training would limit the efficacy of video training as compared with life training, as previous practice in a role playing situation would require additional training time and costs.

A limitation of the present study was the lack of a more sophisticated experimental design. The demonstration of the effects of the video training would have been more robust if we had used a multiple baseline design or a multiple probe design, as in most previous studies on video training. However, the selection of this pre- and postintervention design was a well-balanced result of an effective experimental design and an efficient on-site training with large number of new staff. Due to the nature of the experimental setting in the research and training site for master students, we faced an urgency to complete the experiment in the shortest time frame to better control for other possible learning and observing opportunities. This also allowed the outcome from this experiment being translated into improvements in the participants' future teaching with their students in the classrooms.

In addition, although there was only one preintervention probe, it was conducted immediately prior to each participant's receiving of the video training. In our experiment given that the participants were exposed to the intervention one after another, they were exposed to different amounts of training prior to their entry of the experiment. Thus, any potential effect of their individual training would have been revealed in the comparison

between the preintervention measurements of the participants that received the intervention early, and the ones who received it later. However, such differences were not observed, thus it is very unlikely that the regular staff training outside the experiment had any impact on the implementation of the mirror protocol.

Furthermore, we believed the limitation from the pre- and postintervention design was also well compensated by the relatively large number of participants in our study. The effects of the video training in the present study was replicated with 13 out of 14 participants, while in previous studies on video training the total number of participants studied was typically as low as three participants (e.g., C. N. Catania et al., 2009; Deliperi et al., 2015; DiGennaro-Reed et al., 2010; Lavie & Sturmey, 2002; Moore & Fisher, 2007; Rosales et al., 2015; Severtson & Carr, 2012; Vladescu et al., 2012).

Another limitation of our study was the absence of a follow-up probe that assessed the maintenance of the trained skills across time. This question should be addressed by future studies. Future studies should also try to identify the parameters that determine the effectiveness of video training (length of the video, delay from watching the video to the implementation of the procedure modeled, range of behaviors modeled, role of voiceover instructions, etc.). In addition, the relative effectiveness of individual versus group video presentation should be addressed, as video presentation in group format may help to save additional time and costs (e.g., Macurik et al., 2008; Weldy et al., 2014). A possible strategy that could increase the effectiveness of video training and might also be worth investigating is to ask trainees to record data on the model teacher that appears on the training video and conducting *Teacher Performance Accuracy and Rate*—a method of direct teacher observation used in the teacher evaluation and training component of the CABAS® model of schooling (Ross, Singer-Dudek, & Greer, 2005)—in order to better identify the key components of the training procedure. Finally, more evidence is needed in relation to whether an increase in procedural integrity as a result of video training actually results in an improvement of the children's behavior following video training (see DiGennaro-Reed et al., 2010).

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