8-2021

Young Adults with Disabilities Acquire Vocational Skills with Video Modeling

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by

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A dissertation submitted to the Graduate College
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
Psychology
Western Michigan University
August 2021

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Western Michigan University, 2021

Students with disabilities often require substantial support to acquire the skills needed to secure work experience and paid employment. Special education transition programs have an obligation to utilize evidence-based practices to facilitate the acquisition of such skills. In the present project, three studies were conducted to examine the effects of video modeling on the acquisition, maintenance, and generalization of job-related tasks taught in a classroom setting to young adults with developmental disabilities. In Study 1, a multiple baseline across behaviors experimental design with four participants was used to assess the effects of video prompts on the percentage of correctly completed steps in doing laundry, checking in to work, and stripping a bed. Study 2 essentially replicated Study 1, except that a multiple baseline across subjects experimental design with four other participants was used in Study 2. As in Study 1, all students acquired the skills using the video prompting intervention. Follow-up data demonstrated that the skills maintained over three months and generalization probes indicated that the participants performed the tasks accurately in a new setting with different materials. Study 3 arranged a multiple baseline across subjects experimental design across subjects with an alternating treatments component to evaluate and to compare in three additional participants the effects of video prompting and full video modeling on the acquisition of a job-related task, rolling silverware. In full video modeling, participants viewed a model completing all steps in a task, whereas in video prompting participants viewed a separate video for each step in the task. All participants mastered the task, with good generalization and maintenance. There was some indication that video prompting was more effective than full video modeling. The results of these

studies strongly suggest that video modeling is an effective intervention for promoting the acquisition, maintenance, and generalization of job-related tasks. Furthermore, the results of study three suggest that video prompting may be more useful than full video modeling, although further research is needed to confirm this difference. Participants were generally satisfied with the intervention and it was relatively easy to use, which are important points in its favor.

TABLE OF CONTENTS

Table of Contents—Continued

Table of Contents—Continued

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Young adults with disabilities are often unemployed, underemployed, or underpaid (U.S. Bureau of Labor Statistics, 2019). Multiple factors contribute to this disheartening reality, including lack of employment experience, limited access to job training and support, and workplace discrimination against individuals with disabilities (Lindstrom, Kahn, & Lindsey, 2013). Researchers and practitioners alike have endeavored to overcome these barriers, with many efforts occurring in the public school system with older students. The Individuals with Disabilities Education Act (IDEA; 2004) permits special education supports and services for individuals until the age of 21 years, with some states extending those services beyond that age. Michigan, for example, extends special education services through the age of 26 years (Michigan Department of Education, 2018). Extending the number of years that educational services are accessible affords an extended opportunity for educators to prepare special education students beyond core academics, emphasizing training and supports for paid employment and independent living. Under IDEA, the practices used to promote these functional skills are required to be evidence-based, which is intended to ensure that the efforts of educators are effective and efficient for the populations they serve (Individuals with Disabilities Education Act, 2004).

Evidence-Based Practice (EBP) "is the integration of the best research evidence with clinical expertise and patient values" (APA, 2006, p. 273). In schools, EBP refers to selecting clearly defined interventions that align with the student's goals and are backed by repeated empirical evidence supporting its effectiveness with similar behaviors, populations, and settings. In addition to meeting special education requirements, behavior analysts working in schools have a fundamental obligation to provide effective behavioral treatments to their clients (Behavior

Analysis Certification Board, 2014; Van Houten et al., 1988). This responsibility not only includes the selection and implementation of scientifically validated interventions, but also the selection of treatments that are feasible and sustainable in the environment where they are to be utilized. In most cases, tenable interventions require limited resources (i.e., materials, time, and staff), are relatively easy to implement with high fidelity, and can be applied to a variety of behaviors, students, and environments. Good behavior analysts working in schools will advocate for proven and feasible interventions that meaningfully address the student's needs and do not overwhelm school staff. Overly complex or resource intensive interventions are likely to be implemented with low fidelity or fail to be maintained for extended periods of time, which will diminish the effectiveness of those interventions, regardless of the quality of the scientific evidence supporting them.

Modeling

Modeling, in which one person performs an appropriate response that is subsequently imitated by the learner, is a widely used EPB (Cooper et al., 2007, p. 413). According to Cooper et al. (2007), "a model is an antecedent stimulus that evokes the imitative response" (p. 413). Modeling is one of three major response prompts used by behavior analysts (the others are verbal instruction and physical guidance) and is a part of many skill-acquisition programs. Modeling itself can be planned or unplanned. In programming for systematic skill acquisition, models are typically preplanned, thus ensuring the model is consistent for each imitative opportunity. In everyday life, however, unplanned models are common and "frequently produce new and helpful adaptive behaviors" (Cooper et al., 2007, p. 413). For example, a new employee successfully clocks into work for the first time by observing a more senior employee complete the task, then imitating their response. Although the model was not preplanned, or even intentional, it still functioned as a response prompt, increasing the likelihood of the new employee correctly performing the task.

Modeling is an EBP commonly used in conjunction with other effective practices (i.e., reinforcement) and can be implemented by a teacher or therapist to evoke the desired response, making it a useful strategy for teaching. It is also a valuable strategy for teaching skills to individuals with an imitative repertoire in a relatively short period of time. An imitative repertoire is present when a learner has generalized imitation, meaning that individual is able to observe and imitate novel models with accuracy, without previous reinforcement for that specific response (Malott & Shane, 2014).

Video Modeling

Modeling as previously described is “live,” in that the model is physically present. There is no inherent problem in this, but a teacher or other care giver who is acting as a model is not able to attend to other tasks. Moreover, arranging live modeling in multiple settings, which is likely to be required to ensure generalization, can be difficult. For these reasons, researchers have examined video modeling (VM) as an alternative to live modelling. As Wong et al. (2015) noted, VM is derived from the traditional live modeling. The two types of modeling differ only in that with VM the model is not an *in-situ* performance, but rather is a "visual model of the target behavior or skill...provided via video recording and display equipment to assist learning in or engaging in a desired behavior or skill" (Wong et al., 2015, p. 1960).

Video modeling is a focused intervention that has grown in popularity among behavior analysts, educators, and other professionals, likely due to its ease of development and implementation. A focused intervention is defined as an individual instructional strategy used to teach a specific skill, making it an easily adaptable intervention to meet a broad assortment of learners' needs (Odum et al., 2010). There is substantial evidence that VM is useful for teaching a wide variety of skills to people with and without disabilities across a broad range of ages and settings (see Cooper et al., 2020, pp. 534-536; Wong et al., 2015). Researchers have examined several aspects of VM modeling, such as the viewpoint from which videos are recorded, the devices on which models are displayed, and the format in which components of the task are presented (e.g., whole task versus sequences video clips). As more investigations of VM appear, the variables that contribute to its effectiveness for different applications are becoming clearer (Cooper et al., 2020).

Video modeling may be more useful in schools than live modeling for three reasons. First, VM is likely to be less expensive, as it requires fewer staff to deliver the intervention and does not require transporting staff to different settings to model the behaviors in-person. Second, video models allow for precise consistency in the model observed by the learner. This consistency allows for the skill to be taught systematically, which facilitates skill acquisition (Charlop-Christy, Le, & Freeman, 2000). Third, VM is a mobile intervention, meaning it can be used in a variety of settings and on various devices, which makes maintaining a consistent intervention in a variety of settings possible. This versatility is important, because students may need support to learn skills in new settings or to maintain previously acquired skills in those new contexts. Other strengths of VM, which are shared with live modeling, are rapid onset of beneficial behavior change and widespread effectiveness (Bellini & Akullian, 2007).

A review by Odum et al. (2015) analyzed research articles from 1990 to 2013, identifying the empirical support for the use of technology in interventions for individuals with ASD. VM was reported to have support of effectiveness in teaching skills in a variety of domains. VM aligns with the regulations for and access to assistive technology outlined by the Individuals with

Disabilities Education Act (2004), because such technology is to be used to “increase, maintain, or improve the functional capabilities” of individuals with special needs. VM’s reliance on technology is increasingly appropriate in today's world because the tools needed to use it (e.g., video cameras, laptop computers, and iPads) are widely available and generally accepted by most people. Video recordings can be captured, edited, and displayed on a variety of devices, making VM a practical intervention in most settings.

The widespread use of technology in our society also makes its use in learning and maintenance programs socially relevant and acceptable. For example, many adults access "how-to" videos regularly on the internet when faced with a novel task or one in which not all steps have been previously mastered (i.e., changing an electrical outlet). After viewing a video of the task executed by a proficient performer, the viewer can imitate the modeled steps to complete the task accurately. Technology is also used regularly by children, adolescents, and adults in almost every setting, making the VM intervention mobile and low profile. For a young adult working on-site to develop job skills, the VM intervention may be less conspicuous than a one-on-one aide or job coach modeling the skill and providing feedback in person. Furthermore, technology driven interventions may promote independence in the immediate and future environment, especially when learners can access the videos directly when assistance to complete a task is needed (Cullen et al., 2017).

Video Modeling Variations

Several variations of VM have been assessed. Traditional VM is perhaps the most common type due to its ease of development and implementation (Bross, Zane, & Kellems, 2019). Traditional VM involves having a leaner observe a video of another person performing a task to mastery. The model can be a peer (i.e., peer video modeling), coworker, educator, or any other individual who can successfully perform task. Models are selected due to their fluent performance, making it easy to capture the appropriate performance and minimizing the need for editing the video. The minimal editing required, if any, can be done on most devices using free or low-cost software (i.e., iMovie® on Apple devices).

The video is displayed via tablet, computer, smart phone, or other video display equipment. The broad range of devices that can be used, some of which are relatively inexpensive and widely available, increases the acceptability of the intervention. In many instances, the same device can be used to capture, edit, and display the video model, limiting the resources needed to develop and employ the intervention. Researchers have used traditional VM to improve athletic performance (Maryam et al., 2009), social safety skills (Spivey & Mechling, 2016), activities of daily living (Kim & Kang, 2020), vocational skills (Cullen et al., 2017; Kellems & Morningstar, 2012), academic skills (Marcus & Wilder, 2009), and independent living skills (Kellems et al., 2018).

Video Self-Modeling (VSM) is another popular and effective VM intervention for individuals with and without disabilities (Buggey & Ogle, 2012). VSM differs from traditional VM, in that the learner watches and learns from videos of their own accurate performance (Buggey, 2005). Thus, learners serve as their own models. In a study comparing the effects of peer video modeling and self-video modeling on the textual response of children with ASD, Marcus and Wilder (2009) reported that self-modeling was more effective and efficient than peer modeling in improving participant performance. They also found that participants were more likely to request the self-models than the peer models during and after intervention. This finding suggests that self-models may be preferred over peer models.

Although the results from VSM studies are impressive, practitioners should note some challenges to developing and implementing VSM. First, this type of VM may require substantial editing to create a video demonstrating appropriate performance if the individual is not yet performing the skill independently or accurately (Bross et al., 2019). Second, the learner's confidentiality may be at risk, especially in instances where the self-model is used in multiple settings. In all forms of VM, however, practitioners need to obtain informed consent from guardians and learners before recording or displaying video models (Buggey & Ogle, 2012). Thirdly, in adhering to confidentiality policies relevant to VSM, practitioners may be required to capture and edit multiple videos of multiple learners working on the same skill, whereas with traditional VM, one video can be developed and implemented for the same skill across countless learners, making it more feasible in educational or vocational programs.

Another promising variation of VM is Point-of-View Video Modeling (POV). POV models are recorded from a first-person point-of-view, allowing learners to view the target behavior from their perspective. The advantage to this viewpoint is that only the principal features are shown, limiting irrelevant or distracting stimuli from the model (Bross et al., 2019). POV models are also relatively easy to film and produce, typically requiring little preparation of the environment and simple editing of the recordings. Researchers evaluating the effects of POV video modeling have demonstrated success in teaching transition behaviors (Cihak, 2011; Cihak et al., 2010; Schreibman et al., 2000), daily living skills (Shipley-Benamou et al., 2002) functional skills (Alberto et al., 2005), play skills (Hine & Wolery, 2006), vocational skills (Heider et al., 2019), cooking skills (Kim & Kang, 2020), and social skills (Tetreault & Lerman, 2010).

Despite these successful applications, POV modeling has received less attention than other VM approaches. For instance, Bellini and Akullian (2007) published a meta-analysis of video modeling, analyzing traditional VM and VSM separately, but failing to address the effects of POV alone. In response to this omission, in 2013 Mason et al. published a meta-analysis showing that implementing POV modeling alone was more effective than combining it with other treatment components. Mason et al. (2013) found that participants in the studies analyzed were typically of the secondary or postsecondary age group, and the treatment was more effective for this age group than for preschool and elementary aged participants. They also found that participants in the reviewed studies were limited to those with autism spectrum disorder (ASD) or other developmental disabilities, with a stronger effect for participants with ASD. Although limited, this review provides practitioners with some insight as to the population for whom POV modeling is likely to be appropriate.

Generalization and Maintenance of Treatment Effects

A review by Park et al. (2019) revealed that previous studies evaluating the effects of video modeling (also referred to as video prompting when videos are broken down step-by-step) focused heavily on teaching daily living skills; 51% of all studies did so. Park et al. (2019) urged future researchers to expand the application of VM and VP techniques to other skills, including job skills. They also encouraged researchers to analyze the maintenance of skills over time and their generalization to new settings, important aspects of applied research largely ignored to many of the studies they evaluated. Examining generalization and maintenance is critical, because often the environment in which these VM interventions are implemented are not the settings in which learners will eventually use their acquired skills. Moreover, for young adults reaching their final years of special education services, they must actually benefit from skills they acquire, and those skills must maintain with minimal support long after their formal schooling ends.

There is certainly good reason to examine the generalization and maintenance of job-related skills young adults with developmental disabilities acquired through VM, because several studies demonstrate the utility of VM in teaching a variety of skills to members of this population and there is some evidence of good generalization and maintenance of these skills. For example, in a directly relevant study, Kellems and Morningstar (2012) conducted a study using VM to teach vocational skills (i.e., vacuuming, cleaning bathrooms, filling vending machines) to four young adult participants with ASD. The vocational skills were taught using a handheld device (i.e. iPod) and the intervention was implemented at the students' worksite. The students were allowed to play, pause, and rewatch video clips as needed, encouraging independence. The results of their study show skill acquisition across tasks and participants, although maintenance data were limited and only collected up to 30 days post intervention. When maintenance data were collected, some participants' performance deteriorated rated to levels obtained during the intervention, even though those skills were performed regularly as part of their employment. Kellems and Morningstar encouraged future researchers to focus on the maintenance of acquired skills over a longer period and to examine variables that affect maintenance.

In a more recent study, Kellems et al., (2018) implemented VP to teach young adults with disabilities independent living skills. Videos were short clips of individual steps in individual tasks (as determined by task analysis) analysis with voice-over instructions that participants could access if they chose to. After each clip, the participant had the opportunity to perform the step viewed portrayed in the video. Verbal prompts were provided at the beginning of each session to access the intervention videos if the participant did not do so independently, although no other models or directions were provided to help the participant complete the task. The intervention videos were not available during maintenance sessions in this study. This procedure led to mastery of all tasks. Maintenance data were collected up to 75 days post intervention. Good performance was generally maintained, although some participant's scores did slightly decrease. Generalization of independent living skills was not assessed in this study.

Kim and Kang (2020) published a study using VP to teach cooking tasks to adolescents of Korean American culture with ASD. They chose cooking tasks and foods that were preferred by their male participants. The researchers used an iPad to display the step-by-step video models. Verbal instructions were included in the video clips, but no additional directions or prompts were provided. In addition, descriptive verbal praise was provided on a fixed-ratio-3 schedule (i.e., one descriptive praise statement for ever three correct responses). Maintenance data were collected one to seven weeks post intervention, with good retention in most cases, but generalization was not probed for any of the participants or skills.

In a study published by Cullen et al. (2017), the researchers used self-directed VP delivered via iPads to teach vocational skills in an integrated employment setting and in the local community to three young men with intellectual and developmental disabilities Error correction included a direction to re-watch the video following an incorrect response, followed by a least-to-most prompting procedure (i.e., verbal, gestural, partial physical, and full physical prompts). Unlike previous studies discussed, generalization was assessed for all but three tasks using different materials in the same setting, completing the same task in a different setting, or having participants complete the same task in the same setting but with different materials and customers. Overall, participant performance maintained and generalized well for tasks.

In 2019, Heider et al. published a study assessing the effects of using self-directed VP to teach vocational skills to two young adult participants with moderate to intensive intellectual and developmental disabilities. In their procedure, following baseline, participants were provided an iPhone with VP clips and instructed to use them to complete the target task. Error correction was implemented following an incorrect response, which involved telling the participant to rewatch the video and providing specific verbal feedback about the error made. Error correction was provided only once per step. During these sessions, the researchers placed the iPhone with the videos on it within the participants view, although participants were not instructed to utilize it to complete the task. In the final phase of their study, the researchers probed the maintenance of the target skills without access to the video clips every two weeks for six weeks. During these probes, participants scores dropped 40-80%, suggesting the skills did not maintain in the absence of the video prompts. Generalization was not assessed in this study.

Video Prompts versus Video Models

As noted, previous researchers using video-based interventions have often made a distinction between video models (VM) and video prompts (VP), asserting that VM depicts a task in its entirety (showing all steps in the task analysis), while VP depicts individual steps separately (Horn et al., 2008). There are few comparisons of the two procedures and findings do not support strong conclusions about their relative effectiveness.

Cannella-Malone et al. (2006) compared VP and VM for teaching daily living skills to six adults with developmental disabilities. They used a multiple-probe-across-participants design with an alternating-treatments component to compare the effectiveness of the interventions. Tasks were counter-balanced across participants to increase experimental control. Findings suggest that VM was less effective for all participants across both tasks, and for some was ineffective.

Cannella-Malone et al. (2011) also compared the effects of VP and VM when teaching daily living skills to individuals with severe intellectual disabilities. Seven adolescent individuals participated in the study. A multiple-probe-across-subjects design with an alternating-treatments components was utilized to demonstrate control. Tasks were counterbalanced across participants. As in the Cannella-Malone et al. (2006) study, VP was more effective than VM on the acquisition of daily living skills. Unfortunately, no maintenance of generalization data were reported.

Thomas et al. (2020) reported results that contradicted those of Cannella-Malone et al. (2006) and Cannella-Malone et al.'s (2011) studies. In the study by Thomas et al., four young adults with ASD were taught to prepare various recipes using an iPad device. The researchers utilized an alternating-treatments design to compare the effectiveness of VM and VP on the acquisition, maintenance, and generalization of the target skill, as well as the efficiency of video-based interventions. Results of Thomas et al. (2020) indicate that VM was more effective than VP for three out of four of their participants. It was noted that two of the three participants for which VM was more effective required fewer sessions to criterion. Furthermore, the authors data reveals less errors were made during the VM condition across participants. Maintenance and generalization probes were conducted three-weeks post intervention with results similar across conditions, though performance during VM conditions was slightly superior to VP conditions for three participants.

Purpose of the Dissertation

Individual studies and meta-analyses (Bellini & Akullian, 2007; Mason et al., 2013) have evaluated the effects of VM and VP across different populations and skill domains, suggesting, in general, that they are useful interventions for promoting skill acquisition. Some applications, however, have not been extensively investigated. For example, although there is evidence that VM and VP can be useful in establishing job-related skills (Cannella-Malone & Schaefer, 2017; Cullen et al., 2017; Heider et al., 2019; Kellems & Morningstar, 2012), research in this area is limited. Furthermore, generalization and long-term maintenance, without frequent practice and exposure, have been ignored in many studies.

Maintenance and generalization of skills should be a core objective of any intervention (Baer et al., 1968), but especially for students transitioning into adulthood, as they will access new and diverse settings in their immediate and long-term future, which may offer few individual supports for the continuation and generalization of acquired skills. In many transition programs, lack of systematic efforts to ensure generalization may act as a barrier, leaving a gap between instruction in a school, contrived, or heavily supported setting and the successful performance of those skills in the applicable work environment. Often, young adults gain vocational skills experience—prerequisite skills and common workplace tasks—in a heavily supported setting before they have an opportunity to gain job-site experience. VM and VP are intervention procedures that may help to bridge this gap, as the interventions can be adapted and transferred from setting to setting, targeting generalization specifically. Furthermore, VM and VP may be appropriate EBPs for transition programming for vocational skills because they are feasible and sustainable interventions for educators. If educators supporting students in the acquisition of behaviors required for vocational success were to develop a bank of video models and video prompts portraying common workplace skills and related behaviors, they could use these interventions as a universal strategy, conserving staff resources for more high needs with students who require more specialized or individualized supports.

This dissertation research examined the use of VP and VM to teach young adults with intellectual and developmental disabilities skills necessary for vocational success. To extend previous research and provide more insight into the effectiveness of VP and VM, the research focused on extending research on the acquisition, maintenance, and generalization of skills using video-based instruction. Study 1 and Study 1 used multiple-baseline designs across skills and participants to assess the effects of traditional VP, as well as to determine the efficiency of this intervention by determining sessions required for skill mastery. Study 3 also assessed acquisition, maintenance, and generalization of job skills. In this study, videos were recorded from a first-person point-of-view. Additionally, an alternating treatments design was used to o compare the effects of VP and VM. In all studies, participant preference for and opinions of the video-based interventions were determined.

The research setting for the studies was a public-school transition program for young adults eligible for special education services. The focus of the program is to prepare students for independent living (to the extent possible) and employment opportunities, specifically targeting domains like activities of daily living, functional skills, and vocational skills. Job coaches, the principal, and other school personnel expressed dissatisfaction with the current vocational skills training program and alluded to a lack of universal strategies. Anecdotally, staff indicated that training was often highly individualized and labor intensive, but nonetheless failed to produce desired results. To improve the training system, the program's job-based learning team set out to develop a universal training program for the following academic year. The goal was to effectively teach a broad range of commonly required job skills to multiple students with a replicable intervention. The school team requested the researcher's assistance in the development of the new system. The universal program would need to be feasible, flexible, effective, and sustainable to meet the needs of the school staff and students.

Planning was begun, with the notion that actual worksite training and evaluation would be a part of the universal program. Unfortunately, COVID-19 prevented most students from going to worksites, producing an immediate need for a strategy which would allow students to continue developing job skills that they would use once worksites reopened. The interventions implemented needed to be effective and flexible to allow for remote learning as well as in-situ use when job-based learning was again available. Furthermore, the interventions needed to be applied with reduced staff, as many job coaches were reassigned to new roles within the school when job site closures were announced. Therefore, the goal of the intervention team was to develop and implement an intervention that could be student-directed, implemented with limited staff, promote independence, and be transferred from location to location. The instructional strategies also needed to coincide with the district's safety policies, including social distancing and sanitation protocols.

Video modeling (VM and VP) was determined to be the best mode of instruction. It allowed students and staff to be appropriately distanced, enabled students to learn new skills with limited staff involvement, and could be easily used in multiple settings. This intervention strategy was viewed by team members to be a socially relevant and acceptable intervention for students, given the commonality of technology use among our society.

Research Questions

The dissertation studies were intended to provide real benefit for participants while making minimal demands on school personnel: they were applied. Their general purpose was to determine the feasibility and effectiveness of VM and VP interventions as tools for developing vocational skills in young adults with disabilities. Within-subject research was conducted to address six research questions.

1. Is traditional video prompting an effective intervention for teaching job-related skills to young adults with intellectual and developmental disabilities?
2. Does video modeling result in the generalization of skills to new settings?
3. Are students more successful with VP or VM interventions?
4. Will skills taught through VP and VM maintain once video models are removed?
5. Will participants show preference for VP and/or VM compared to traditional modeling techniques?
6. Are VP and VM feasible interventions for meeting the transition program's needs (i.e., are they easily developed and implemented, sustainable, transferable, and acceptable to consumers)?

Human Subjects Institutional Review Board Approval, Informed Consent, and Assent

The project in its entirety was approved by the Western Michigan University Human Subjects Institutional Review Board. In each study, informed consent was obtained from the legal guardians of participants, the par and assent was obtained from the individual participants, who were free to leave the study at any time.

STUDY 1

Study 1 was conducted to answer research questions related to the effectiveness of VP in promoting job-skill acquisition, maintenance, and generalization for young adults with intellectual and developmental disabilities. This study is a continuation of a previous line of research demonstrating the general effectiveness of VP (Cannella-Malone et al., 2006; Cannella-Malone et al., 2011; Cullen et al., 2017; Kellems et al., 2018, Kim & Kang ,2020; Heider et al., 2019; Thomas et al., 2020), with the additional purpose of increasing the maintenance window and assessing skills in the absence of a VP intervention. This study also differed from prior research by using a minimal error correction procedure, in which the participant rewatched the video without additional descriptive feedback or prompting, which were used by Cullen et al., (2017) and Heider et al., (2019). Praise statements in the present study were general (e.g., "good job today") and limited, provided only at the conclusion of each session, unlike in Kim and Kang's (2020) research in which descriptive praise was provided on a fixed-ratio schedule. Study 1 assessed generalization to the limited extent allowed by COVID restrictions by using different materials and locations, similar to the arrangement used by Cullen et al. (2017).

Methods

Participants

Participants for each study were young adults receiving special education services. Each participant attended an onsite transition program throughout the week and exhibited consistent attendance. All participants were eligible for work-based learning during the 2020-2021 school year, based on the program's assessments and their IEP goals. None of the participants had prior employment experience, nor were they able to perform the target tasks to mastery before the intervention was introduced. Additionally, each participant was noted to have a generalized imitative repertoire and could attend to visual models without exhibiting challenging behaviors.

Four students participated in Study 1. Stacy was a 24-year-old, Black woman with a primary diagnosis of moderate cognitive impairment. She resided with her mother and did not receive free or reduced lunch. Kevin was a 21-year-old, white man and had a primary diagnosis of moderate cognitive impairment. He lived with his parents and was not eligible for free or reduced lunch. Jimmy was a 19-year-old, Hispanic man with a primary eligibility diagnosis of mild cognitive impairment. He lived with family and did not receive free or reduced lunch through the school. Mark was a 20-year-old, White male with a primary diagnosis of mild cognitive impairment. He resided with parents and was not eligible for free or reduced lunch through the school program.

Setting

The participants in all studies attended the transition program for approximately six hours a day, five days a week. During baseline, intervention, and maintenance sessions, the students were removed from their classrooms, one at a time, and led to a separate commons area (i.e., the job skills area). This was a large room with cubical dividers separating a portion of the area into four work zones. Each work zone was constructed as a mock job site, housing the items that would be needed to complete the job-site specific task (i.e., fully made bed to simulate the hotel job site). The divided areas ranged in size, with the smaller work zones approximately 5x6 feet, and the larger work zones approximately 12x12 feet.

Generalization sessions occurred in a separate classroom. The room was novel to the participants and was being used primarily as a storage space for the transition program. During generalization trials, the work sites were set up in various sections of the classroom, although cubical dividers were not used to separate the work zones. Students were removed from their classroom for these sessions, one participant at a time.

Materials

Materials consisted of those the researcher had access to through the transition program and those purchased individually. The mock hotel worksite contained a queen size inflatable mattress, a queen size bed frame, a chair, a hamper, and two cubical dividers. We also used bedding to simulate hotel bedding, including two pillows with pillowcases, a fitted sheet, loose sheet, comforter, and duvet cover. To train participants to check into work, the work zone included two room dividers, a hook with a clip board and sign in sheets, a pen, multiple aprons with participants' name tags attached, hand sanitizer, and disposable gloves. For the vacuuming task, there was a large portion of the floor taped off and no room dividers. This task required a vacuum and baby powder, to simulate a dirty floor. The laundry task included a clothing rack, a hamper, hangers, 16 polo shirts (i.e., eight the same color, eight various colors), eight name tags attached to the inside of the shirts, a table, and a room assignment key. To collect data on participant performance, premade task analysis data sheets and pens were used.

Two, 10.2-inch iPads were used during the intervention. Video models were recorded on a GoPro 8 and transferred to the researcher's laptop for editing. The researcher used the application, Movavi Video Editor 15 ®, to cut, combine, and apply voice over to the video clips. Once edited, the videos were uploaded to the iPads and stored in separate video albums by task. In each task album, the videos were organized in the order they were sequenced on the task analysis. For ease of viewing the video models while completing the target tasks, the iPads were secured to an adjustable tripod stand (16.5-50 inches in height) using a tablet clamp holder.

During generalization trials, materials differed from those used during training. For the hotel task, a different queen size mattress and bed frame was used. The sheets, pillowcases, comforter, duvet cover, and hamper also differed from the training materials. For the checking into work task, different pens, aprons, hand sanitizers, and hook placements were used. For the laundry task, a different set of name tags were used, in addition to a new room assignment key. The clothing also differed that used in training and comprised coats, short and long sleeve shirts, and button-up shirts. Generalization trials for the vacuuming task used the same vacuum and baby powder, but a specific area was not taped off.

Procedure

Task analyses and video models were developed prior to the researcher conducting baseline sessions. The tasks chosen were based on school staff's recommendations and experience at the job-based learning sites. The tasks for Study 1 included hanging and sorting laundry, checking in for work, stripping a bed, and vacuuming. These tasks were chosen based on reports of students struggling to complete them independently at the work sites in the past. The tasks varied in the number of steps required to complete the job, though tasks with more steps were deemed comparable because they included repetitions of the same step. The laundry task, shown in Table 1, included 40 steps, with the first five steps repeating eight times. Checking in to work, as seen in Table 1, required 18 steps with only two steps repeating. Stripping the bed, also shown in Table 1, was the shortest task, requiring 14 steps with three repeating. Lastly, the vacuuming task, shown in Table 2, included 15 tasks with no steps repeating.

Task analyses were developed in two ways. The first consisted of the researcher observing and recording a job coach from the program completing the target task as would be expected of the participant at the off-site worksite. In other instances, the researcher recorded themselves completing the task as they had observed students and job coaches completing them at the jobsites the year prior; before sites were closed. Using the videos, the researcher broke the tasks down into discrete steps. The task analyses were then reviewed by the job coach to ensure accuracy and for input on skills that may need to be broken down even further. Once the task analyses were approved, the researcher recorded videos of herself completing the different tasks, as specified in the task analysis, using a GoPro camera and a tripod. Videos were shot from a third-person point-of-view and captured more than the crucial stimuli for a given step. The videos were then transferred to a laptop computer for editing. Videos were cut so only one step was shown per video and voice over of the researcher describing the step was added. Videos varied in length with the shortest being 3 seconds and the longest being 1 minute 2 seconds. Video clips were then labeled with the corresponding step number and uploaded to an iPad. Videos for each task were saved in separate albums on the device in the order they were to be viewed.

During baseline sessions, the participant was asked to complete a specific task (i.e., "Strip the bed," "Hang and sort the laundry," "Get ready for work"). The video models were not provided during this condition. If the student failed to begin the next step within 5 seconds of the discriminative stimulus (the initial direction or the completion of the previous step in the chain) or began performing an incorrect response (i.e., steps out of order or responses not related to the task), the research would instruct the participant to stop and close their eyes (or turn around). The researcher then completed that step of the task out of the participant's view. Once the step was completed by the researcher, the participant was directed to "keep going". If the participant requested help from the research or made comments like, "I do not know what to do" or "what do I do next?" the researcher responded with, "try your best" or "just do what you think you should."

Prior to implementing the intervention, and before the last baseline probe, researchers conducted a pre-training session. During this session, the participants were trained to operate the iPad® (i.e., selecting the first video in an album), watch and imitate the video model, and swipe left to progress to the next video after completing the previous step. Participants were trained one at a time and remained in training until they had mastered operating the video and imitating the models without prompts. During this pre-training session, the researcher described the expected responses, modelled them, allowed the participant to practice, and provided feedback. The pre-training tasks were selecting, stacking, and hole punching paper, and selecting, stacking, and stapling paper.

During the intervention phase, the researcher's directions were the same as in baseline, adding the specification to use the iPad® (i.e., "hang and sort the laundry using the iPad"). The participant then selected the first video in the album, which was already displayed on the iPad®, and viewed the video model. If the participant stopped watching the video for two seconds (i.e., glancing around the room or at people entering the area) they were reminded to "watch the video." If they began engaging in the response before the video ended, the researcher reminded them to "watch the whole video first." Once the video ended, the participant imitated the step of the task demonstrated in that clip. If they imitated the model and completed the response correctly, they swiped left on the iPad® screen to progress to the next video. They continued this process until all steps of the task were completed and no video models remained in the album. If they participant failed to imitate the video model and complete the response correctly, error correction was implemented. Error correction consisted of the research instructing the participant to re-watch the video. The participant would view the video for a second time and reattempt to imitate the model and complete the step accurately. If the participant completed the step correctly, they swiped left on the video and began viewing the next model. If they completed the step incorrectly for a second time, they were instructed to turn around or close their eyes while the researcher completed the step for them. Once the researcher had completed the step, as to establish the discriminative stimulus for the next step, they directed the participant to continue on with the task (i.e., watch the next video). Data was collected on responses that occurred after error correction, but only the original response was included in the data.

Maintenance trials were conducted in a similar manner to the baseline sessions; however, if the participant completed the step incorrectly, they were not instructed to turn around or close their eyes while the researcher corrected or completed that step. Instead, participants continued through the task and data on the accuracy of each step were recorded. Generalization sessions were conducted the same way, although the location of the session and stimuli different from baseline, intervention, and maintenance sessions. These sessions were conducted in a novel classroom at the school and different materials were used (i.e., different bedding and clothing). Date was collected by the researcher on the percentage of steps in the task the participant completed correctly.

Dependent Variable and Data Collection

The participant's performance on each task served as the dependent variable. Data were collected on the accuracy of the participant's performance for each step of the task, as determined by the task analysis. Each task analysis was created in collaboration with the transition program's job-coaches to ensure performance mirrored what would be expected of students at the community jobsites. A correct response was defined as the participant beginning the step within five seconds of the discriminative stimulus (i.e., the researcher's direction, the completion of a previous step, or the conclusion of the video model) and completing the step within one minute (three minutes for tying the apron and unbuttoning the duvet cover due to fine motor deficits and three minutes for vacuuming to ensure all debris was removed).

An incorrect response was defined as the participant failing to begin the correct response within five seconds of the antecedent stimulus and/or requiring more than one minute (three minutes for select responses) to complete the task. An incorrect response also was recorded if a participant engaged in incompatible behavior or initiated an inappropriate step in the task (e.g., the participant moving the vacuuming back and forth over the designated area before plugging the vacuum in and turning it on). Performance accuracy was calculated as a percentage by dividing the number of steps the participant performed correctly by the total number of steps and multiplying the total by 100. Data were also collected on the number of sessions required to meet mastery criteria, which was 100% correct responding across three consecutive sessions, with or without the video models (i.e., intervention and maintenance conditions).

Design

A multiple probe design across tasks was used for each participant to demonstrate a functional relationship between video modeling and the participant's performance. Baseline data for each task were gathered concurrently. Probes were used during baseline to reduce reactivity and to better determine the effects of the independent variable on the dependent variable (Horner & Baer, 1978). The conditions were baseline, intervention, and maintenance, with generalization probes occurring in maintenance. For all participants, a minimum of three data points with a stable or decreasing trend was required to move from baseline to intervention. Participant scores in baseline were also required to fall below 80% accuracy for that task to be targeted for intervention.

For Stacy and Mark, the intervention condition was introduced for the subsequent task once mastery criteria for the previous task had been met in the maintenance condition. For Jimmy, the intervention was introduced for the second task when the first task met mastery criteria in maintenance. The intervention was introduced for his third task while the second task was still in the intervention phase. This variation was due to concerns of the school moving to remote learning in response to COVID-19 precautions. However, the researcher ensured high, stable responding for task two was present before introducing intervention for task three. For Kevin, only two tasks were targeted for intervention. The intervention was implemented for his second task when mastery criteria had been met in the intervention condition. This variation was also due to concerns of in-person instruction being suspended as well as him requiring more sessions to meet criteria.

Interobserver Agreement

Interobserver agreement (IOA) was calculated for each participant across the tasks they were exposed to using trial-by-trial IOA. This method of calculating IOA divides the number of agreements by the total number of observations (agreements plus disagreements) and multiplies by 100 to produce a percentage. For Stacy, who completed three tasks, trial-by-trial IOA was conducted for 33% of total sessions. IOA ranged from 83% to 100% across sessions, with an average of 98% IOA. Mark completed three tasks and IOA was calculated for 30% of his total sessions. IOA ranged from 87 to 100% across sessions, with an average of 98%. For Jimmy, who also completed three tasks, IOA was calculated for 37% of his total sessions. IOA ranged from 93 to 100% across sessions, with an average of 99%. Kevin completed only two tasks and trial-by-trial IOA was calculated for 22% of his total sessions. The average agreement was 99% with percentages ranging from 89 to 100% across sessions.

Treatment Integrity

The research team conducted a task analysis to delineate the steps required for the researcher to deliver the intervention in Study 1; those steps are described in Table 3. A trained observer used a checklist to determine from watching tapes of experimental sessions whether each individual step was performed correctly. Treatment integrity data were calculated for 11% of sessions (23 out of 215). Treatment integrity scores ranged from 90% to 100% across sessions, with an average above 99% (99.6%).

Consumer Satisfaction

At the end of the study participants were asked to complete an anonymous survey conducted by the researcher. The questions asked are shown in Figure 5.

Results

A multiple baseline design across tasks was used to demonstrate the effectiveness of video modeling on the acquisition, maintenance, and generalization of vocational skills for all four participants. Three young adult participants mastered three vocational tasks and one participant mastered two tasks. The multiple baseline design across tasks for each participant demonstrates a functional relation between the video models with error correction and correct performance of the vocational task. There were four participants in Study 1.

Kevin learned to perform the laundry and checking into work tasks successfully. His performance is shown in Figure 1. During baseline sessions for the laundry task, Kevin scored at or below 60% consistently, scoring 60, 55, and 55%, across sessions. During the intervention phase, his scores fluctuated between 93 and 100%. Between sessions six and 17, Kevin's scores were variable and did not meet the three sessions at 100% criteria. The materials were modified so that all shirts used in the task were the same color, aiding the participant in attending to the relevant stimuli (i.e., the tag in the collar of the shirt with the fake resident's name). Once the shirts were modified, Kevin met mastery criteria in seven sessions with scores ranging from 95 to 100%. During maintenance, when no iPad was provided, the original, different colored shirts were reintroduced and Kevin scored 100, 100, 95, and 100% across the four maintenance sessions. Kevin also scored 100% at the one-week follow-up, one month follow-up, generalization session, and the three-month follow-up.

For Kevin's second task, checking in to work, baseline was collected for five sessions with scores ranging from 44 to 56%, with scores of 44, 56, 44, 44, and 50%. When the iPad was introduced in the intervention phase, scores ranged from 89 to 100%, with the mastery criteria met in 15 sessions. Only two maintenance sessions were conducted following the intervention phase due to a holiday break. Kevin scored 100% during one- and three-month follow-up and generalization sessions.

Stacy participated in the laundry, checking into work, and the stripping the bed tasks, as shown in Figure 2. For the laundry task, baseline data were collected for three sessions with scores of 33, 50, and 43%. When the intervention was implemented, the task was mastered in six sessions with scores ranging from 95 to 100%. Stacy scored 100% for three sessions in a row during maintenance sessions. Scores for her two-week follow-up, two-month follow-up and generalization session, and four-month follow up were 95, 95, 95, and 98%, respectively.

The second task completed by Stacy, checking into work, was evaluated in six baseline sessions, with scores ranging from 17 to 33%. During intervention, scores ranged from 83% to 100%, with mastery criteria met in seven sessions. During maintenance, Stacy scored 100% for three consecutive sessions. During the one-month follow-up, generalization session, and three-month follow-up, Stacy scored 100, 89, and 100%, respectively.

Stacy's third and final task was stripping the bed, for which baseline data were collected for nine sessions. Her score was 0% for eight of these sessions and 21% for the eighth session. During the intervention phase, Stacy met mastery criteria in four sessions, scoring 93, 100, 100, and 100%. She scored 100% across three maintenance sessions, as well as during her one-month follow-up, generalization session, and three-month follow-up session.

The third participant, Jimmy, mastered the laundry task, checking in to work, and stripping the bed, as shown in Figure 3. The first task, laundry, was evaluated in three baseline sessions, in each of which Jimmy scored 60%. During the intervention phase, his scores ranged from 95 to 100%, with his performance meeting the mastery criteria in nine sessions. Jimmy scored 100% during all maintenance sessions, his two-week follow-up, one-month follow-up, generalization session, and three-month follow-up.

Jimmy's second task was checking into work. Baseline data were collected for five sessions, with scores ranging from 28 to 50%, with the last three session stable at 50%. When the intervention was implemented, Jimmy's scores ranged from 89 to 100%, with 13 sessions occurring before the mastery criteria was met. Jimmy scored 100% in each of three maintenance sessions. He scored 94% at his one-month follow-up, 100% during his generalization session, and 100% at his three-month follow-up.

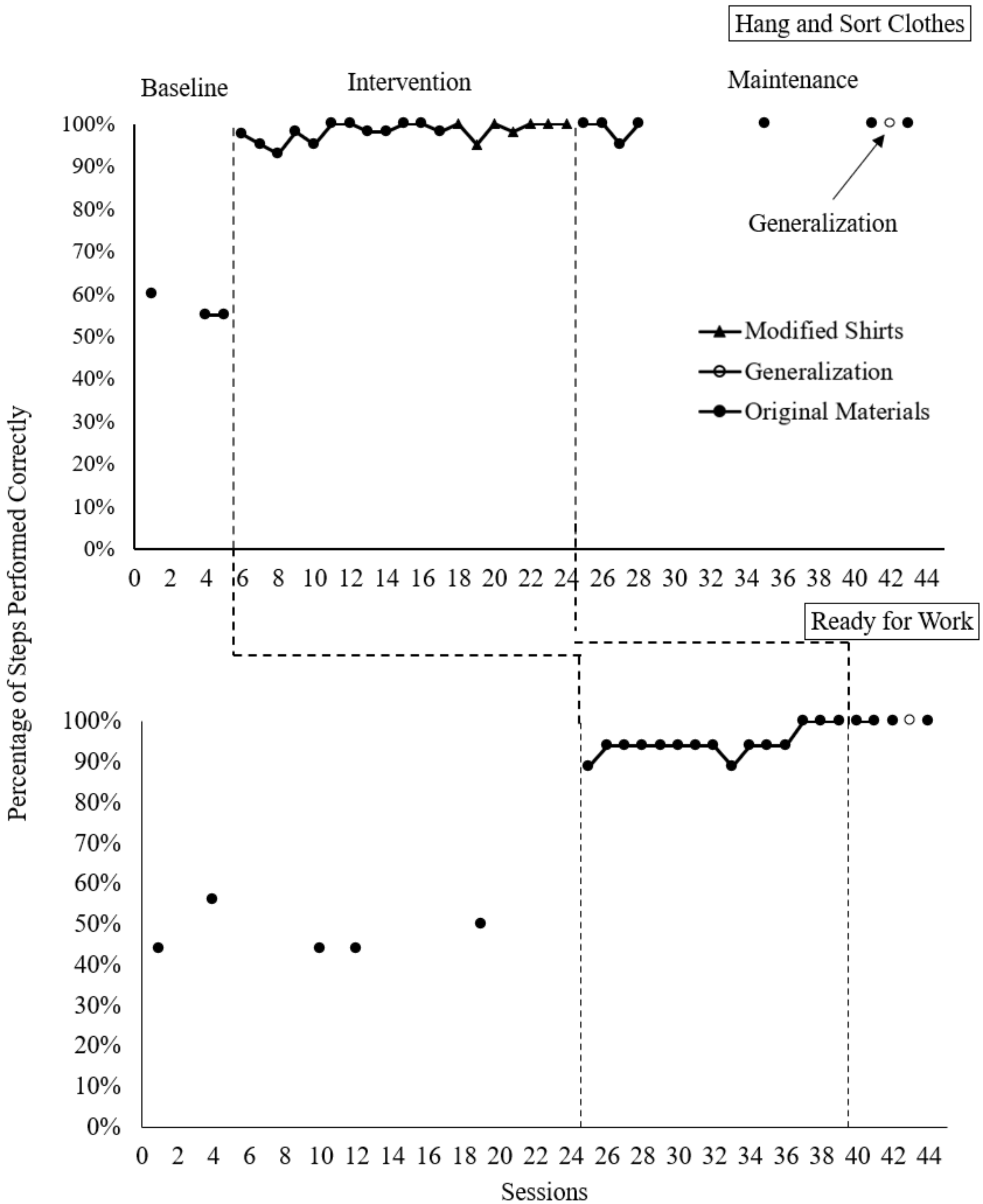
Jimmy's final task was striping the bed. Baseline data were collected for six sessions, with scores ranging from 0 to 50%. When the intervention was implemented, he met mastery criteria in four sessions with scores of 93, 100, 100, and 100%. Jimmy also scored 100% across three maintenance sessions. Scores of 100% were also obtained at his one-month follow-up, generalization, and three-month follow-up sessions.

The final participant, Mark, was trained across three tasks: laundry, stripping the bed, and vacuuming. Data for this participant are shown in Figure 4. The first task was laundry, for which there were three baseline sessions. Mark's scores were 60% for each of these baseline sessions. During the intervention phase, Mark scored 100% across three consecutive sessions, meeting mastery criteria in three sessions. During maintenance sessions, Mark scored 100% consistently. He also scored 100% during his one-month follow-up, six-week follow-up, two-month follow-up, generalization session, and four-month follow-up.

Baseline data were collected for four sessions for Mark's second task, stripping the bed. Baseline scores ranged from 43 to 57% with the last three sessions having scores of 57% consistently. Once the intervention was implemented, Mark met mastery criteria in three sessions. Mark scored 100% for all three maintenance sessions. Scores of 100% were also recorded at his two-week follow-up, six-week follow-up, generalization session, and four-month follow-up.

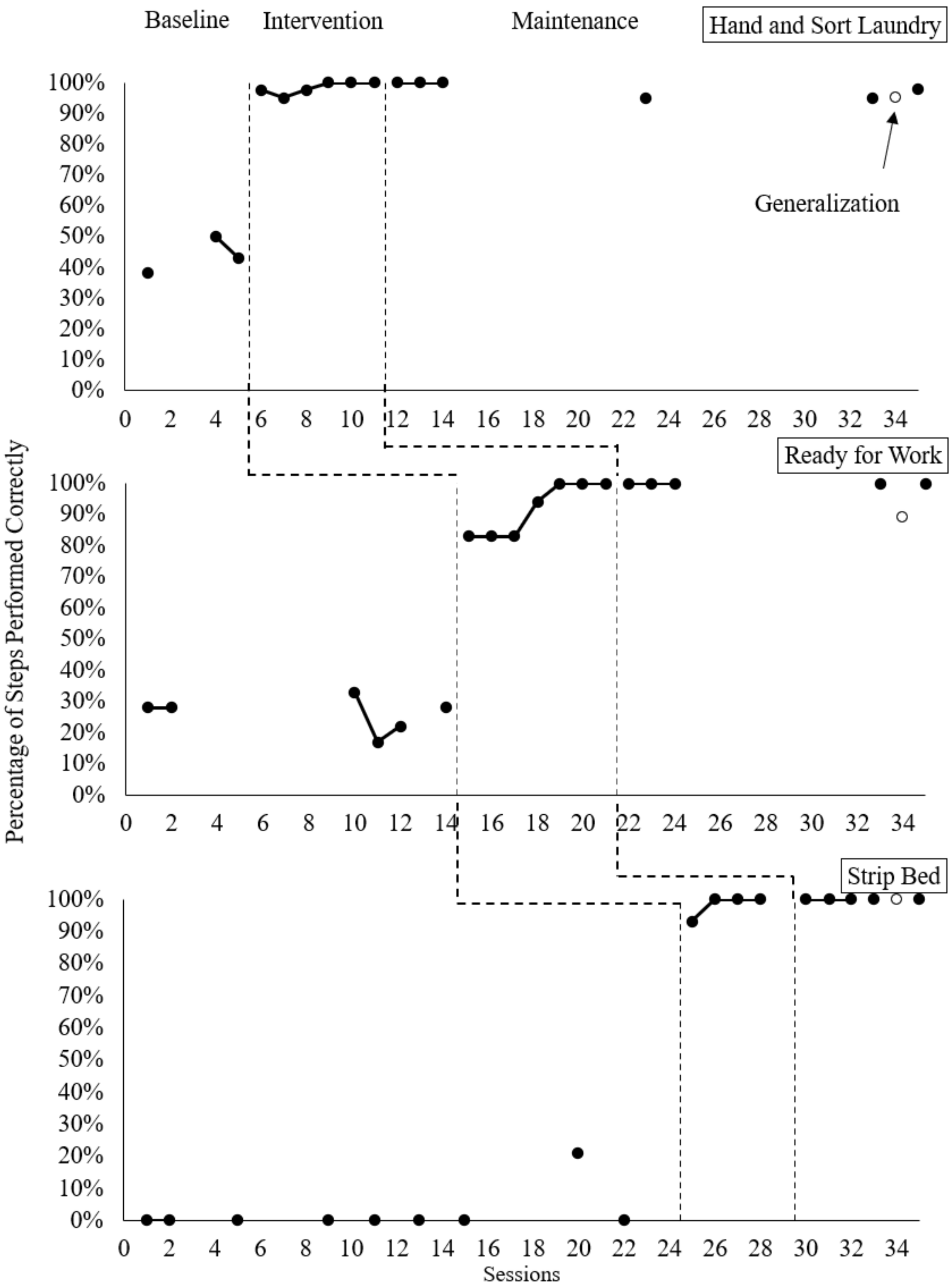
Mark's final task was vacuuming. Baseline data were collected for six sessions with scores ranging from 27 to 60%. The intervention was implemented for seven sessions before mastery criteria was met, with scores gradually increasing from 87 to 100%. Mark consistently scored 100% across all three maintenance sessions, his one-month follow-up, generalization session, and three-month follow-up.

Figure 1. Kevin's Performance Data



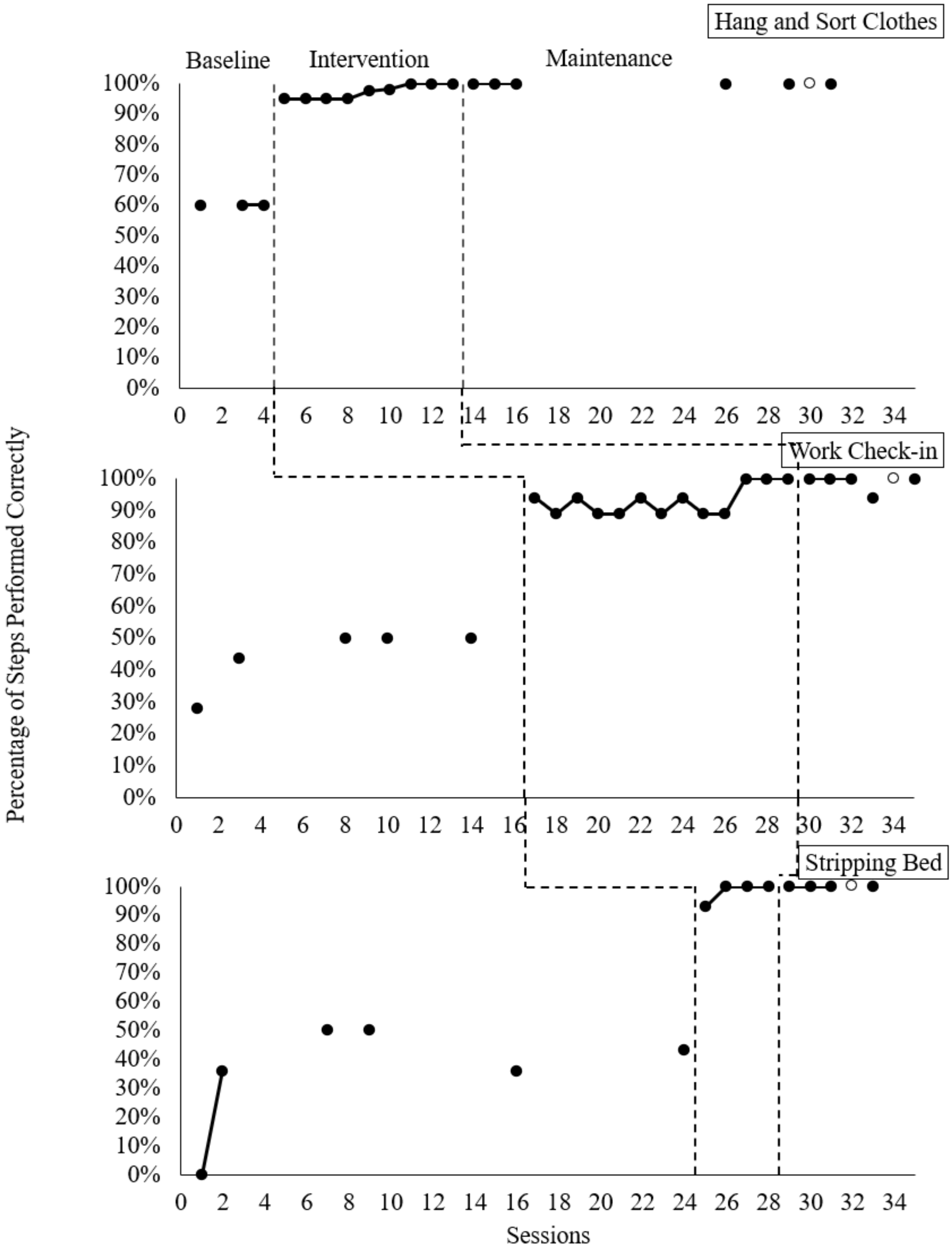
Note. Kevin's performance data across tasks.

Figure 2. Stacy's Performance Data



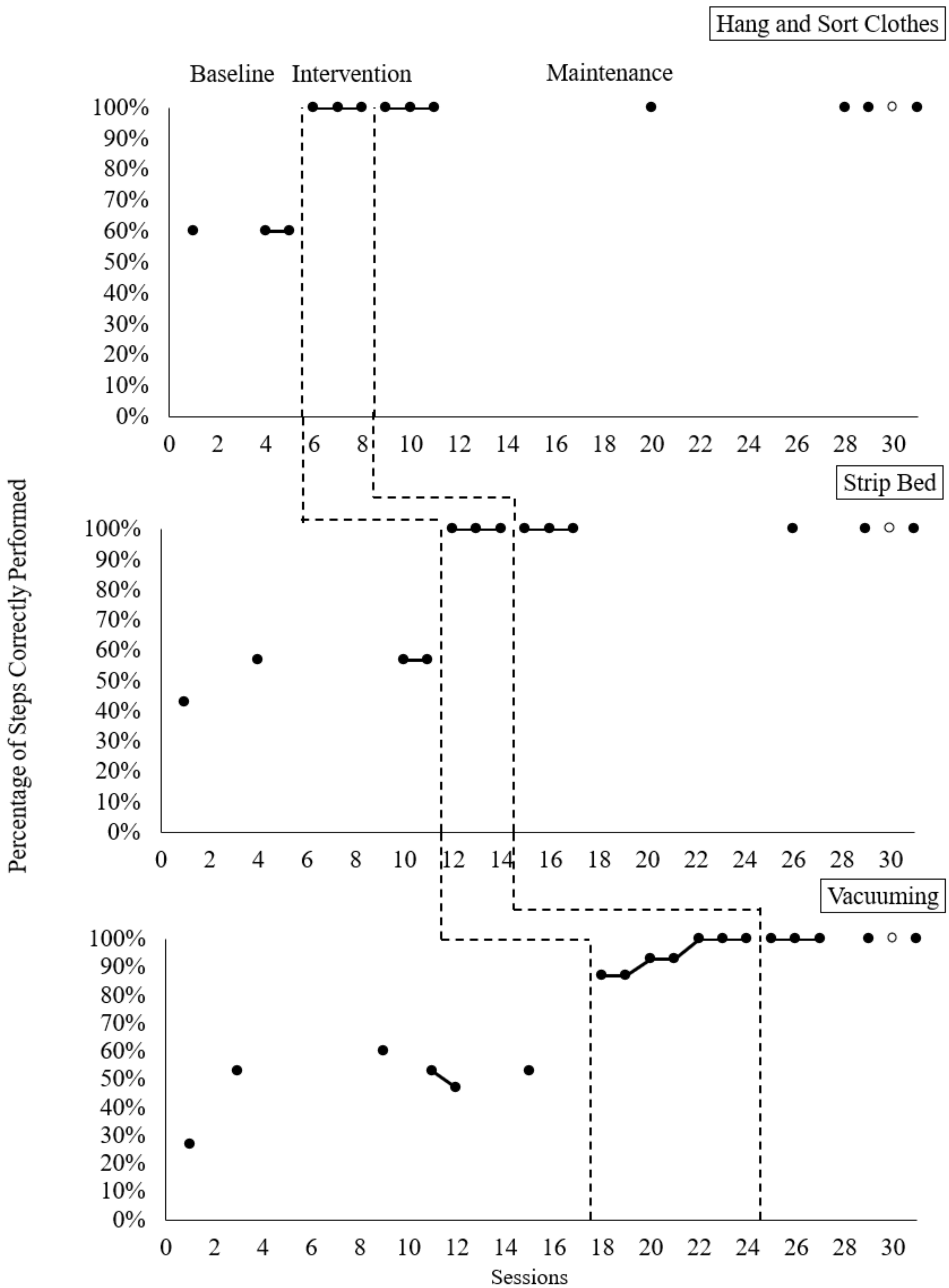
Note. Stacy's performance data across tasks.

Figure 3. Jimmy's Performance Data



Note. Jimmy's performance data across tasks.

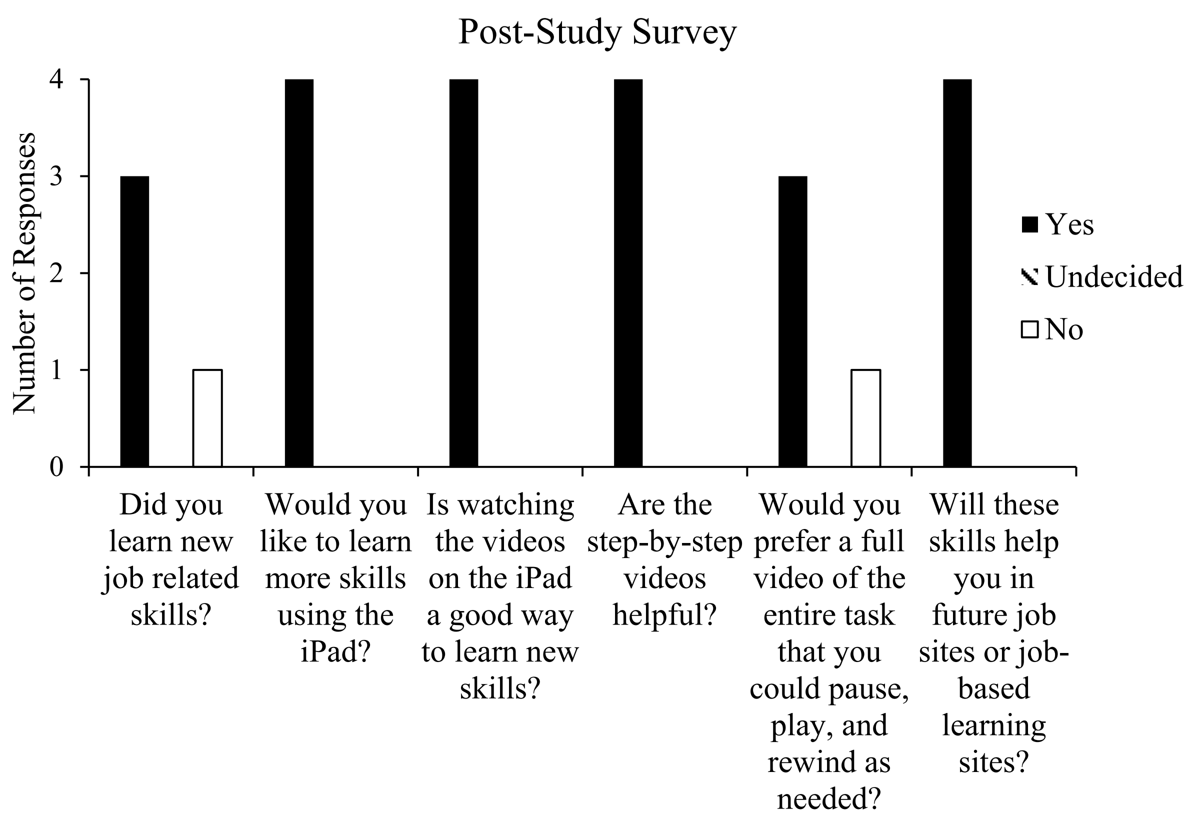
Figure 4. Mark's Performance Data



Note. Mark's performance data across tasks.

All four participants completed the acceptability questionnaire, and the results are depicted in Figure 5. Four out four participants indicated that they would like to learn more skills using the iPads, that watching videos on the iPad was a good way to learn new skills, that the step-by-step videos were helpful, and that the skills they learned will help them at future job sites or job-based learning sites. Three of the participants said they learned new job skills during the study, while one participant said they did not. When asked, "would you prefer a full video of the entire task that you could pause, play, and rewind as needed?" three participants answered "yes," and one indicated "no."

Figure 5. Study 1 Consumer Satisfaction Survey Results



Note. Study 1 post-study consumer satisfaction survey results.

Discussion

The results from Study 1 indicate that VM was an effective intervention for teaching job-related skills to the four young adult participants with developmental and intellectual disabilities. These results align are in agreement with prior findings that demonstrate the value of this procedure (Cannella-Malone et al., 2006; Cannella-Malone et al. 2011; Cullen et al., 2017; Heider et al., 2019; Kellems et al., 2018; Kim & Kang, 2020). All participants in the present study fully mastered their tasks and they met the mastery criteria in a relatively short period of time with limited errors. These skills were well maintained over a substantial time in the absence of the intervention. Two prior studies have demonstrated similar retention of skills (Cullen et al., 2017; Kellems et al., 2018), although one did not (Heider et al., 2019). The variables responsible for whether or not results are well maintained are important, but yet to be determined. Generalization probes in the present study indicated that the skills could be performed accurately in different settings and with different stimuli, which is similar to the findings of Cullen et al., (2017).

STUDY 2

The present research was conducted in the context of helping school personnel provide effective job training for their students and the participants in Study 1 were not the only students in need of training. Therefore, to benefit other students, a second experiment comparable to Study 1 was conducted. In addition to the applied value of the Study 1, there is a sound scientific rationale for conducting two very similar studies: For scientists, replication is tantamount to believability in science.

Study 2 was a replication of Study 1 using different participants and a slightly different experimental design (multiple baseline across participants versus across tasks). As in Study 1, traditional video models were used and they were not available during maintenance and generalization sessions. Error correction procedures and praise statements also mirrored those used in Study 1.

Methods

Participants

Four students participated in Study 2. Three of the participants were trained on three tasks, while the fourth participant was only trained on one due to baseline criteria. None of the participants were eligible for free or reduced lunch through the school. Sam was a 19-year-old, white, male with a primary eligibility of ASD. Tim was a 20-year-old, white male with a primary eligibility diagnosis of ASD. Baily was an 18-year-old, African American female with a primary special education label of mild cognitive impairment. John was a 20-year-old, white male with a primary eligibility of mild cognitive impairment. He attended the program only four days a week, while the other participants attended five day a week.

Setting

Baseline, intervention, and maintenance sessions occurred in the same setting as Study 1. Generalization probes also occurred in the same novel classroom utilized in Study 1. Details of those settings are described above.

Materials

The materials used in Study 1 were identical to the ones used in Study 1, with one exception. None of the participants in Study 1 were trained on the vacuuming task, therefore, the vacuum, taped off area, and baby powder were absent in this study. Also, due to a fine motor deficit with one of the participants, Tim, a work apron was modified to include Velcro on the tie straps. The same iPads®, tripods, video recording equipment, and task analysis datasheets were used. See above for a more detailed inventory of the materials used for each task.

Procedure

The procedures for baseline, intervention, maintenance, and generalization were identical to Study 1, except the vacuuming was not included in this study. See above for more details.

Dependent Variable and Data Collection

The dependent variable and data collection methods were the same as described in Study 1, with the exception of the vacuuming task, as it was not included in Study 2. See section above for more details.

Design

A multiple probe design across participants was used in Study 1 to demonstrate a functional relationship between video modeling and participant performance on the target job tasks. Baseline data were collected concurrently across participants and baseline probes were used to reduce reactivity and assess the effects of the independent variable. The conditions were baseline, intervention, and maintenance, with generalization probes occurring during the maintenance condition. The requirement to move a participant from baseline into intervention was a minimum of three data points with a stable or decreasing trend below 80% accuracy, apart from the fourth participant, Sam, for the *getting ready for work* task, where his performance increased across baseline. The intervention was still implemented, due to his scores falling below the 80% accuracy criteria. Across tasks, subsequent participants moved from baseline into intervention when the preceding participant completed three sessions in the intervention condition. The only exception was in the *strip bed* task, as the third participant moved from baseline into intervention after participant two completing only two sessions in intervention due to an absence on the day of the third session.

Interobserver Agreement

Trial-by-trial IOA was used to calculate interobserver agreement for the second study. IOA was calculated across tasks for each participant. Agreement was measured for 21% of total sessions across all tasks. IOA ranged between 90% and 100% across sessions, with a 98% average agreement. More specifically, IOA was calculated for 17% of strip bed sessions; IOA was 100% for all of these sessions. IOA was calculated for 17% of ready for work sessions were calculated for IOA. Agreement ranged from 94 to 100% across sessions, with an average agreement of 98%. IOA was calculated for 27% of the laundry task sessions. IOA ranged from 90 to 100% across sessions, with 98% average agreement.

Treatment Integrity

Intervention integrity was determined as described for Study 1. Tasks analyses were developed and used to collect treatment integrity data in each condition and are shown in Table 3. Treatment integrity data were collected for 10% of sessions (15 out of 153). All treatment integrity scores were 100%.

Consumer Satisfaction

Consumer satisfaction was determined as described for Study 2. The specific questions asked are shown in Figure 9.

Results

A multiple baseline across participants design was utilized in the second study. Four young adults participated in this study with Sam and Tim receiving training on three tasks, Bailey on three tasks (only reaching mastery criteria for two), and John on only one task. The target tasks in this study were laundry, checking into work, and stripping the bed. This research design allowed for a functional relation to be identified between video modeling with error correction and job-task performance.

All participants were trained on the laundry task with data represented in Figure 6. Baseline data were collected for three sessions for Tim with consistent scores of 28%, four sessions for Sam with scores ranging from 48 to 50%, five sessions for Bailey with scores ranging from 60 to 68%, and seven sessions for John with scores ranging from 24 to 50%. Video modeling was implemented with Tim first and he met the mastery criteria in eight sessions with scores ranging from 93 to 100% during this phase. Tim maintained scores of 100% during the three maintenance sessions, the two-month follow-up, generalization session, and three-month follow-up.

Sam was the next participant to move into the intervention phase. He met mastery criteria in five sessions with scores ranging from 98 to 100%. Sam maintained scores of 100% across the three maintenance sessions, the one-month follow-up, generalization, and three-month follow-up. Bailey was the third participant to move into the intervention phase. Her scores ranged from 93 to 100%, although the mastery criteria were never obtained due to her decision to move to remote learning for the remainder of the school year. The final participant to receive the intervention was John. He met the mastery criteria in six sessions, with scores ranging from 95 to 100%. He maintained scores of 100% across the three maintenance sessions, the generalization session, and the one-month follow-up.

Checking into work was the second task trained. Bailey, Tim, and Sam were the only participants trained in this job task and their data is shown in Figure 7. Baseline data were collected for four sessions for Bailey, with scores ranging from 39 to 44%; for five sessions for

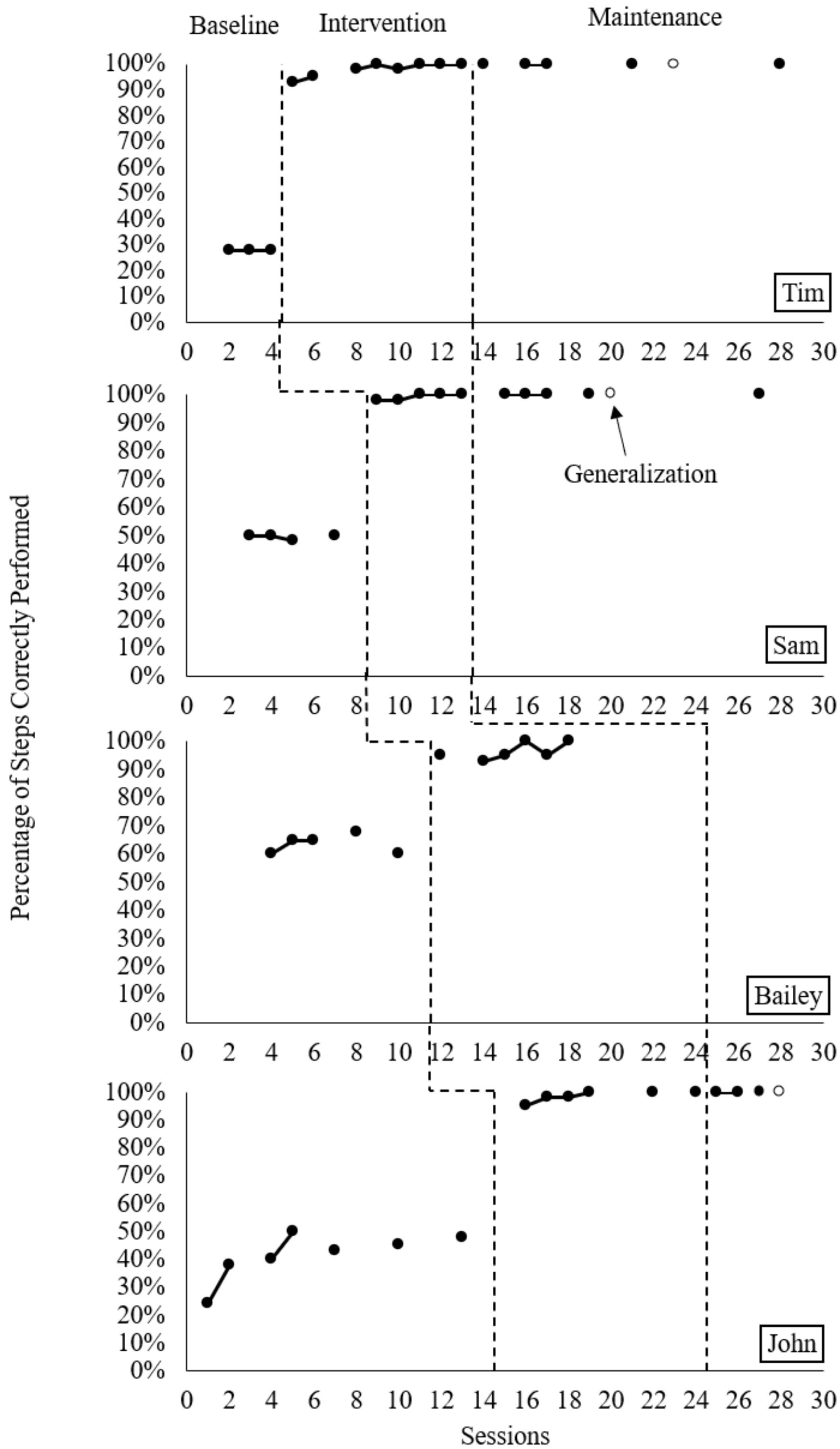
Tim, with scores ranging from 17% to 28%; and for six sessions for Sam, with scores ranging from 39 to 67%. Bailey was the first participant to receive the video modeling intervention for this task. She met the mastery criteria in six sessions with scores ranging from 94 to 100%. Bailey also met the mastery criteria in maintenances, scoring 100, 94, 100, and 100% across sessions. Follow-up and generalization data were not collected for Bailey due to her transitioning to remote learning.

Tim was the second participant to be introduced to the video modeling intervention for the checking into work task. He met the mastery criteria in eleven sessions, with scores ranging from 83 to 100%. During maintenance sessions, Tim scored 100% across three consecutive sessions. Tim scored 100% at his two-month follow-up session, 94% during the generalization session, and 100% at his three-month follow-up session. Sam was the third and final participant to receive the video modeling intervention for checking into work. Sam met the mastery criteria in three sessions. He scored 100% during maintenance, one-month follow-up, generalization, and three-month follow-up sessions.

Data for the third task, stripping the bed, are shown in Figure 8. Sam, Bailey, and Tim were exposed to this task. Baseline data were collected for four sessions for Sam, with scores ranging from 14 to 36%; for five sessions for Bailey, with scores ranging from 0 to 7%; and for six sessions for Tim, with scores consistently 0%. Sam received the intervention first, meeting the mastery criteria in three sessions. He scored 100% during maintenance, one-month follow-up, generalization, and three-month follow-up sessions. Bailey received the intervention second and met the mastery criteria in three sessions. Bailey scored 100% during the maintenance sessions. Follow-up and generalization data were not collected for Bailey due to the student's absence. Tim was the final participant to move into the intervention phase for stripping the bed.

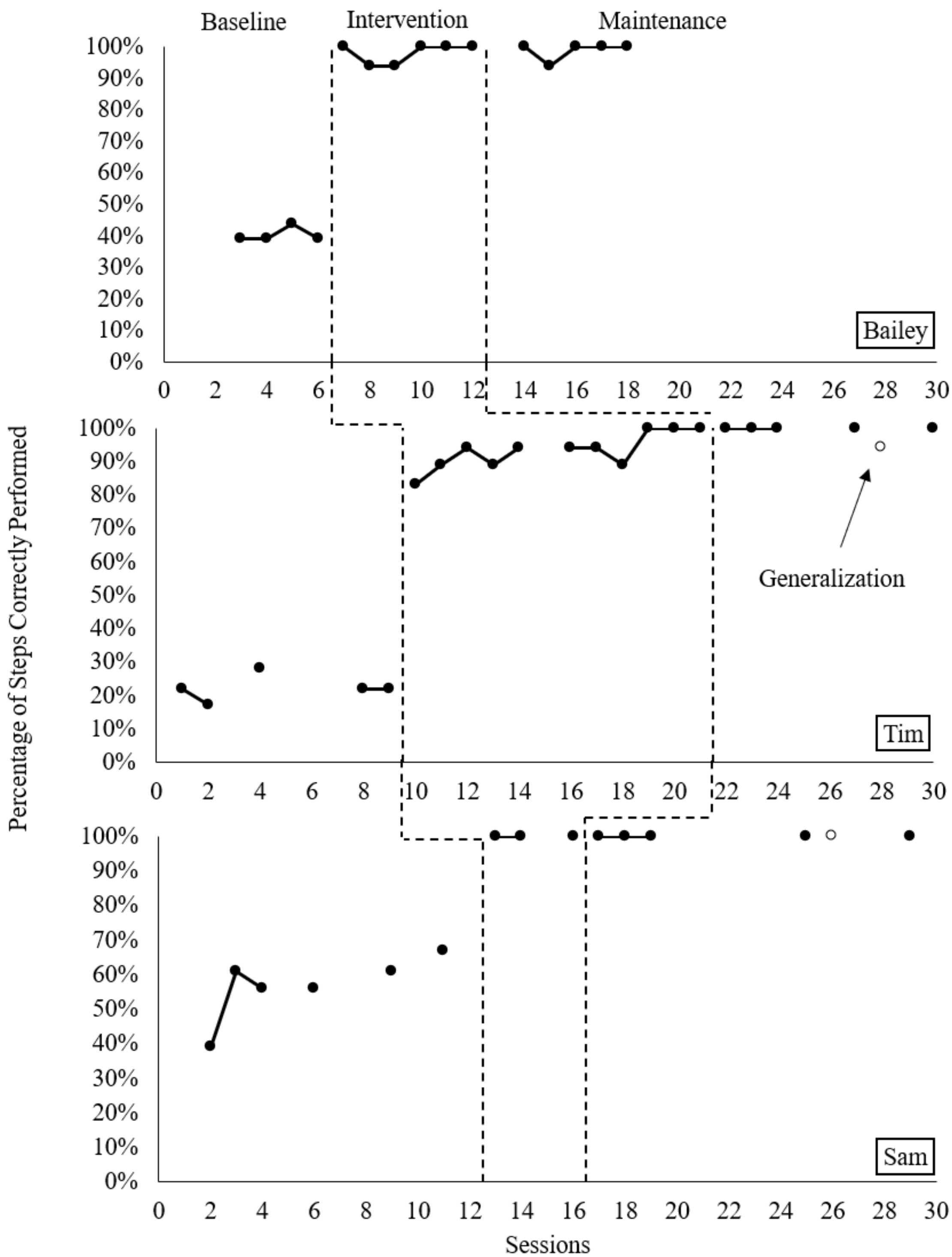
He met the mastery criteria in four sessions with increasing scores ranging from 93 to 100%. Tim scored 100% during maintenance sessions, 100% during his two-month follow-up, 79% during generalization sessions, and 100% at his three-month follow-up.

Figure 6. Participant Performance Data for Hang and Sort Laundry



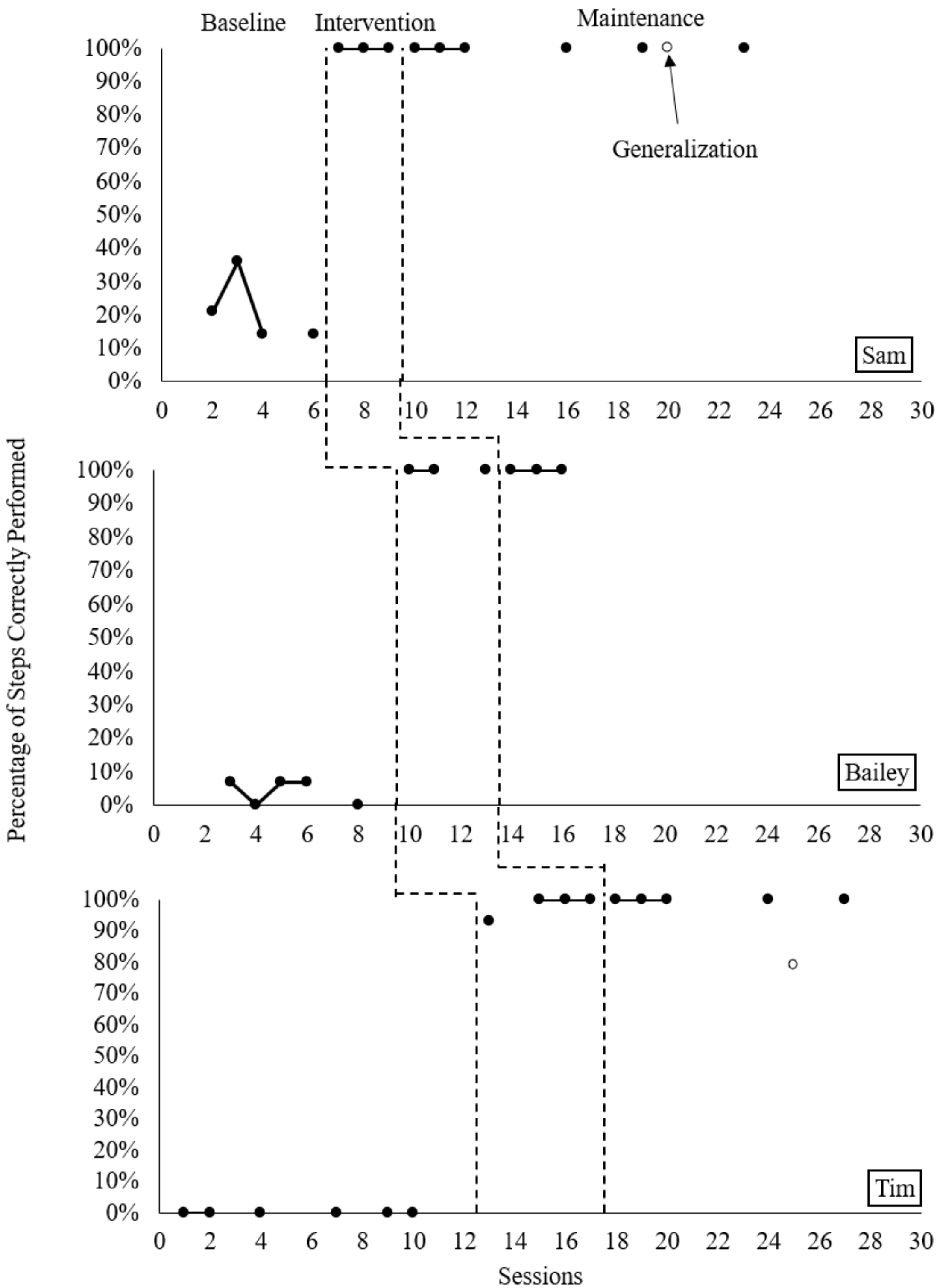
Note. Participant performance data for hang and sort laundry.

Figure 7. Participant Performance Data for Work Check-in



Note. Participant performance data for work check-in.

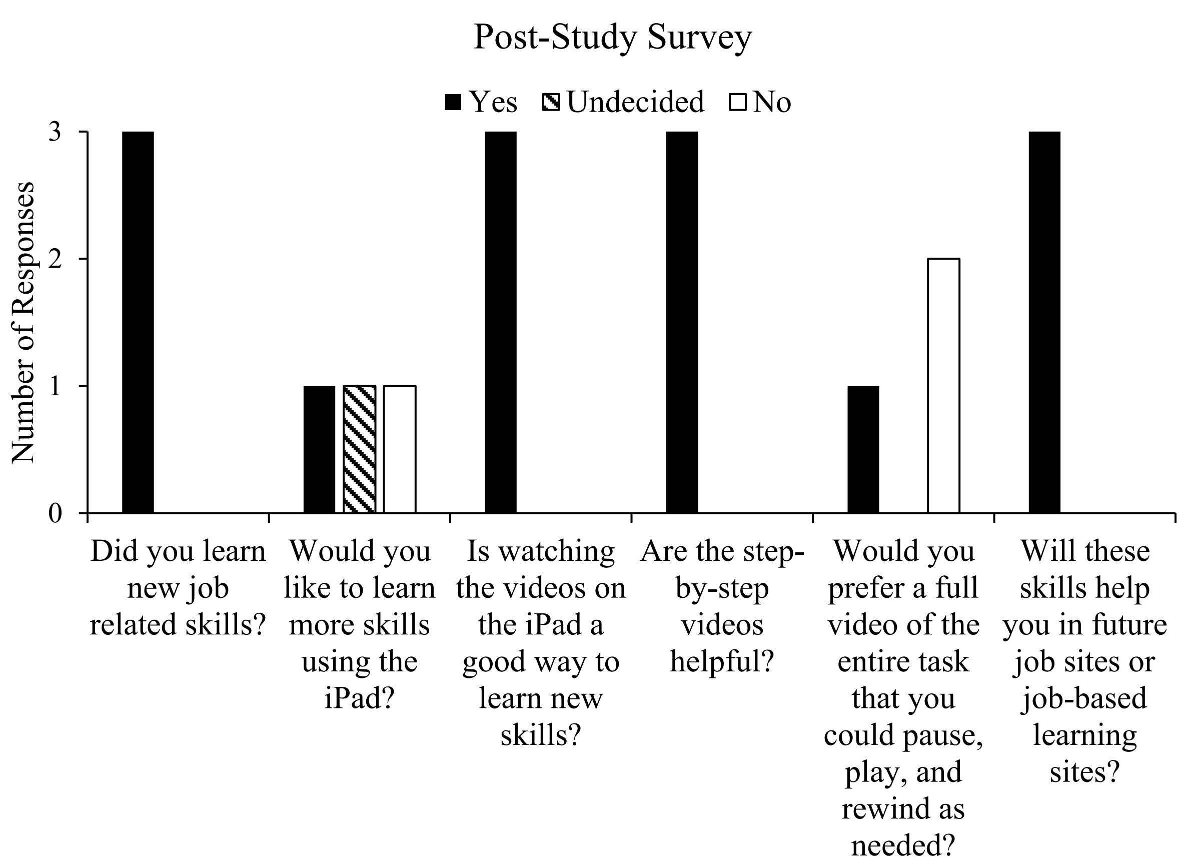
Figure 8. Participant Performance Data for Strip Bed



Note. Participant performance data strip bed.

All four participants completed the acceptability questionnaire, and the results are depicted in Figure 9. Four out four participants indicated that they would like to learn more skills using the iPads, that watching videos on the iPad was a good way to learn new skills, that the step-by-step videos were helpful, and that the skills they learned will help them at future job sites or job-based learning sites. Three of the participants said they learned new job skills during the study, while one participant said they did not. When asked, “would you prefer a full video of the entire task that you could pause, play, and rewind as needed?” three participants answered “yes,” and one indicated “no.”

Figure 9. Study 2 Consumer Satisfaction Survey Results



Note. Study 2 post-study consumer satisfaction survey results

Discussion

Study 2 was meant to replicate Study 1, using a slightly different experimental design and different participants. Study 2 assessed the impact of VP on job-skill acquisition, maintenance over time, and generalization to new settings and stimuli. The results indicate that participants acquired skills quickly with limited exposure and few mistakes. The results also indicate that VP was effective in teaching new skills which could be performed for an extended time in the absence of the intervention, which are consistent with the findings of Study 1 and of Cullen, et al. (2017), Kim and Kang (2020), and Kellems et al, (2019). Furthermore, the participants were able to perform the job tasks in a different location with different stimuli, suggesting generalization was also a product of the intervention, as was the case in Study and in prior work by Cullen et al. (2017). The results of Study 1 and Study 2 are of interest in suggesting that VP is an effective and efficient intervention promoting vocational skill acquisition, long-term maintenance, and generalization for young adult participants with disabilities.

STUDY 3

Because some students needed to develop different skills from those examined in Study 1 and Study 2, Study 3 used POV video models to teach participants to roll silverware. POV modeling was used because it has been shown to be useful in teaching similar tasks, although it has not been studied extensively (Mason et al., 2013). The experimental design used in Study 3 differed from that used in Study 1 and Study 2, but skill acquisition, maintenance, and generalization were again examined. Study 3 also compared the effects of VP and VM. Both procedures have proven useful, but it is unclear whether either is generally superior (Cannella-Malone et al., 2006; Cannella-Malone et al., 2011; Thomas et al., 2020). Error correction was minimized in Study 3, implemented only when a student’s performance was stagnant and below criterion for a substantial time. Minimal error correction was used to better determine the effects of video-based instruction alone. Error correction may have played an important role in producing the positive results obtained in Study 1 and Study 2 and in prior investigations (Cullen et al., 2017; Heider et al., 2019).

Methods

Participants

Three young adult students participated in Study 3. Each participant was trained across one task. None of the students received free or reduced lunch through the transition program. Peter was a 19-year-old, white male with a primary special education label of mild cognitive impairment. Becky was a 20-year-old, white female with a primary eligibility of moderate cognitive impairment. Jack was a 22-year-old, African American male with a primary eligibility of mild cognitive impairment.

Setting

Baseline, intervention, and maintenance sessions took place in the same commons area (i.e., job skills area) used in studies one and two. This area was equipped with cubical dividers separating different mock work sites arranged with materials to imitate community job sites participants are typically assigned for work-based learning opportunities. The divided areas differed in size depending on the task and materials needed, with the smaller work zones approximately 5x6 feet, and the larger work zones approximately 12x12 feet. Only one task was taught in Study 3 and the portion of the commons area utilized was a 3x3 table with an adult size chair. The table was not surrounded by dividers.

Generalization sessions, if possible, will occur in a separate room, such as an empty classroom or the cafeteria when not in use. The participants will have no prior experience completing the job task in these settings. In addition to a change in setting, materials will differ in appearance from those used in baseline, intervention, and maintenance conditions. Students will once again be pulled out of class individually for these sessions.

Materials

The materials used were those provided by the transition program or purchased by the researcher. For the rolling silverware task, the materials included five linen restaurant napkins, a silverware basket, a bin for rolled silverware, and eight sets of silverware (i.e., eight knives, eight spoons, and eight forks). The task was completed at a small table with a chair for the participant to sit. The participants performance was measured using premade task analysis datasheets.

As in Study 1 and Study 2, 10.2-inch iPads were used during the intervention condition. A video of the researcher completing the entire task was recorded on a GoPro 8 and transferred to the researcher's laptop for editing. Videos were cut, combined, and voice over applied by the researcher using the Movavi Video Editor 15 ® application. Two types of videos were created for this task. The first was a full video of the model rolling five rolls of silverware. This video was approximately five minute long. The second set of videos was divided, showing one step at a time. These videos varied in length from three to 14 seconds. Once edited, the videos were uploaded to the iPad and stored in separate video albums (i.e., "Roll silverware full" and "roll silverware partial"). In the partial or step-by-step video album, the videos were arranged in the order they were sequenced on the task analysis. During the intervention phase the iPad was secured to an adjustable tripod stand (16.5-50 inches in height) using a tablet clamp holder.

During generalization trials, materials differed from those the participants manipulated in baseline, intervention, and maintenance. The napkins will be a different color and the silverware will differ in color or material. The silverware basket and bin for completed rolls will also be different from those used in the other conditions.

Procedure

Rolling silverware was the only task targeted in Study 3. Prior to baseline sessions, the research developed the task analysis and video models. The task analysis was created by observing and recording previous restaurant employees rolling silverware. The researcher reviewed the video recordings and broke the task down into discrete steps. This resulted in 47 steps to complete five rolls of silverware, with nine of the steps repeating five times. See Table 2 for the full list of steps. Once the task analysis was approved by competent performers, the researcher recorder herself rolling five rolls of silverware on a GoPro camera using a tripod. Videos were all recorded from a third-person point-of-view. The recordings were then transferred to a laptop computer for editing.

Videos were edited by cutting and creating separate video clips for each step specified in the task analysis. Voice over was also added to each clip and included the researcher describing the step. These separate videos were used in the partial video conditions. Videos varied in length with the shortest being 3 seconds and the longest being 13 seconds. These videos were labeled corresponding to the step they were on the tasks analysis and uploaded to the iPad in a separate album with videos organized in the order they would be viewed. After creating the one-step video clips, the researcher combined all edited clips together, creating a full sequence video model. This video was 4 minutes 50 seconds and showed the entirety of the task in one model. This video was saved in a separate album on the iPad.

During baseline, the researcher gave the participant the direction, “roll five rolls of silverware.” Video models were not provided during this phase. If the student failed to begin the task within five seconds of the discriminative stimulus (i.e., the researcher's direction or the completion of the previous step) or began an incorrect response (i.e., a different step when order of responses was critical or an incompatible response), the researcher would have the participant close their eyes, turn away, or gaze at the opposite side of the room. Out of the participants view, the researcher would complete the step, establishing the antecedent stimulus for the next response. Once the researcher had made the correction, the participant was instructed to refocus on the task and keep trying. If the participant asked for help or stated they were unsure of the next step, the researcher responded with phrases like, "try your best" or "just do what you think might come next."

After the final baseline probe, prior to implementing the intervention, participants were exposed to a pretraining session. During this session, the participants were taught to select, view, imitate, and navigate the video models on the iPad®. The researcher gave a description of the expected responses, modelled the responses, and had the students practice until all steps were completed without prompts. Pretraining tasks included a full video of selecting, stacking, and hole punching sheets of paper, and a partial video of selecting, stacking, and stapling sheets of paper together. These sessions were also conducted with one participant at a time.

The first intervention condition included alternating treatments. Treatment one was a full-length video model of the researcher completing the entire job task (i.e., rolling five rolls of silverware) and the second treatment was partial videos depicting one step of the task at a time. Treatments were alternated each session, beginning with the full video model. The direction during this condition was the same as in baseline, with the specification of using the iPad (i.e., "Roll five rolls of silverware using the iPad"). The participant then selected the first or only video in the album, which was already displayed on the iPad, and viewed the entire video or clip.

If the full video treatment was in place, the participant watched the entire video then attempted to complete the entire task, imitating the responses they viewed in the video model. When the partial or step-by-step video clip treatment was implemented, the participant would view the video, imitate the video model, and swipe left to progress to the next video. This process was repeated until no more video clips remained and the task was complete. If the participant stopped viewing the video for two or more seconds, the researcher would remind them to "watch the video." If the participant began the task before the video was done, they were reminded to "watch the whole video." No error correction occurred during this phase. If a mistake was made, the research recorded data accordingly and allowed the participant to progress through the steps.

If, after five sessions in each treatment the participant had not received a score of 100%, they moved to the second intervention phase. This condition included only the step-by-step (partial) video clips and incorporated error correction. If the participant completed a step incorrectly, they were directed to re-watch the video model and try again. If they completed the step correctly after error correction, they were told to, "keep going." If they completed the step wrong for the second time, the researcher had them close their eyes, turn away, or look at an object on the other side of the room while the researcher made the correction. Once the correction was made, the student was instructed to continue with the task. The error correction procedure was applied only once per step. Data was collected on responses after data collection, but only data on the participants initial attempt was calculated into their overall score.

Maintenance sessions will be conducted similarly to baseline sessions; however, the researcher will not divert the participants gaze and complete or correct their response when incorrect. Instead, the researcher will allow the participant to continue performing the task while recording data on each step accordingly. Generalization sessions will be conducted in the same way, though the location and stimuli will differ from baseline, intervention, and maintenance sessions. Date will be collected by the researcher on the percentage of steps in the task the participant completes correctly.

Dependent Variable and Data Collection

The dependent variable is the participants performance on the target task. Data were collected on the accuracy of the participants performance for each step in the task, as determined by the task analysis. Comparable to Study 1 and two, the task analysis was developed in collaboration with the programs job coaches and mirrors the expectation for rolling silverware at the community jobsites. A correct response was defined as the participant beginning the step within five seconds of the discriminative stimulus (i.e., the researcher’s direction, the completion of a previous step, or the conclusion of the video model) and completing the step within one minute. An incorrect response was defined as the participant failing to begin the correct response within five seconds of the antecedent stimulus and/or requiring more than one minute to complete the task. These instances included participants engaging in incompatible behaviors or beginning a different step in the task that would ultimately alter the outcome of the task (e.g., rolling the napkin without first selecting and positioning the silverware). Performance accuracy was calculated as a percentage by dividing the number of steps the participant performed correctly by the total number of steps and multiplying the total by 100. Data was also collected on the number of sessions required to meet mastery criteria, which was 100% correct responding across three consecutive sessions, with or without the video models (i.e., intervention and maintenance conditions). In the alternating treatments condition, three consecutive sessions for the same treatment was required. Whistle blow criteria was five sessions in each condition without meeting mastery criteria or at least one session with 100% accuracy. If this criterion was met, the participant moved into the step-by-step video models with error correction phase. Mastery criteria was the same in this phase as intervention phase one and the maintenance condition.

Design

A multiple probe design across participants was used to demonstrate a functional relationship between video modeling and the participants performance. An alternating treatment design was also implemented during the intervention phase to determine the effects of a total-task video model compared to partial video models on the participants performance. Baseline probes were collected concurrently across the three participants. Like Study 1 and two, probes were used during baseline to reduce reactivity and better assess the effects of the independent variables. The conditions were baseline, intervention, and maintenance, with generalization probes occurring during the maintenance condition. For each participant, a minimum of three data points with a stable or decreasing trend was required to move from baseline to intervention. Participant scores also had to consistent be below 80% accuracy for that task to be included in the study. Subsequent participants moved from baseline to intervention when the preceding participant was exposed to three sessions in the first intervention phase. Participants moved from the alternating treatment condition to the step-by-step videos with error correction condition when whistle criterion was met.

Interobserver Agreement

Interobserver agreement was calculated for Study 3 using the same trial-by-trial method used in the previous studies. IOA was calculated for total sessions and across participants. IOA was calculated for 27% of the total sessions. IOA ranged from 79% to 100% across sessions, with an average agreement of 96%. For Peter, 24% of his sessions were scored for IOA.

Agreement ranged from 98 to 100% with an average of 99% IOA. Twenty-two percent of Jack's sessions were scored for IOA, which ranged from 85 to 100% across sessions, with an average of 95%. For Becky, 33% of her sessions were scored for IOA, which ranging from 79 to 100% across sessions, with an average of 94%.

Treatment Integrity

Intervention integrity was determined as described for Study 1. Treatment integrity data were collected for 73% of sessions (49 out of 67). For all sessions, treatment integrity was 100%.

Consumer Satisfaction

Consumer satisfaction was determined as described for Study 1. However, in Study 3, some questions differed from the questionnaires proposed in Study 1 and 2, as participants had exposure to full video models and sequenced video prompts. For specific questions posed, see Figure 11 and 12.

Results

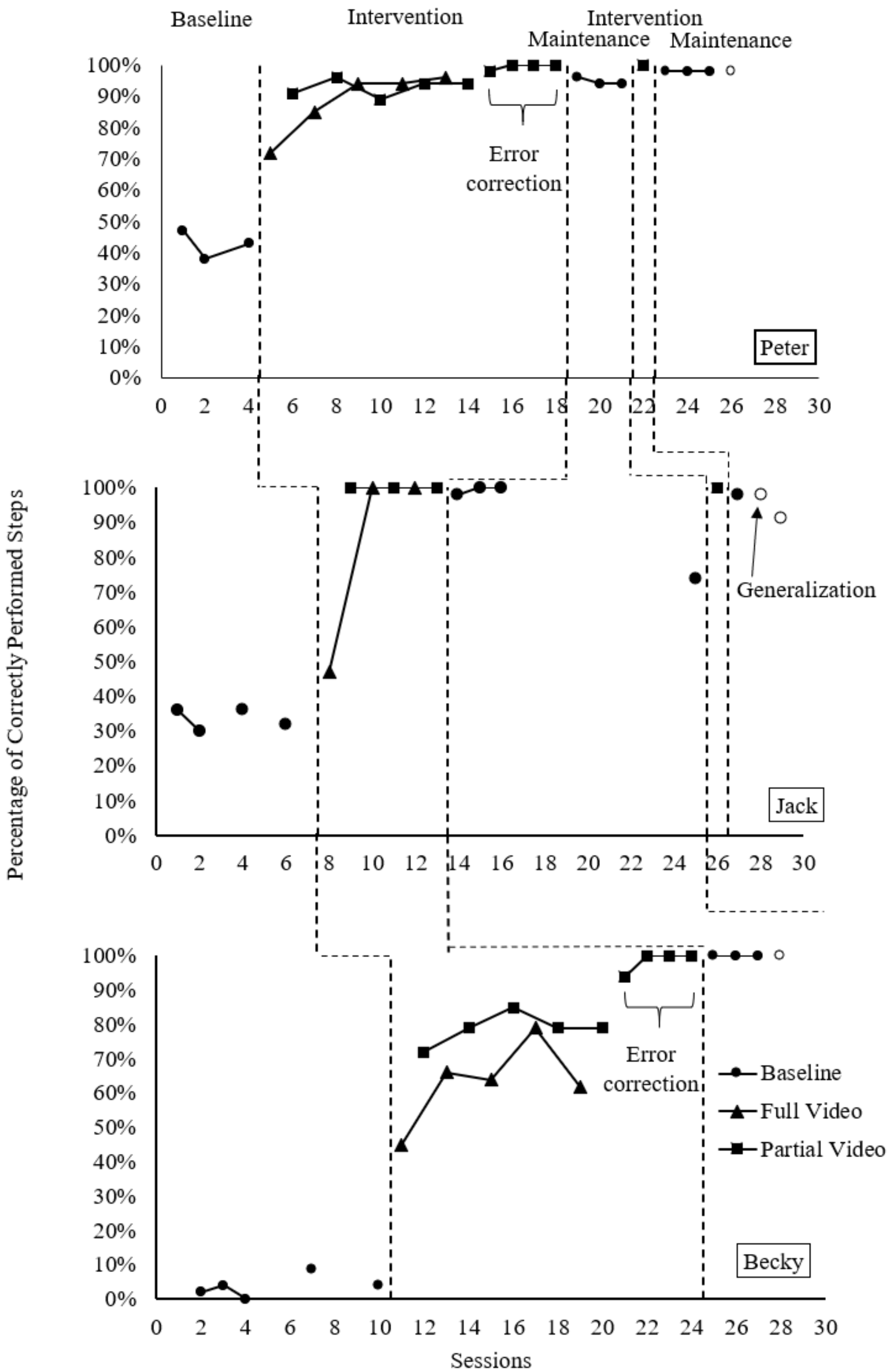
A multiple baseline across participants design with an alternating treatments component was used in Study 3. Three young adults served as the participants in this study and each completed training for one vocational task - rolling silverware. Data for Study 3 are shown in Figure 10. The first participant, Peter, participated in three baseline sessions prior to being exposed to the first intervention phase, which was alternating sessions between the full video of the job-task (i.e., rolling five rolls of silverware) and the partial videos (i.e., separate clips showing one step of the task). During baseline, Peter scored 47, 38, and 43% across sessions. During the alternating treatments phase, Peter's scores ranged between 72 and 96% for full video models and 89 and 96% for partial video models. The mastery criteria were not met in the first 10 sessions (i.e., five full video sessions and five partial video sessions), so the partial videos with error correction phase (intervention phase 2) was implemented consistently. Once this occurred, Peter's scores ranged from 98 to 100% and he met the mastery criteria within four sessions. During the first maintenance phase Peter scored 96%, 94%, and 94%, respectively. Because none of his score met the 98% threshold (i.e., turning of the napkin into a diamond shape was not required during maintenance as it did not alter the outcome of the task), a booster session using the partial video models with error correction was reimplemented. During this booster session, Peter scored 100%. Maintenance sessions were conducted once more, and Peter scored 98% across three consecutive maintenance sessions and 98% during a generalization session.

The second participant, Jack, participated in four baseline sessions with scores of 36, 30, 36, and 32%. During the alternating treatments phase, Jack scored 47, 100, and 100% during full video model conditions and 100% across three consecutive partial video model sessions. The mastery criteria (i.e., three scores of 100% in one condition) was met in six sessions (i.e., three perfect scores in the partial video model condition). During maintenance sessions, Jack scored 98, 100, and 100 across three consecutive sessions. During a follow-up session two weeks later, Jack scored 74%. A booster session was conducted, and Jack scored 100%. Maintenance was reassessed following the booster session and a score of 98% was obtained. During generalization sessions two weeks and four weeks later, Jack scored 98 and 91%, respectively.

The third participant, Becky, participated in five baseline sessions with scores ranging from 0 to 9%. During the alternating treatments phase, Becky's scores ranged from 45 to 79% during full video model conditions and from 72 to 85% during partial video model conditions. The mastery criteria were not met in 10 sessions (five of each condition) and phase two of the intervention was implemented (partial video models with error correction). During this phase, Becky scored 94, 100, 100, and 100% and met the mastery criteria in four sessions. During maintenance sessions, Becky scored 100% across three consecutive sessions. She also scored 100% during a two-week follow-up and one month generalization session.

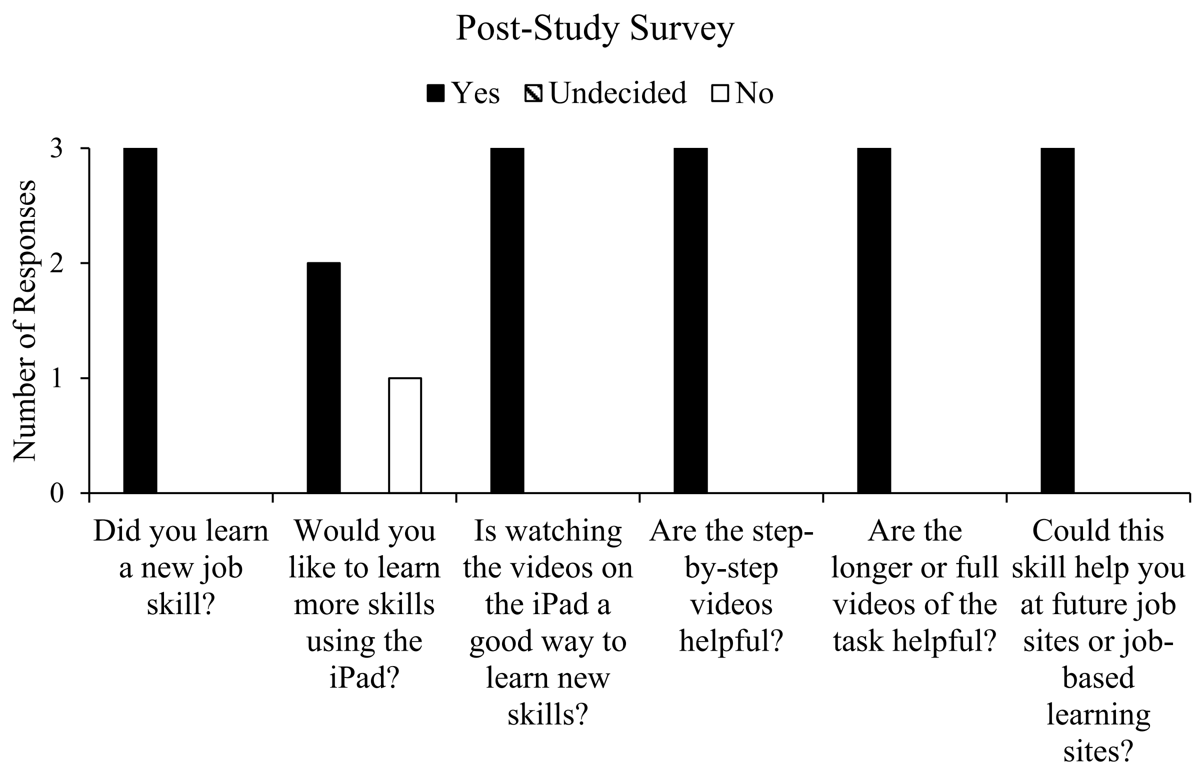
All three participants in Study 3 completed the end of study survey and results are represented in Figure 11 and Figure 12. All participants indicated that they learned a new job skill, that watching the videos on the iPad was a good way to learn new skills, and that the step-by-step videos were helpful. Each participant also indicated that the longer or full videos of the task were helpful, and that the skill learned could help them at future job sites or job-based learning sites. In response to the question, “would you like to learn more skills using the iPad?” two participants indicated they would, and one participant said “no”. When asked, “Did you learn better with the short or long videos?” one participant indicated the short videos were better, one was undecided, and one indicated the longer videos were better. Two participants indicated that they liked the short or partial videos better, and one participant indicated that they preferred the long or full videos.

Figure 10. Participant Performance Data for Rolling Silverware



Note. Participant performance data for rolling silverware.

Figure 11. Study 3 Consumer Satisfaction Survey Results



Note. Study 3 post-study consumer satisfaction survey results

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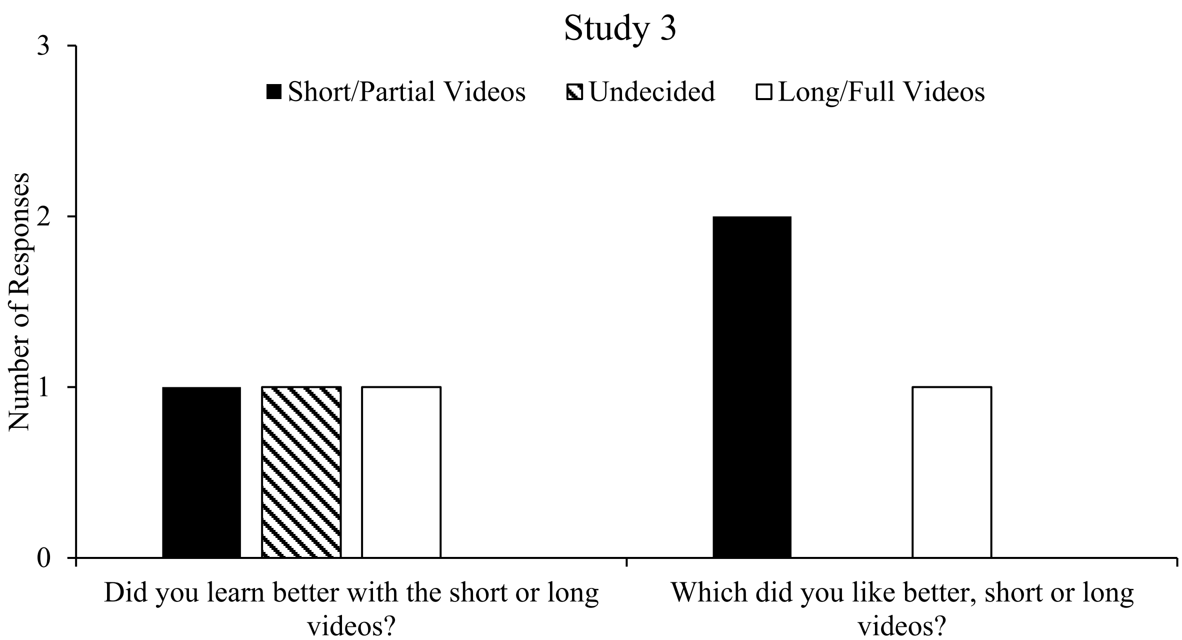
Figure 12. Study 3 Consumer Satisfaction Survey Results



Note. Study 3 post-study consumer satisfaction survey results

Discussion

Study 3 was meant to compare the effects of VM and VP, assess skill acquisition, maintenance, and generalization, and evaluate if POV VM and VP were effective for the participants. Results indicate that only one participant performed the tasks accurately with VM. Two of the participants required VP with error correction to meet mastery criteria. All participants maintained the vocational skill when the interventions were removed and were able to perform tasks accurately in the absence of the intervention in a new setting with similar materials. The results of Study 3 provide further evidence of the potential value of POV interventions, which have received relatively little attention (Mason et al., 2013) and appear to merit further investigation. The effectiveness of different video perspectives was not compared in Study 3, although such research is worthwhile.

GENERAL DISCUSSION

The present studies assess the effectiveness of VM (including VM and VP) as a tool for teaching young adults with developmental disabilities job-related skills. The effects of the intervention were examined with respect to skill acquisition, maintenance, and generalization. In Study 1 and Study 2, a multiple baseline experimental design was used to demonstrate a functional relation between video prompts displayed on an iPad and the percentage of correctly performed steps in the target job tasks. The intervention produced positive results quickly and consistently, which suggests that it is useful strategy for teaching. This conclusion is consistent with the findings of earlier studies, in which participants were taught a variety of functional skills (Cannella-Malone et al. 2006; Cannella-Malone et al., 2011; Cullen et al., 2017; Kellems et al., 2018; Kim & Kang, 2020). It is noteworthy that, in the present study, job skills were well maintained after the intervention was removed. Performance in the absence of the independent variable was assessed up to four months post intervention. Participant performance scores remained high, even in the absence of practice or exposure to the tasks between follow-up sessions. The results of these two studies extend the research on long-term maintenance and generalization of vocational skills in the absence of the VP intervention, which only a few studies have examined (Cullen et al., 2017; Kellems et al., 2018; Kim & Kang, 2020). Consumer satisfaction data, although limited, suggest that the intervention was generally acceptable to the young adults who experienced it, which is important.

The results of Study 1 and Study 2 also indicate that a VP intervention can be effective with little augmentation, because those studies arranged minimal praise, descriptive feedback, or prompting. Because the VP procedure used was relatively simply and did not require individualization, it appears to be useful as a tier one intervention for special education vocational programs that need quick and feasible interventions that work for an array of individuals and skills. Staff could easily implement this intervention with multiple students at once, which is a point in its favor.

It should be noted that the findings of Study 1 and Study 2 differ from those published by Heider et al., (2019). In their study, participants initially had access to the video prompts during intervention and maintenance sessions. During intervention, the students were directed to use the videos to complete the tasks, while during maintenance they were not directly instructed to use the videos, although they were available. When videos were available, participants' performance scores were high, indicating accurate performance. When performance was probed in the absence of the VP, however, performance scores dropped significantly. In our studies, video prompts were never available during maintenance sessions and participants maintained consistent accurate performance, suggesting they had truly acquired and maintained the skills in the absence of the independent variable. As noted previously, the variables that determine whether treatment gains are maintained have not been determined and merit investigation.

In addition to our emphasis on the long-term maintenance of vocational skills post intervention, Study 1 and Study 2 focused on the generalization of skills to new settings and materials. Generalization was specifically targeted in these studies by programming common stimuli, as suggested in the seminal 1977 article by Strokes and Baer. Generalization was assessed using different materials and locations when available. Participant's performances suggest that the VP intervention was effective at promoting generalization of job skills. In Study 1 and Study 2, generalization trials took place in a different classroom within the school.

Different materials were also used for the laundry, strip bed, and checking into work tasks. For vacuuming, the location differed and a specific area to be vacuumed was not marked off. Once participant in Study 1, Tim, scored a 79% during his generalization session for strip bed, but his scores improved during the next follow-up session. The researcher believes that this was due to the laundry basket used in the generalization trial being smaller than the one used during intervention and maintenance sessions. This resulted in the student failing to place all dirty linens in the basket, lowering his score.

It is noteworthy that there are substantial differences in the details of VP procedures that have proven effective. For instance, Cullen et al., (2017) required participants to turn the iPad on, select the application from the home screen, select the specific task, paly and watch the clip, advance through the video clips, and finally exit the app and turn the device off at the end of the session. Our procedures more closely resembled those used by Kim and Kang (2020) and Heider et al., (2019), in that students selected and played the first video clip for the task, progressing through the videos after completing the previous step. Participants in these studies and our own were not responsible for turning the device on and off or selecting the specific application or album that housed the video models. The procedure used by Kellems et al., (2018) also differed from ours and those used in previous studies in that students were not required to watch and imitate each video model, but rather they were available for steps for which they needed assistance.

Although it is possible that specific versions of VP are especially effective, the finding that procedures that differ substantially are useful may indicate that the procedure is generally robust. Intervention integrity was very good in the present studies, but this may not be the case outside research settings, that is, in the everyday use of the procedures. If some variability in how VP is arranged does not seriously compromise its effectiveness, that is, if the performance is adequate even when intervention integrity is suboptimal, that would be a highly useful characteristic.

Study 3 also provided evidence of the general value of VP. It compared the effects of VM and VP on the acquisition of a job task, while also assessing generalization and maintenance of performance over time. The multiple-baseline design across participants and the alternating treatment design used in Study 3 indicates a functional relation between video modeling and the percentage of steps correctly performed. More specifically, a functional relation was first identified in the initial intervention phase, which included alternating treatments conditions, when scores rapidly increased. Nonetheless, the scores for two of the participants in Study 3 improved to meet mastery criteria only once error correction was implemented with VP alone in the second intervention phase. This suggest that although VM in general may be effective in increasing performance, VP may be more effective than VM. These findings align with the results published by Cannella-Malone et al., (2006) and Cannella-Malone et al., (2011), who found VP to be superior to VM when teaching daily living skills to young adult participants with moderate and severe disabilities. The results from their studies also show a rapid increase in performance when VP is implemented as compared to no, slow, or limited increases in participant performance in the VM conditions.

Our findings are similar to theirs, in that acquisition was more rapid during VP conditions and acquisition was limited during the VM condition for one participant (i.e., Becky). Unfortunately, maintenance and generalization data were not collected as part of the Cannella-Malone et al., (2006) and Cannella-Malone et al., (2011) studies, thus we cannot compare findings along that dimension. Participants in our study did maintain the target job skill post-intervention. If, and when, participant scores consistently dropped below mastery criteria in the first three maintenance sessions immediately following the removal of the video models, a booster session was implemented. A booster session was also reinstated during later follow-up sessions if scores dropped below 80%. Booster sessions consisted of the researcher re-implementing the intervention for one session with general feedback to rewatch specific videos if errors were made. Two of three participants in Study 3 needed booster sessions and their scores improved immediately following those sessions.

The results of Study 3 are not consistent with the findings of Thomas et al., (2020), as they found VM to be more effective than VP for three out of four of their participants. Their results also suggest that tasks taught using VM were more likely to maintain and generalize than those taught with VP. Although we cannot comment on the maintenance and generalization of skills taught with the differing video modeling techniques due to the limitations of our design, our results suggest that maintenance and generalization of skills remained high in the absence of the VP intervention. Further research comparing VP and VM with a variety of tasks and participants is certainly needed.

Our findings are equivocal with respect to the relative value of VP and VM. For Peter, scores during VM and VP conditions were similar, even though the mastery criterion was not met until error correction was combined with the VP. For Jack, responding was similar for VM and VP, but it is possible that this may be attributed to some carryover effect from the VP condition. As seen in Figure 8, there was a steep increase in performance in the alternating treatments phase from the first VM session to the first VP session. Jack's performance during VM sessions increased only after successful job performance during a VP session, suggesting that learning in one condition may have influenced performance in the other. As for Becky, scores during the VM conditions were consistently lower than those in the VP conditions but the mastery criteria were not met until VP with error correction was implemented.

The results of our third study suggest that the inclusion of error correction (i.e., having the student re-watch video prompts after incorrectly performed steps) made the intervention more effective for two out of three participants (66%). This outcome suggests that the addition of general feedback as an error correction procedure may facilitate behavior change and may be a valuable part of a treatment package. The error correction procedure we used was simpler that the one arranged by Heider et al. (2019) and should be relatively easy for educators to arrange. However, its actual value needs to be confirmed in subsequent studies.

Limitations

Although the present studies provide compelling evidence of the value of the interventions examined, they have some significant limitation. The primary one is that COVID-19 presented us from examining whether the skills our participants acquired generalized to, and were maintained over time in, an actual workplace. The researcher continues to collaborate with personnel at the school where the present studies were conducted. It appears that this line of research can be continued and extended to examine the value of procedures similar to those examined in the present studies in teaching skills to students that allow them to succeed in actual workplaces, as well as to examine whether school staff alone can develop and implement such procedures.

A limitation of Study 1 and Study 2 not related to COVID-10 was the lack of preassessments to determine, objectively, whether the participants had prerequisite skills. For instance, Kevin and Jimmy in Study 1 and Tim in Study 2 struggled with fine motor skills, which limited their ability to tie and apron.

The most significant limitation was in Study 3 and was related to the experimental design as it resulted in somewhat inconclusive results. First, an alternating treatment design was used to compare the effects of VP and VM, but the absence of counterbalancing limited experimental control. As discussed earlier, there may have been some carryover effect from the VP condition to the VM condition, most apparent with Jack.

A final limitation of these studies is the lack of inclusion of school staff. Because staff were reassigned to other roles during the COVID-19 impacted school year, the researcher was the sole staff member implementing the intervention. This limited the researcher's ability to determine the feasibility of the intervention for school staff and assess treatment fidelity when school staff were the implementors. Anecdotally, however, school staff have expressed interest and excitement in using, expanding, and implementing these interventions with their students next year

Future Research

The studies conducted as part of this research provides avenues and recommendations for future research. First, maintenance of skills should be assessed for even more extended periods of time. Second, generalization should be assessed at worksites, with different staff, with similar tasks, and different materials. Third, VM and VP research should be assessed with more severely impaired students to determine its effectiveness with that population. Fourth, future research should continue to directly compare the effects of VP and VM on skill acquisition, maintenance, and generalization. Fifth, studies should more directly compare traditional VM and POV VM. And finally, future research should focus on the staff implementation aspect of VP and VM interventions. For instance, training school staff to identify target skills, create task analyses, assess baseline performance, capture and edit video models, implement the intervention across students with fidelity, and collect objective performance data.

Conclusion

The present studies were conducted as part of an effort to improve the job-training program at a school during COVID-19, when job-based learning sites were unavailable to the young adult students. They assessed the effectiveness of VP interventions on skill acquisition, maintenance, and generalization, as well as compared the effects of VM and VP on performance. The researcher and school professionals were looking for an effective and feasible intervention to prepare a large and diverse group of students for on-site and off-site job experiences. The procedures examined in the studies appear to be such an intervention. They produced robust and enduring effects and appear to be appropriate for establishing a broad range of job be accessible to students with limited or advanced job skills. Variants of VM appear to provide a universal strategy for students to learn new job skills. As a result of this research, the school has invested more money into the on-site training program and is planning to extend it to other programs in the agency and their off-site classrooms. The intervention is also being used by other staff members to teach cooking and gardening skills to students, for both functional and leisure activities. Most importantly, the students have improved their job skills and, anecdotally, have enjoyed the experience. Most of the participants have asked, unsolicited, to learn more skills using the iPads and all participants were excited and willing to attend sessions with the researcher. These, like the actual data obtained, are significant findings.

Table 1. Task Analyses for Laundry, Work Check-in, and Strip Bed

Hang and sort laundry	Check in for work	Strip Bed
1. Grab one shirt out of the laundry basket	1. Remove the pen from wall hook	1. Remove pillowcase from one pillow
2. Grab one hanger from the clothing rack	2. Remove clipboard from wall hook	2. Put the pillowcase in the hamper
3. Put the hanger through the shirts neck hole and position shoulder seams	3. Write first and last name in the first available "name" column box	3. Stack the uncovered pillow on the chair
4. Compare the shirt's name tag to the room assignment key	4. Check digital clock for time	4. Remove the pillowcase from the other pillow
5. Hang the shirt on the clothing rack in the assigned area	5. Record time as shown on clock on the sign-in sheet, in the corresponding "time in" column	5. Put the pillowcase in the hamper
6-40. *Repeat step 1-5*	6. Hang clipboard on wall hook	6. Stack the uncovered pillow on the chair
	7. Hang pen on wall hook	7. Unbutton duvet cover
	8. Dispense one pump of hand sanitizer into the palm of hand	8. Separate duvet from comforter
	9. Rub hand sanitizer over the entire surface of the hands until the sanitizer is dissolved/dry	9. Put the duvet cover in the hamper
	10. Locate apron with the participants name on it	10. Place the comforter on the chair with the pillows (off the floor)
	11. Remove the assigned apron from the hook	11. Remove the flat sheet from the bed
	12. Place the neck strap of the apron over the head, with the bib in the front	12. Place the flat sheet in the hamper
	13. Cross straps behind the back and pull them forward, one strap in each hand	13. Remove the fitted sheet
	14. Tie the two straps in a knot/bow	14. Place the fitted sheet in the hamper
	15. Pull a single glove from the box	
	16. Put and keep the glove on hand	
	17. Pull a single glove from the box	

Table 1 – continued

18. Put and keep the glove on hand

Table 2. Task Analyses for Vacuuming and Rolling Silverware

Vacuuming	Roll Silverware
1. Walks to the cleaning supply area and selects the vacuum	1. Unfold stack of napkins (all 5) and lay flat
2. Pulls, pushes/, or carries the vacuum to the area to be cleaned	2. Turn the stack of napkins into a diamond shape
3. Unwinds the electrical cord completely	3. Fold the bottom corner of the napkin up to the top corner, making a triangle with edges flush
4. Plugs the vacuum in to the closet available wall outlet	4. Grab a knife
5. Adjusts the height of the vacuum cleaner relevant to the carpet height	5. Grab a spoon
6. Grabs extra cord in one hand	6. Grab a spoon
7. Turns the vacuum cleaner on by pressing the foot pedal	7. Stack the utensils horizontally along the bottom edge of the folded napkin, within 2 inches above the fold, starting with the knife, ensuring all handles are facing the same direction
8. Releases the vacuum cleaner by pressing on the “handle release” pedal with foot	8. Fold the right/left corner in towards the opposite corner until the fold is flush with the silverware
9. Move vacuum in a back-and-forth motion, moving from left to right across the area	9. Fold the right/left corner in towards the opposite corner until the fold is flush with the silverware
10. Vacuums until floor is clean (baby powder or crumbs removed)	10. Tightly roll the silverware in the napkin upwards towards the top of the napkin (overlapping corners), ensuring no silverware is sticking out
11. Pushes vacuum handle back into an upright position (until pedal catches)	11. Stack the roll of silverware in the basket
12. Turn the vacuum off	12-47. *Repeat steps 3-11*
13. Unplugs cord from wall outlet	
14. Winds cord back onto the vacuum and secure the end clip	
15. Return vacuum to clean supply area	

Table 3. Treatment Integrity

Baseline	Intervention	Maintenance & Generalization
1. Arranges appropriate materials at workstation **(see descriptions below for the specific task)**	1. Arranges appropriate materials at workstation **(see descriptions below for the specific task)**	1. Arranges appropriate materials at workstation **(see descriptions below for the specific task)**
2. Provides the S^D for the target task (as specified on the data sheet)	2. Places turned-on iPad on the tripod in the workstation area	2. Provides the S^D for the target task (as specified on the data sheet)
3. Implement error correction (i.e., completing the step out of participant view) after an incorrect response occurs (i.e., completes the step incorrectly, engages in a different response, does not begin within 5 seconds)	3. Opens the video album on the iPad for the target task	3. Error correction is not implemented after an incorrect response (i.e., completes the step incorrectly, engages in a different response, does not begin within 5 seconds
4. Provides only general praise at the end of session or in response to participant's solicitation of feedback	4. Checks to ensure the iPad volume is appropriate	4. Provides only general praise at the end of session or in response to participant's solicitation of feedback
5. Records data on task specific datasheet	5. Provides the S^D for the target task (as specified on the data sheet)	5. Records data on task specific datasheet
	6. Implement error correction after an incorrect response (i.e., completes the step incorrectly, engages in a different response, does not begin within 5 seconds): *"re-watch that video" or "re-watch the video and try again."*	
	7. Implement error correction only once per step, completing the step out of participant view after a 2nd failed attempt	

Table 3 – continued

8. Provides prompt or feedback when student swipes the wrong way, skips a video, or begins performing a future task (not shown in the model)
9. Provides only general praise at the end of session or in response to participant's solicitation of feedback
10. Records data on task specific datasheet

APPENDICES

Appendix A. Task Materials and Set-Up

Task	Materials	Set-up
Hang and Sort Laundry	• Shirts (8) • Hangers (8) • Clothing rack • Laundry basket • Room # Key • Room labels for clothing rack (Room 1, Room 2, A, A, B, B) • Table	Put 8 shirts in the laundry basket and place 8 hangers on the rack's side hook. Ensure the shirts have name tags inside and the room assignment key is hanging on the divider wall. The rack should have a Room 1, Room 2, A (2), and B (2) labels displayed across the top. Position the table about five feet in front of the clothing rack at the edge of the cubical.
Vacuum	• Vacuum • Baby powder • Tape • Available plug socket	Coat carpet with thin layer of baby powder in the taped off area. Place vacuum in the cleaning supplies area. Vacuum cord should be wrapped and secured with the carpet height knob set to 5 or 5.
Work Check-in	• Pen • Clip Board • Sign-in sheet • Wall hooks (2) • Digital cock • Aprons (3 minimum) • Hand sanitizer • Gloves	Have a log-in sheet on the clipboard hanging on the wall hook with the pen. Have hand sanitizer and gloves on the ledge. Have at least three aprons, each with name tags hanging on the divider hook (one name tag should be the participants name). Check that the digital clock is on and secured above the clipboard (attached to Velcro).
Strip Bed	• Pillowcases (2) • Pillows (2) • Fitted sheet • Flat sheet • Comforter • Duvet cover with buttons • Chair • Bed frame • Mattress • Hamper/laundry basket	Have a fully made bed with the chair and hamper placed next to the bed; pillowcases on pillows, pillow near the head of the mattress, fitted sheet on the mattress, flat sheet spread across the mattress, comforter covered by the duvet cover, and the duvet cover's opening buttoned (all buttons). Bed should be messed up a bit to simulate it being slept in.
Roll Silverware	• Spoons (8) • Forks (8) • Knives (8)	On the table, stack five unfolded napkins on top of each other with the edges lining up. Fold the entire stack

	• Silverware basket • Cloth napkins (5) • Basket for rolled silverware • Table • Chair	in half (creating a rectangle). Fill the compartments of the silverware basket with the spoons, knives, and forks (8 of each). Position the folded napkins in the middle of the table, the stocked silverware basked off to the right side, and the basket for rolled silverware towards the tops of table (opposite to where the participant will be sitting).

Note. Description of the mock work site staging and set-up.

Appendix B. HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: October 15, 2020

To: Alan Poling, Principal Investigator
Carly Schroeder-MacKay, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 20-09-22

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

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., ***add an investigator, increase number of subjects beyond the number stated in your application, etc.***). Failure to obtain approval for changes will result in a protocol deviation.

In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

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

A status report is required on or prior to (no more than 30 days) October 14, 2021 and each year thereafter until closing of the study.

When this study closes, submit the required Final Report found at https://wmich.edu/research/forms.

Note: All research data must be kept in a secure location on the WMU campus for at least three (3) years after the study closes.

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