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A Comparison of Video-Based Interventions to Teach Data Entry to
Adults with Intellectual Disability: A Replication and Extension

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Abstract

Researchers have demonstrated that video-based interventions are effective at teaching a variety of skills to individuals with intellectual disabilities. To replicate and extend this line of research, we initially planned to compare the effects of video modeling and video prompting on the acquisition of a novel work skill (i.e., data entry) in two adults with moderate intellectual disabilities using an alternating-treatment design. When both interventions failed to improve performance, the instructors sequentially introduced a least-to-most instructor-delivered prompting procedure. The results indicated that the introduction of instructor prompts considerably increased correct responding in one participant during video modeling and in both participants during video prompting. Overall, the study suggests that practitioners should consider incorporating instructor-delivered prompts from the onset, or at least when no improvements in performance are observed, when using video-based interventions to teach new work skills to individuals with intellectual disabilities.

Keywords: intellectual disability, prompting, video prompting, video modeling, vocational training, work

A Comparison of Video-Based Interventions to Teach Data Entry to
Adults with Intellectual Disabilities: A Replication and Extension

The rate of employment is consistently lower for individuals with disabilities than for those without disabilities (The Kessler Foundation, 2019). One factor that contributes to lower employment rates for individuals with intellectual disabilities is the deficits in adaptive and cognitive functioning they experience, which may impede these individuals work performance (Lysaght, Ouellette-Kuntz, & Lin, 2012). For example, researchers have demonstrated that some individuals with intellectual disabilities experience challenges with both recall and memory (e.g., Edgin, Pennington, & Mervis, 2010; Schuchardt, Gebhardt, & Mäehler, 2010) and have difficulties completing complex tasks (Allen, Burke, Howard, Wallace, & Bowen, 2012; Siberski et al., 2015). As such, individuals with intellectual disabilities often do not have access to competitive employment opportunities.

Researchers have found that, with appropriate supports, individuals with intellectual disabilities can learn to perform complex tasks required in the workplace (e.g., Cannella-Malone & Schaefer, 2017; Smith, Shepley, Alexander, & Ayres, 2015). Two strategies to help individuals with intellectual disabilities learn to perform complex tasks include video modeling (Alexander, Ayres, Smith, Shepley, & Mataras, 2013; Goh & Bambara, 2013; Mechling, Gast, & Gustafson, 2009; Taber-Doughty et al., 2011) and video prompting (Park, Bouck, & Duenas, 2019; Smith et al., 2016; Smith, Shepley, Alexander, Davis, & Ayres, 2015). In a review of the literature on video modeling and video prompting, researchers found that both interventions have positive effects on teaching individuals with intellectual disabilities a variety of skills including job skills (Park et al., 2018).

In video modeling, the instructor shows a video recording of the skill prior to the individual performing the skill (e.g., Goh & Bambara, 2013; Taber-Doughty et al., 2011). The person in the video model can be the individual targeted for intervention (i.e., self-model; Wert & Neisworth, 2003), a peer (Kourassanis, Jones, & Fienup, 2015), or an instructor (Mason, Davis, Ayres, Davis, & Mason, 2016; Mason, Ganz, Parker, Burke, & Camargo, 2012). Furthermore, the perspective of the video can be from the point-of-view of the person executing the task (i.e., first-person perspective; view of the person completing the task) or that of an uninvolved observer (i.e., third-person perspective; view of a person watching the task). During video modeling, the participant typically watches the video once at the beginning of a training session prior to completing the skill. For example, Mechling, Gast, and Gustafson (2009) used a video model to teach three adults with developmental disabilities to extinguish different types of cooking fires. Participants watched a video model prior to each session and were then immediately given an opportunity to extinguish the type of fire depicted in the video. The video model was effective in teaching all participants to safely extinguish cooking fires.

In comparison, video prompting involves a continuously accessible external support (e.g., visual supports, audio cueing, videos) that walks the person through the task (Allen et al., 2012; Smith et al., 2015). During video prompting, the video plays continuously throughout the task while the participant imitates each step (Park et al., 2019). A study by Smith, Shepley, Alexander, and Ayres (2015) provides an example of video prompting. The authors used video prompts to teach three participants with autism spectrum disorder to complete a computer maintenance task. Participants were provided with first-person video prompts that guided them through each step of the task. The video prompts were effective in increasing all participants performance on the computer maintenance task.

When accessible on a mobile device, practitioners may use video modeling and video prompting in a wide variety of work settings. Additionally, both interventions have the advantage of potentially limiting the need for a live model to be present during training. In the case of video modeling, viewing all the steps of a chain prior to implementation may increase the rate of responding during training. However, viewing all steps in the chain may make the task more difficult to learn when the steps are numerous (Cannella-Malone et al., 2006). In contrast, video prompting allows individuals to imitate one step at a time, which may facilitate initial acquisition of multiple steps but also reduce the rate of responding during training (Mechling et al., 2014). Given the merits and drawbacks of each of these video-based instruction interventions, comparison studies seem warranted.

At least three studies have compared the effects of video modeling and video prompting interventions (i.e., Cannella-Malone et al., 2006, 2011; Mechling et al., 2014). These comparison studies targeted daily living skills in individuals with intellectual disabilities. Two studies by Cannella-Malone et al. (2006, 2011) suggested that video prompting was generally more effective than video modeling. Conversely, a more recent study by Mechling et al. (2014) indicated that instructor prompting may be an essential component of video-based interventions. The conflicting findings of these studies suggest the need for additional replications.

Instructor prompting typically consists of a combination of vocal, gestural, and physical prompts provided contingent on participant errors. These prompts are typically faded as the participant increases their correct responding. Instructor prompts have been used both in isolation and in combination with other interventions to teach individuals with intellectual disabilities a variety of skills, including pedestrian safety (e.g., Batu, Ergenekon, Erbas, & Akmanoglu, 2004), daily living skills (e.g., McDonnell & Ferguson, 1989; Murzynski &

Bourret, 2006), spelling (Coleman-Martin & Wolff Heller, 2004), and play skills (e.g., Libby, Weiss, Bancroft, & Ahearn, 2008). Researchers have found that an instructor prompting component may improve responding during video-based interventions (Mechling & Stephens, 2009; Taber-Doughty et al., 2011; Tetreault & Lerman, 2010). For example, Tetreault and Lerman (2010) evaluated the effects of a point-of-view video model on the social skills of three individuals with Autism. Although the video model was effective at teaching two of the participants to initiate and maintain conversations; the third participant only acquired the skill after the addition of a least-to-most prompts system. Instructor prompts may be a necessary addition to video-based interventions if participant performance does not improve substantially.

Replicating these studies with work skills appears important as video prompting and video modeling may produce differential responding during training, which may in turn influence work productivity. Work productivity is the amount of work an individual can complete in a specific amount of time. Maintaining productivity levels like those of their typically developing peers may help individuals with intellectual disabilities access and retain work opportunities (Drucker, 1999). Wacker et al. (1988) taught individuals with intellectual disabilities to first label a character and then enter it into a computer. The self-labeling strategy was effective in increasing participants correct entries. The authors note however that it was unknown whether participants would continue to overtly emit the labels long term, a potentially disruptive behavior in a work setting. With video-based instruction models could be viewed and listened to discreetly avoiding potentially stigmatizing situations.

The initial purpose of the study was to replicate and extend the studies conducted by Cannella-Malone et al. (2006, 2011) by comparing the effects of video prompting and video modeling on a complex work skill (i.e., data entry) in two individuals diagnosed with moderate

intellectual disability. We selected data entry as a target because (a) it is a common task in office work environments, and (b) only one study previously targeted the same skill in individuals with moderate intellectual disabilities (Wacker et al., 1988). The paucity of studies on teaching data entry skill instruction underscores the importance of conducting additional research teaching this skill. However, in the current study, both strategies were ineffective at increasing correct responding while decreasing errors. The experimenters thus changed the purpose of the study to evaluate the effects of an instructor-delivered prompting component on the effectiveness of video modeling and video prompting. The main research question was, “Does adding an instructor-delivered prompt increase correct responding during video modeling and video prompting?”

Method

Participants and Settings

Two adults with moderate intellectual disabilities participated in the current study. The experimenters recruited the participants from local agencies providing residential and community-integration services (i.e., services targeting skills that enable individuals to become more independent members of their communities.). Nancy (pseudonym) was a 24-year-old female also diagnosed with dysphasia and dyspraxia. During her participation in the study, Nancy completed an internship to learn work skills. Jacob (pseudonym) was a 28-year-old male. Jacob attended a center for adults and worked as a clerk in a foodbank during his participation in the study. Both participants had previously accessed computers for personal leisure use, but neither had prior experience in systematic data entry. The study took place in a quiet room equipped with a computer at the University or the participant’s home.

Work Tasks

Each participant completed two tasks, which were alternated systematically (i.e., A, B, A, B...) across sessions within an alternating-treatment design. Task A involved entering the identification number (one to three digits), age (two digits), and total score (typically two digits) of individuals on the Brief Assessment of Service Satisfaction in Persons with Intellectual Disability (BASSPID; Lanovaz, Argumedes, Lamontagne, Duquette, & Morizot, 2013). The participant entered each number from the hand-written questionnaire in the correspondingly labeled column of a Microsoft Excel spreadsheet. When participants finished entering the data for one questionnaire, they took the next questionnaire and moved to the next row in the spreadsheet. During Task B, the participant also entered three values from a questionnaire: the identification number (one to three digits), the self-injury frequency score (typically two digits), and the self-injury severity score (typically two digits) from the Behavior Problems Inventory (BPI-01; Rojahn, Matson, Lott, Esbensen, & Smalls, 2001). As with Task A once the participant finished with a questionnaire, they moved on to the next one. The project involved 500 questionnaires each for Tasks A and B.

Dependent Variables and Data Collection

Rate of correct responding. The experimenters defined a correct response as when the participant accurately enters the numbers from the questionnaire into the corresponding row and column of the spreadsheet. The first author converted the frequency (i.e., count) of correct responses to rate by dividing the number of correct responses by the duration of the session (i.e., 10 min). Rate was selected as the dimension of interest because it provided a measure of productivity.

Percentage of errors. The experimenters defined an error as when the participant enters the data into the incorrect row or column or enters an incorrect number. Calculating percentage

of errors involved dividing the number of errors by the sum of correct responses and errors and multiplying the result by 100%. Percentage of errors was included as an additional measure to provide information on participant accuracy. A participant could maintain a high rate of correct responses while still making a large number of errors.

Experimental Design and Procedures

The current study used an alternating-treatment design. An alternating-treatment design involves monitoring behaviors during the alternation of two or more interventions to identify differences in behavior between those interventions (Gast & Ledford, 2014). Initially, the experimenters compared the effects of video modeling and video prompting on rate of correct responding and percentage of errors for both participants. In Phase 2 the interventions were counterbalanced across the participants such that video prompting was used for Task A for Nancy and Task B for Jacob, while video modeling was used for Task B for Nancy and Task A for Jacob. Then, the experimenters systematically added an instructor prompting component to each intervention to examine its effects for each participant's responding. Each participant met with a research assistant once or twice per week during which, the participants typically completed six 10-min sessions. The six sessions were conducted in one block. In total Nancy completed 96 sessions and Jacob completed 58 sessions.

Baseline. At the beginning of the session, the research assistant sat the participants in front of a computer with the Excel spreadsheet open, asked them to enter as much data as possible in 10 min, and handed them the questionnaires. The research assistant provided no further instructions. When the session ended, she thanked them for their participation. If a participant showed no correct responding for five consecutive minutes, the instructors terminated the sessions (instead of letting the participant make errors continuously for 10 min).

Video prompting. The video prompts were presented on an iPhone. We chose to present the videos on an iPhone because smartphones are highly accessible devices that were available in the environment in which we were conducting the study. The video prompts lasted 2 min 9 s for Task A and 2 min 33 s for Task B. The videos offered a point-of-view model of an individual completing the task with step-by-step voiceover instructions and involved a total of 10 steps. This format allowed the current study to remain consistent with and replicate Cannella-Malone et al. (2006, 2011). The video comprised a zoom in of the model pointing to data on the questionnaire and then entering it in the corresponding area of the spreadsheet. During the data entry portion, the video showed stills of the questionnaire on which the data to be entered were circled. The videos included 5-s pauses after each step to provide the participants with time to imitate the modeled step. The final video prompt showed the participant how to restart the video. The instructors asked the participants to watch and follow the video prompts continuously during the session. The instructor never corrected participant errors during video prompting. All other procedures remained the same as in baseline.

Video modeling. During video modeling, the participant watched the video prior to the session rather than continuously during the session. The videos were identical to those used for video prompting except that the instructors removed the 5-s pauses after each step as the participants did not have access to the task while they were watching the video. No error correction procedure was implemented during this condition.

Instructor prompting. Because the percentage of errors remained near 100% following video modeling and video prompting, the experimenters sequentially introduced an instructor prompting procedure within each condition. During instructor prompting, the instructor stopped the video after each step. If the participant made an error or did not provide a response within 5

s, the instructor implemented a least-to-most prompting procedure. We used a 5-s delay as our experience with this population indicated that individuals were unlikely to respond after this delay. First, she repeated the vocal instruction. If nonresponding or an error persisted, she added a gestural prompt, by pointing to the materials or data relevant to each step. Finally, the prompting sequence ended with a hand-over-hand prompt, which only occurred once during the study. During video prompting, the instructor implemented the prompting sequence throughout the session as the video played continuously. During video modeling, she only provided prompts as the participant completed a questionnaire while watching the video model (once at beginning only).

Follow-up. By its nature, video prompting limited the rate of responding to the pace of the video. Moreover, the addition of instructor prompts often prevented the participant from engaging in errors. Thus, the study ended with a follow-up phase to examine whether independent responding would persist following the removal of the procedures. The follow-up sessions were identical to the baseline sessions and took place immediately following the video modeling and video prompting with instructor prompts phases.

Calibration Checks and Interobserver Agreement

The second author programmed the spreadsheet to automatically measure the number of correct responses and errors. Following the completion of the study, an independent data collector manually checked the automatic scoring for 100% of sessions across both participants. A cell was considered correctly calibrated if both the manual check and automatic scoring returned the same value (i.e., correct or incorrect); otherwise, the cell was considered as incorrectly calibrated. A correct calibration score was calculated by dividing the number of correctly calibrated cells in each spreadsheet by the number of correctly calibrated cells plus the

number of incorrectly calibrated cells and multiplying by 100%. Mean calibration scores were 100% for Nancy and 99.9% (range, 98.9%-100%) for Jacob. A second observer collected data to calculate interobserver agreement of the primary data collector's calibration check. Secondary data were collected on 20% of sessions for each work task for each participant. Interobserver agreement was 99.6% (range, 96.4%-100%) for Nancy and 99.1% (range, 92.1%-100%) for Jacob.

Analyses

The first author initially graphed the rate of correct responding and the percentage of errors to examine patterns and changes across conditions. Then, the second author used a calculator developed by Tarlow (2016) to measure the Tau effect size of each intervention when compared to baseline. Tau produces a value between -1 and 1 (Tarlow, 2017) with the sign of the values indicating the direction of the change and with values farther away from zero (in either direction) representing larger effect sizes (as in a correlation). Researchers increasingly use Tau to conduct meta-analyses of single-case research and to report the effect size of individual studies due to its properties and its ease of interpretation (e.g., Hutchins, Burke, Bowman-Perrott, Tarlow, & Hatton, 2019; Kleinert, Coddling, Minami, & Gould, 2018; Vismara, McCormick, Shields, & Hessel, 2019). It is for that reason that we chose to calculate this measure as part of the current study.

Results

Figure 1 shows the rate of correct responding and percentage of errors across conditions for Nancy and Jacob. The first panel of Figure 1 shows that Nancy rarely responded correctly during baseline, video prompting alone and video modeling alone (i.e., first and second phases). The second panel of Figure 1 indicates that the percentage of errors remained near 100% during

these same phases. The instructor exposed Nancy to the video modeling and video prompting for approximately 15 sessions in the absence of learning as the experimenters had initially anticipated that repeated exposure to the video would eventually lead to learning, this ultimately was not the case. Our anecdotal observations suggested that Nancy did not readily understand the vocal instructions. To address this issue, the instructor replaced the voice-over with pictorial aids in the video and combined some steps to reduce their number (from 10 to 7 steps) starting at session 31, but this modification did not produce noticeable improvements. The third phase shows that adding instructor prompts increased correct responding during video prompting while decreasing the percentage of errors. The addition of instructor prompts to video modeling in the fourth phase marginally increased correct responding for Nancy, but it did not decrease the percentage of errors. Therefore, the instructor replaced video modeling with video prompting for Task B in the fifth phase, which increased correct responding while reducing errors. At follow-up, the removal of video prompting further increased the rate of correct responding (as the rate of responding was no longer limited by the pace of the video) and reduced the percentage of errors for Task A. However, both behaviors returned to baseline levels for Task B.

Similarly, the third panel of Figure 1 reveals that Jacob never responded correctly during the first two phases, which included baseline, video prompting alone, or video modeling alone conditions. The fourth panel of Figure 1 shows that errors remained at 100% during these first two phases. The introduction of instructor prompting for video modeling in the third phase increased correct responding while decreasing errors for Task A. To a lesser extent, the addition of instructor prompting during video prompting in the fourth phase increased correct responding and reduced errors to near-zero levels. Finally, correct responding increased at follow-up for the task taught with video prompting (Task B) to reach a similar rate as the one observed for the task

taught with video modeling (Task A). Errors remained near-zero levels for both tasks during this last phase.

Table 1 presents the means and effect size measures across tasks and conditions for each participant. The results are consistent with those described in Figure 1. In the absence of instructor prompting, both participants engaged in near-zero levels of correct responding while the percentage of errors remained very high. In these cases, the Tau values were small or in the opposite direction of the desired change. For example, Tau compared to baseline for video modeling alone was 0.23 for Nancy and 0.06 for Jacob. Conditions with instructor prompting produced higher rates of responding and were associated with higher values of Tau. For example, the Tau for video-prompting with instructor prompts was 0.53 for Nancy and 0.95 for Jacob. Concurrently, instructor prompting led to lower percentages of errors and were associated with Tau values closer to -1. One notable exception was video modeling with instructor prompting for Nancy, which did not result in reductions in errors (Tau = -0.75).

Discussion

The ultimate purpose of the study was to evaluate the effectiveness of instructor prompts on completion of two data entry tasks when video modeling and video prompting alone were ineffective. The introduction of instructor prompts considerably increased correct responding while decreasing errors in one participant during video modeling and in both participants during video prompting, indicating that it was an essential training component. During follow-up, the analyses found no differences across tasks for Jacob. In contrast, Nancy displayed differentiated responding at follow-up. Practice effects may explain this differentiation. Given the order of introduction of video prompting for each task, she had considerably more opportunities to

engage in Task A correctly than she did with Task B. Presenting additional sessions of Task B with video prompting may have eventually produced similar responding across tasks.

The findings are generally consistent with those studies that have shown that video-based interventions with instructor-delivered prompting are effective at teaching skills to individuals with disabilities (e.g., Alexander et al., 2013; Goh & Bambara, 2013; Mechling & Stephens, 2009; Taber-Doughty et al., 2011). The study shows that instructor prompts were an essential component without which the percentage of errors remained high. As such, video modeling and video prompting alone seemed insufficient to change the target behavior in the participants; the introduction of instructor prompting appears to be the mechanism that produced the observed behavior change. Noteworthy, rate of correct responding increased considerably for both participants when video prompting was withdrawn at follow-up. Video prompting may initially suppress high rates of responding as the individuals may match their responding to the pace of the video. Conducting regular baseline probes to monitor progress and identify when the video prompting should be faded may address this issue in practice.

Limitations and Future Research

One of the limitations of the current study is that we only included two participants, which limits the generalizability of the results. A second limitation is that experimenters did not assess the effects of instructor prompting alone. Therefore, whether the videos were even necessary to increase correct responding remains unclear. Third, the experimenters counterbalanced the order of introduction of the instructor-prompting procedure and which task was associated with a given intervention, but order and practice effects remain issues that should be carefully considered in the future. Furthermore, we did not assess whether the data entry skills taught during the study would generalize to novel data entry tasks or across novel environments.

It is possible that participant data entry behaviors may not extend to data entry tasks not addressed in the study. Future research should evaluate the extent to which video modeling and video prompting with instructor prompts can establish a generalized repertoire of data entry behaviors. The lack of social validity and procedural integrity measures is also a limitation that should be carefully addressed in future research.

Despite its limitations, the current study makes a meaningful contribution to the literature on teaching work skills to individuals with intellectual disability. Practitioners and researchers may assume that the videos themselves are responsible for the behavior changes. Current research seems to support this assumption as video modeling and video prompting have strong support in the literature (Park et al., 2018). However, a closer look at the literature shows that researchers often include an instructor prompt component or error correction procedure to their video-based interventions (e.g., Alexander et al., 2013; Cannella-Malone et al., 2006-2011; Goh & Bambara, 2013; Taber-Doughty et al., 2011). Our study experimentally shows that this instructor prompt may be an essential component to improve correct responding in some individuals with intellectual disability during video-based interventions. As such, practitioners should carefully consider this issue when designing teaching programs for this population. The results also extend the scant literature on teaching clerical skills, in our case data entry, to adults with developmental disability. Replications are paramount in single-case research to establish the generality of such findings.

Finally, the participants' rate of correct responding increased, but did not attain the same levels as would be expected from workers without disabilities. In a related study on productivity, our research team found that the mean rate of workers without disabilities was 31 correct responses per min on the same tasks (McDuff et al., 2019). Whether or not society should expect

individuals with disabilities to achieve the same level of productivity than their peers without disabilities remains open to debate (see Kirsh et al., 2009; Lysaght, Ouellette-Kuntz, & Lin, 2012). Future research should replicate the results with a larger sample and examine to what extent intellectual functioning moderates the effects of video-based interventions. Continuing to examine questions related to work skills in individuals with intellectual disabilities is important to facilitate and promote their social inclusion to the fullest extent possible.

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Table 1

Mean Rate of Correct Responding, Mean Percentage of Errors, and Tau Compared to Baseline Across Tasks and Conditions for Each Participant

Participant	Condition	Rate of Correct Responding		Percentage of Errors	
		Mean	Tau	Mean	Tau
Nancy					
	Task A: Baseline	0.07		98%	
	Task A: VP	0.02	-0.39	98%	0.31
	Task A: VP + IP	0.85	0.53	8%	-0.56
	Task A: Follow-up	4.03	0.80	10%	-0.78
	Task B: Baseline	0.00		100%	
	Task B: VM	0.09	0.23	99%	-0.23
	Task B: VM+IP	0.30	1.00	98%	-0.75
	Task B: VP+IP	1.17	0.83	3%	-0.83
	Task B: Follow-up	0.00	0.00	100%	0.00
Jacob					
	Task A: Baseline	0.01		100%	
	Task A: VM	0.02	0.06	100%	-0.06
	Task A: VM + IP	10.40	0.76	1%	-0.81
	Task A: Follow-up	9.93	0.84	1%	-0.85
	Task B: Baseline	0.00		100%	
	Task B: VP	0.79	0.27	95%	-0.27
	Task B: VP+IP	0.95	0.95	0%	-1.00
	Task B: Follow-up	9.17	0.94	0%	-0.96

Note. VM: video modeling, VP: video prompting, IP: instructor prompting

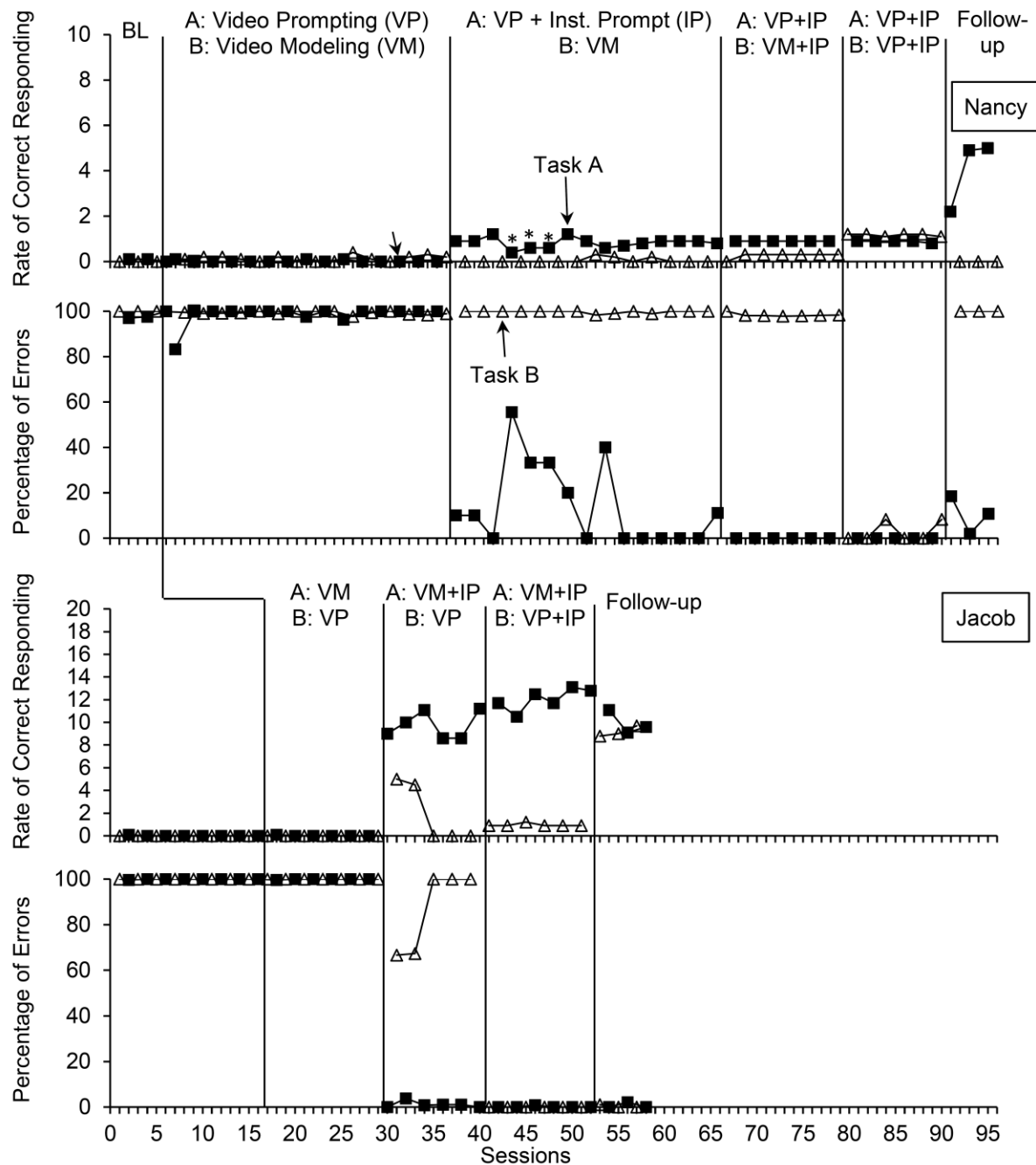


Figure 1. Rate of correct responding (per min) and percentage of errors on tasks A and B across baseline (BL), video modeling (VM), video prompting (VP) with and without instructor prompting (IP), and follow-up conditions for Nancy and Jacob. The unlabeled arrow identifies the introduction of a new video and the asterisks identify three sessions wherein the research assistant did not provide instructor prompting due to a procedural error (Nancy only).