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ORIGINAL PAPER

Using Point-Of-View Video Modeling and Forward Chaining to Teach a Functional Self-Help Skill to a Child with Autism

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Abstract This study examined the effectiveness of point-of-view video modeling in a forward-chaining procedure to teach a 4-year-old boy with autism to serve himself an afternoon snack. Task analysis was undertaken, and the task was divided into 3 phases with 1 video produced for each phase. A changing criterion design was used to evaluate the effects of the intervention on the participant's ability to independently prepare and serve himself Weetbix. The results indicated that the combination of point-of-view modeling and forward chaining was effective in teaching the child to serve himself a snack without any prompting. The results also indicated that although the skill was maintained at follow-up, generalization to snacks other than Weetbix and to a different setting was limited. Parents reported satisfaction both with the procedures undertaken and with the outcomes of the intervention.

Keywords Autism · Point-of-view video modeling · Forward chaining · Self-help skill

Introduction

Autism is characterized by significant impairments in social interaction, language, communication, and a repertoire of restricted and repetitive behaviors and activities (American Psychiatric Association 1994). In recent years, increasing research attention has been devoted to the evaluation of interventions designed to address the needs of individuals with the disorder (Wolery et al. 2005).

Interventions targeting daily self-help skills are particularly important due to the deficits in adaptive behavior evident with individuals with autism. The ability to

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perform functional tasks like grooming, using the toilet, eating, and basic household chores is vital for independent living. Without such skills, an individual's potential to flourish in educational, vocational, and domestic settings is limited (Pierce and Schreibman 1994). Additionally, continued reliance on parents or caregivers for such tasks can stress those individuals (Estes et al. 2009). Effective intervention programs addressing basic self-help skills, therefore, have the potential to improve the quality of life for parents and caregivers as well as the children concerned.

There is strong evidence that video modeling, a procedure which involves an individual watching a video demonstration of desired behaviors and then imitating the behavior of the model, can be effective in teaching various skills to individuals with autism. Reviewers have concluded that video modeling can be considered an established intervention procedure, one which yields a large effect across a range of participants, target behaviors, settings, and intervention personnel (McCoy and Hermansen 2007; Shukla-Mehta et al. 2010). Point-of-view modeling (POVM), a relatively recent development, involves videotaping completion of a task from the target individual's perspective (Hine and Wolery 2006). The video thus shows the behavior exactly as the target individual would view it when he or she is performing the task. POVM may not only be cost- and time-efficient (no matched model required in production of the video), but can also be more personalized by its use of first-person perspective (Hine and Wolery 2006; Shipley-Benamou et al. 2002). It might also be particularly useful in depicting behaviors that require fine motor skills.

Video-modeling procedures usually involve watching the entire task without interruption or opportunity to perform the task while viewing (Sigafoos and Green 2007). Shipley-Benamou et al. (2002) showed POVM using a whole-task procedure to be effective in teaching functional living skills to three 5-year-old children diagnosed with autism. However, others have reported varying success with this procedure, especially with longer or more complex behavior chains. Alcantara (1994), for example, used video modeling to teach purchasing skills to three children with autism. The video involving a 32-step sequence was presented in its entirety to the children who were then given the opportunity to complete the purchasing task. Alacantra reported that verbal prompts and an in vivo training procedure were necessary to complete the training; four steps could not be completed via video modeling alone.

Arising from the varying effectiveness of POVM for teaching longer behavior chains, video prompting (VP) procedures have been examined, particularly when teaching functional self-help skills (Cannella-Malone et al. 2006; Graves et al. (2005). In VP, a complex behavior is broken down into simpler steps and each step of the behavior is recorded with pauses inserted, during which the viewer attempts that step before watching subsequent steps. Cannella-Malone and colleagues demonstrated VP to be superior to video modeling in teaching living skills like setting a table and putting away groceries by six adults with developmental disabilities. Graves, Collins, and Shuster also successfully used VP to teach food preparation to three individuals with moderate disabilities, and Sigafoos et al. (2005) used a similar procedure to teach three individuals with autism to make microwave popcorn. However, such prompting methods may also result in prompt dependency. For example, Sigafoos et al. (2006) taught three individuals with developmental disabilities to wash dishes through VP. Although the individuals acquired the skill when VP was implemented, their performance deteriorated when the videos were withdrawn because the participants were dependent on the video prompts. Sigafoos and colleagues then "chunked" the videos together in order to fade the prompts and increase independence. Separate videos were combined to form larger video clips, each clip consisting of an increased number of steps. Though time-consuming, the video fading procedure proved effective in facilitating independence.

Forward chaining is an alternative method for teaching complex behaviors that can be broken down into a series of steps. In forward chaining, the first step of a task analysis is taught first followed by each succeeding step, requiring the cumulative performance of all the previous steps in the correct order until the learner performs the whole chain of tasks independently (Cooper et al. 2007). In this way, individuals learn complex behaviors in their correct sequence (McDonnell and McFarland 1988). Used in conjunction with video modeling, forward chaining may have all the merits of VP without the problem of prompt dependency.

Forward chaining has been used in conjunction with video-modeling interventions and has proven effective in teaching various skills to children with autism. Taylor et al. (1999) used a forward-chaining procedure with video modeling to teach a child with autism to engage in play-related statements with siblings. More recently, Tereshko et al. (2010) attempted to teach four children with autism to build complex toy structures through video modeling. The children were initially presented with a video depicting the entire building sequence, but for three children, this whole-task presentation was unsuccessful. The children were then introduced to a treatment condition involving a forward-chaining procedure. The forward-chaining approach resulted in these three children effectively learning to build complex toy structures in the correct sequence. Similarly, Jowett et al. (2012) successfully taught a 5-year-old boy diagnosed with an autism spectrum disorder to identify and write the Arabic numerals 1–7 and comprehend the quantity each numeral represented using an iPad-based POVM procedure combined with forward chaining.

To date, forward chaining has not been used in conjunction with POVM to teach self-help skills to individuals with autism. In the current study, it was predicted that a combination of POVM and forward chaining would result in an increase in the participant's ability to independently prepare and serve himself a bowl of Weetbix (a local breakfast cereal) and clean up afterwards. It was further predicted that the skill would generalize to snacks other than Weetbix and to a different setting and would maintain over time after the intervention was completed.

Method

Participant and Setting

The participant, John (a pseudonym), was 4 years and 10 months of age at the commencement of the study. A psychologist not involved in this study had previously diagnosed John with mild autistic disorder. Initial observations indicated that he had trouble following instructions, got distracted easily, and had difficulty completing tasks.

All data collection and intervention sessions were conducted in the kitchen/dining area of the family home. Similarly, all materials used in the video production and subsequent phases of the study were from the home. The participant's mother ran most sessions with the first author conducting at least two sessions per phase. Most sessions, including John watching the video, were video recorded so that treatment fidelity could be measured and data analysis could be undertaken at a later date.

Dependent Measures and Data Collection

The target behavior, independently preparing and eating an afternoon snack and tidying up afterwards, was identified in consultation with John's mother. The dependent measure was his performance of this task. A task analysis was undertaken to identify the required steps and sequence of the task to develop operational definitions.

The steps were divided into three cumulative phases involving: a) setting-up, b) eating, and c) cleaning-up (see Table 1). The first phase consisted of Steps 1–4 of the task analysis. The second phase included Steps 1–10, and the third phase included the entire sequence (Steps 1–13). Performance was measured by the number of steps completed independently and without prompting. To this end, a count was taken of the number of steps completed between the initial instruction to get some Weetbix and the first prompt given.

All sessions were recorded by either the first author or John's mother using a Flip Video™ camcorder. Data analysis was conducted from the video recordings of the sessions.

Materials

A Flip Video™ camcorder, Apple Macintosh™ MacBook laptop, iMovie™, an external hard drive, a bowl, spoon, Weetbix, and milk were used for the video.

Video Content

Three videos were produced, one for each phase, with John's mother as the model. As the videos were intended to represent the participant's point-of-view, the camera was held over the model's shoulders showing two hands completing the tasks, with a voiceover explaining the steps. The first video, which began with a voiceover providing an initial prompt to start the task, saying, "I'm hungry! Let's get some Weetbix without any help!" included a visual representation of Steps 1–4, and was 2 min 6 s in duration. The second video included Steps 1–10 and was 3 min 28 s long. The final video was 3 min and 45 s and included Steps 1–13. All three videos included verbal praise, "Great job!", at the end.

Table 1 Task analysis for the target behavior

	Steps	Phases		
1)	Get a bowl from the drawer			
2)	Get a spoon from the drawer	Phase 1		
3)	Get Weetbix from the cupboard			
4)	Get soy milk from the fridge			
5)	Put two Weetbix in the bowl			
6)	Open the lid of the milk bottle		Phase 2	
7)	Pour some milk in the bowl just enough so the Weetbix can still be seen			Phase 3
8)	Close the lid of the milk bottle			
9)	Break the Weetbix up			
10)	Eat			
11)	Take the bowl over to the sink			
12)	Put the Weetbix back in the cupboard			
13)	Put the milk back in the fridge			

Parental Satisfaction Questionnaire

A parental satisfaction questionnaire was created to measure social validity in terms of the acceptability of the procedure, the significance of the goals, and the importance of the outcomes (Wolf 1978; available from the first author upon request). The questionnaire consisted of 8 items and used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was completed by John's mother at the end of the study and examined satisfaction both with the effectiveness of the procedures undertaken and the social importance of the outcomes of the intervention.

Experimental Design and Procedures

A changing criterion design was used to measure the effectiveness of the intervention, with the criterion for successful completion of a phase being three consecutive unprompted completions with 100 % accuracy.

Prior to the intervention, ethics approval was granted by the University Human Research Ethics Committee and informed consent obtained from John's mother.

Video Production

Recordings were obtained using a Flip Video™ camcorder. The audio was muted, and voiceover was added later during editing. All editing was done on an Apple Macintosh™ MacBook laptop using, iMovie™. The videos were transferred to an external hard drive in order to be shown to John at his home.

Baseline

Baseline sessions were conducted over a period of 5 days immediately before the intervention. All observations were conducted at afternoon snack time when John returned from playschool. The participant was asked if he was hungry and, if so, was instructed to help himself to some Weetbix. If John responded "No," no session was conducted. Each baseline session included the whole 13-step sequence. The participant was verbally and physically prompted where necessary. All efforts were praised.

Intervention

During the intervention sessions, John was asked if he was hungry. If he said he was, he was asked to watch the video on the desktop computer in the family room. After viewing the video, John was instructed to get some Weetbix for himself and he was prompted where necessary. On occasions where John forgot the steps, he was verbally prompted. At the completion of the phase, John was given verbal praise for his effort, as well as high fives and cuddles from his mother.

Generalization Probes

Once during each of the three intervention phases, the participant was asked to get a snack other than Weetbix or was asked to get Weetbix during breakfast instead of in the afternoon and sit at a different location. No videos were shown during these sessions.

Follow-Up

Follow-up data were collected 2 weeks after the intervention. John was not shown any videos, and all other conditions were as in baseline except that no prompts were provided other than an initial invitation to help himself to Weetbix.

Interobserver Agreement (IOA) and Treatment Fidelity

IOA was obtained by two observers independently scoring the recorded videotapes of 13 of the 24 sessions drawn randomly from all study conditions. The primary observer was the first author. The second observer was a trained graduate student, who was naïve to the study aims and blind to the condition from which the videos were taken.

IOA was calculated by dividing the number of items that were agreed upon by the total number of items and multiplying the product by 100 % (Cooper et al. 2007). The total agreement reliability for those 13 sessions was 100 %.

Treatment fidelity was measured to assess the extent to which procedures were carried out as intended. The use of video modeling as an intervention provides consistency of aspects of the treatment by ensuring the use of identical models. In addition, video recordings of the training sessions were reviewed, and a procedural checklist was used to ensure the accuracy of the treatment delivery (available from the first author upon request). The procedural checklist was used to record whether John took more than the required time to watch the video. In addition, the number of times he left the room was recorded and/or if he stopped watching the videotape and whether he needed prompts to attend to the video. Treatment fidelity was calculated by dividing the total number of items on the list performed as intended by the total number of accurate plus inaccurate items and multiplying by 100 %. Treatment fidelity for the entire intervention was 100 %. On occasion, John did get distracted while viewing the video and required prompts to return to the task; however, on all such occasions, he finished watching those videos without stopping or pausing.

Results

Figure 1 presents the number of steps John completed independently during baseline, intervention (Phases 1, 2, and 3) and follow-up together with the

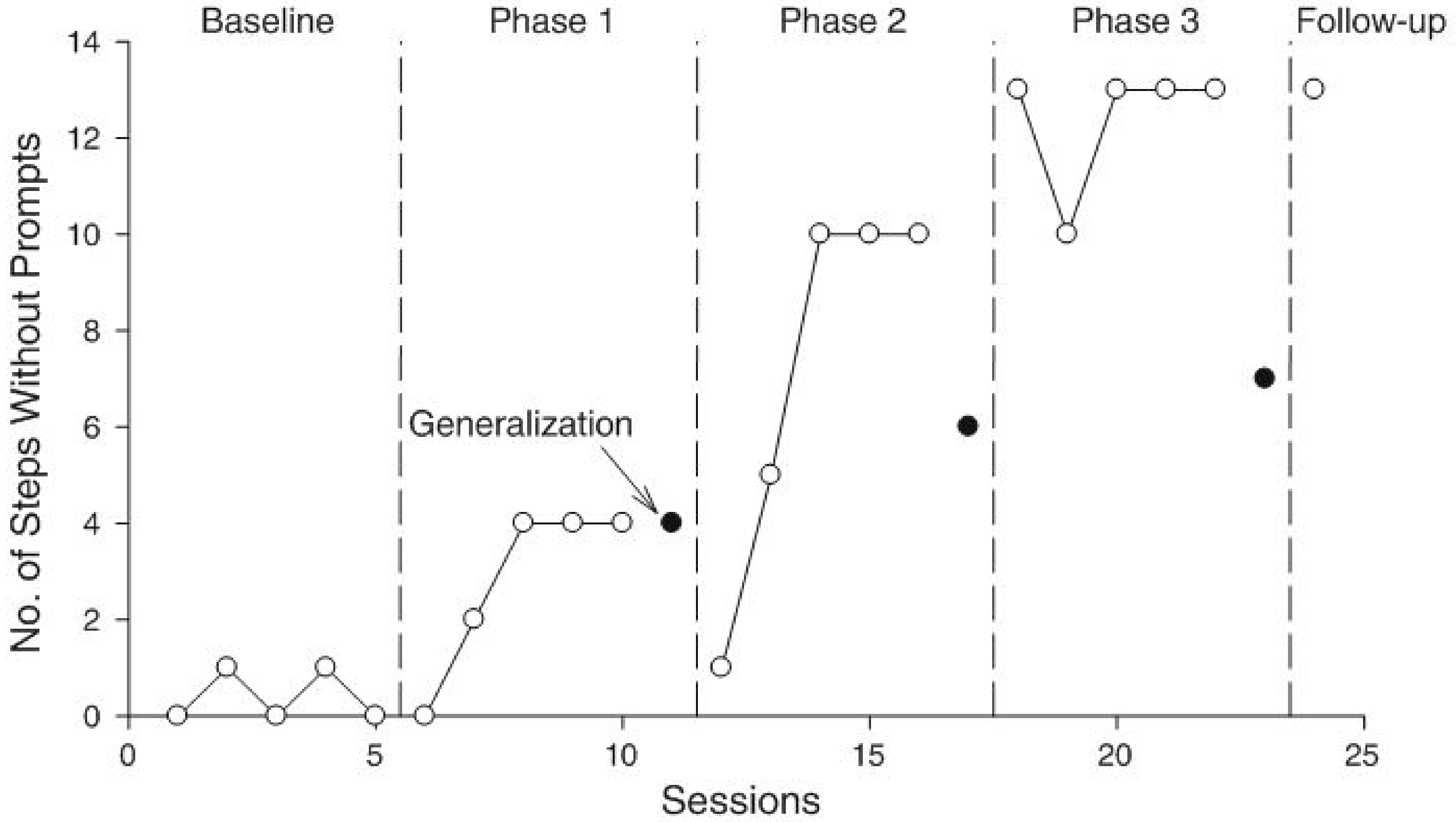

Fig. 1 Number of steps completed independently before first prompts

generalization probes. The graph reveals a clear and criterion-related increase in the number of steps completed.

During most baseline sessions, John did not initiate the task without prompts. On the two occasions that he did, he was only able to do the first step before requiring additional assistance/prompts. Introduction of the Phase 1 video, depicting Steps 1–4, was associated with an increase in steps completed such that by the third session of the intervention he completed all four steps independently, reaching the criterion two sessions later. A similar pattern is evident in both Phase 2 (Steps 1–10) and Phase 3 (Steps 1–13), with the performance criterion again being achieved by the fifth session in both phases.

Generalization

Generalization probes obtained upon completion of intervention Phases 1, 2, and 3 are displayed in Fig. 1. In these probes, generalization was assessed by asking John that he serve himself fruit puree instead of Weetbix (Phase 1), eat at a different bench and during breakfast time instead of after-school snack time (Phase 2), and serve a cereal other than Weetbix (Phase 3).

John performed to criterion in the Phase 1 probe but only completed six and seven steps (respectively) before a prompt was required in the second and third generalization probes, showing improved performances but not to criterion.

Follow-Up

Results from a follow-up session conducted 2 weeks after the intervention ended indicated that the skill was maintained over time. The participant completed all 13 steps of the task without prompts.

Social Validity Results

With average scores of 4 for both satisfaction and importance, the parental satisfaction questionnaire completed by John's mother when the intervention ended provides some indication of the social validity of the procedure. The mother reported improvement in John's ability to help himself to a snack without prompts. Additionally, the responses indicated that the procedures used were seen as fair and ethical and could be useful for other children with autism, suggesting the social appropriateness of the procedures.

Discussion

The aim of the current study was to explore the effectiveness of POVM in conjunction with a forward-chaining procedure. The goal was to teach a child with autism to help himself to an afternoon snack without adult prompting. The prediction that a combination of POVM and forward chaining would result in an increase in the participant's ability to independently help himself to Weetbix during after-school snack time and clear up afterwards was confirmed. Moreover, the predictions that the skill would generalize to other foods and settings and that the skill would be maintained at follow-up, were also supported, albeit only partially in the case of the generalization probes. Consistent with previous research, the results suggest that POVM is an effective intervention in teaching functional and adaptive skills to children with autism (Shipley-Benamou et al. 2002). The present study extends the existing literature on POVM by combining it with a forward-chaining procedure.

The results indicated that POVM led to rapid acquisition of skills. During baseline, a low and stable performance was observed; however, the progressive intervention criterion changes in the three intervention phases each resulted in mastery criteria being met within five sessions, demonstrating a rapid skill mastery following video viewing. These findings are consistent with previous studies that have demonstrated that video modeling can result in effective and immediate acquisition of skills (Catania et al. 2009).

The 2-week follow-up probe provides clear, though restricted, evidence of the POVM effect being maintained post intervention. Limited evidence of generalization is also presented. John completed the four targeted skills in the Phase 1 generalization probe though, in each subsequent generalization probe, he was observed to complete some but not all of the targeted skills. Informal observation throughout the study suggested that John consistently had coordination difficulties with opening the milk bottle (Step 6 of the task analysis) and pouring the right quantity of milk (Step 7). When this was observed during the Phase 1 training sessions, the Phase 2 video was edited to include a specific message regarding pouring volumes—“I’ll pour *some* milk in the bowl just enough so that I can still see the Weetbix.” Although this was useful while he was training with Weetbix, the alternate cereal provided less buffering and slower absorption than did the Weetbix, and consequently, the milk did not remain at the bottom of the bowl in the generalization probe, hence the need to prompt “stop.” Restricted maintenance and generalization data are clear limitations in this study. This is particularly true for the absence of generalization probes in baseline as this limits our ability to ascertain how many of the skills were learned from the video modeling. Further research exploring response generalization following POVM training is warranted.

Treatment fidelity and social validity data were two strong points in this study. The procedure was carried out as intended, increasing confidence in ascribing a functional relationship between the intervention and the observed behavior changes. The participant never left the room during the video viewing times and watched the entire video in all sessions.

The high treatment fidelity also suggests high social validity of the procedure. Other measures of the social validity of the intervention, parental satisfaction with the social significance of the goals, the appropriateness of the procedures, and the return in terms of effect for effort were important elements in this evaluation. The need to reduce the participant’s prompt-dependent behavior was considered *socially significant*, as indicated by the participant’s performance during baseline. Moreover, the procedure was deemed *appropriate* by the mother, as it was a time-efficient intervention that was carried out in an ethical and fair manner. The sessions took no more than 20 min each and did not interfere with the family's daily schedules. Lastly, the intervention provided *outcomes that were important* for the participant and his family. Before the intervention, the mother needed to constantly prompt John during each meal. After the intervention, he not only completed the tasks without any prompts, but also initiated the task himself and helped himself to food while his mother was not around. This reduced demands for the mother and increased John's independence.

While these results provide support for POVM with forward chaining, the usual caveats regarding generalization from single-case studies apply. Further research exploring the replicability of these findings is warranted. These procedures are cost-effective and relatively easy-to-use. The flip camera used in the study is a simple and inexpensive instrument. Moreover, simple editing programs like Microsoft Movie Maker, Avid FreeDV and Pinnacle VideoSpin are now available, which makes video modeling a relatively simple intervention to implement. This is particularly applicable for parents/caregivers or teachers who could use such procedures to teach new skills to individuals with disabilities and help them increase their independence. Future investigations could also integrate tutorial sessions for parents/caregivers who implement video-based interventions with minimal professional support and include longer-term follow-ups.

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