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RESEARCH ARTICLE

Using 21st century video prompting technology to facilitate the independence of individuals with intellectual and developmental disabilities

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Abstract

Barriers in acquiring, maintaining, and generalizing daily living skills are factors that contribute to discrepancies in independent living outcomes among transition age youth and young adults with intellectual and developmental disabilities (IDD). Acquisition and generalization of daily living skills empowers transition age youth and young adults with disabilities to meet their own needs with minimal reliance on others. Infusing the use of technology as a self-prompting device facilitates the acquisition of tasks that may not be otherwise attainable. In this study, self-directed video prompting on an iPad with the My Pictures Talk application was used to help young adults with IDD in a postsecondary program acquire daily living skills in a single subject, multiple probe across subjects design. The effects of the intervention on generalization to tasks that were one, two, and three components different were also assessed. Results demonstrated a functional relationship between the introduction of the intervention and improvement in skill performance.

KEYWORDS

daily living skills, generalization, intellectual and developmental disabilities, self-determination skills

1 | INTRODUCTION

Becoming self-sufficient or independent adults is the goal for most high school graduates, including those young adults with intellectual and developmental disabilities (IDD). Self-sufficiency is a societal value commonly achieved through educational, employment, and independent living pursuits. Self-sufficiency is evaluated using the social construct of quality of life aimed at assessing the personal outcomes of individuals and the efficacy of program practices. Specifically, personal development and self-determination are the quality-of-life domains associated with positive postschool outcomes for young adults with IDD (Verdugo, Navas, Gómez, & Schalock, 2012). Behaviors associated with personal development include pursuing educational opportunities, developing personal skills, and performing adaptive behaviors. Exhibiting independence, goal setting, choice making, and decision making are behaviors related to self-determination. Despite daily living skills being the focus of most of their K-12 education, quality-of-life outcomes

for young adults with IDD have been persistently poor. The National Longitudinal Transition Study-2 (NLTS-2) found that 17% of young adults with autism, 36% of young adults with intellectual disabilities, and 16% of young adults with multiple disabilities live independently compared to 59% of the general population (Newman et al., 2011). Therefore, it is important to examine what contributes to these discrepancies among young adults without disabilities and those with IDD.

There are several factors that contribute to the lack of independence among young adults with IDD. In this paper, the authors will discuss factors relevant to daily living skills including environmental constraints due to living with family or other restrictive settings, the lack of self-determination, and barriers in achieving independence (Nota, Ferrari, Soresi, & Wehmeyer, 2007). Effective instruction in daily living skills results in higher levels of self-determination, which is being able to make things happen to improve one's life (Wehmeyer & Schalock, 2001). Acquisition of daily living skills also allows greater access and involvement in community settings and employment opportunities (Neef, Iwata, & Page, 1978; Test et al., 2009). Thus, identifying methods to address deficits in daily living skills will result in young adults with IDD being able to help themselves, rather than relying on others to meet their needs (Cullen & Alber-Morgan, 2015; Simmons-Reed, Cullen, Day, Izzo, & Colebaugh, 2013).

Given the important benefits of personal development of daily living skills and self-determination, it is imperative to examine where, what, and how to support their development. Although teaching daily living skills in the natural environment is the most effective method to facilitate generalization, findings from the NLTS-2 reveal that 85% of instruction occurs exclusively in K-12 special education classrooms (Chiang, Ni, & Lee, 2017). The needs of young adults with IDD endures into adulthood, with 80% of individuals classified as having significant problems completing daily living skills independently (Chiang et al., 2017). Identifying effective practices in natural settings to ensure young adults with IDD have equitable access to achieve their independent living goals continues to be a critical need (Nota et al., 2007).

College has long been considered the place for young adults to transition into independent, self-sufficient adults. College attendance is associated with increased earnings and higher employment rates for young adults with or without disabilities. Young adults between 25 and 34 with a bachelor's degree earned twice as much as those without a high school diploma and 62% more than high school graduates (Snyder, de Bray, & Dillow, 2016). Until recently, young adults with IDD were not afforded equitable access to college. For example, only 28% of young adults with autism attend college, despite the fact that 50% have average to above average intelligence. Due to increased mandates involving transition planning for students with disabilities and the Higher Education Opportunities Act (2008), inclusive college programs for young adults with IDD are now available. Emerging research findings from these inclusive college programs have found a similar positive relationship between college attendance and attainment of self-sufficiency. Young adults with IDD who attend inclusive college programs have higher rates of employment, higher wages, and increased independent living outcomes (Moore & Schelling, 2015). Therefore, developing effective instructional practices that facilitate independence and self-determination in the natural environment or less restrictive settings helps to close the gap between those with and without disabilities (Nota et al., 2007).

When determining what to teach, it is important to utilize evidence-based instructional practices. These practices include identification of the target skills, strategies for programming opportunities to practice and maintain the skills, and the coordination of supports and accommodations needed to generalize the performance of the skills across tasks and settings (Wehmeyer & Schalock, 2001). Two categories of daily living skills, known as activities of daily living (ADL's) and instrumental ADL's (IADL's), are important for planning instruction. ADL's are meaningful, functional personal care tasks such as eating, brushing teeth, bathing, and personal hygiene, and IADL's are skills such as cleaning, making meals, grocery shopping, and banking (American Occupational Therapy Association [AOTA], 2014). Skills that should be taught in self-determination include setting goals, problem solving, making choices, self-managing, and advocating for one's needs (Finn, Getzel, & McManus, 2008; Wehmeyer & Schalock, 2001).

How to teach or deliver the instruction effectively is an equally important consideration for teaching daily living and self-determination skills. Instructional methods that have been effective for teaching daily living skills to individuals with IDD include embedded practice in typical daily routines, simulations, in vivo or community-based instruction, and visual prompting (Steere & DiPipi-Hoy, 2012). Embedded practice consists of opportunities for practice

throughout the day in the participant's typical setting such as practicing money skills during math (Bambara, Koger, Burns, & Singley, 2016). Simulations take place in the participant's typical setting and include rehearsed practice of the daily living skill. An example of a simulation would be role playing purchasing groceries with items from the school snack bar and a fake debit card. Although these instructional methods utilize typical settings and routines, the opportunities to practice daily living skills are contrived and have limited generalization to natural environments. Alternatively, in vivo or community-based instruction for daily living skills occurs in the individual's natural environments such as home or community (Bambara et al., 2016). In community-based instruction on travel skills, the student would learn how to pay bus fare while riding the bus with visual, verbal, gestural, and/or physical prompts provided as needed. Another instructional method is visual prompting where a visual cue on what to do to complete the daily living skill is shown to an individual with IDD while they are completing the skill. Although these methods of instruction have been effective in promoting acquisition of daily living skills, they require support from others and encourage prompt dependency.

To maintain skills young adults with IDD require multiple daily or weekly opportunities to perform the skill over several months, and even more time to generalize the skills to other environments (Alwell & Cobb, 2009). However, findings from previous research indicate that mastery of independent performance of daily living skills requires both time and planning. Generalization refers to the occurrence of established behavior under different, untrained conditions, such as across subjects, settings, people, behaviors, and/or time (Stokes & Baer, 1977). Programming for generalization is an effective and efficient instructional practice, regardless of the instructional method used. Generalization allows new skills to emerge without having to directly teach them or results in less time spent teaching the skills (Alessi, 1987; Axe & Sainato, 2010). Interventions for daily living skills must systematically plan what generalization targets will be planned for, what strategies for generalization will be used, and how it will be assessed prior to implementation.

Several strategies to maximize generalization of instruction have been proposed for interventions including recombinative generalization, matrix training, stimulus equivalence, and using near and far generalization of acquired skills (Alessi, 1987; Axe & Sainato, 2010; Goldstein, 1983; Toglia, 1991). An example of utilizing stimulus equivalence in daily living skills would be: (a) teaching the student to match written names of food items to pictures of the items, (b) teaching the student to find food items in the grocery store when shown a picture, (c) then assessing whether the student could find the food items when shown the written name of the food item. In recombinative generalization, components of instructed tasks are recombined to assess generalization (Axe & Sainato, 2010; Goldstein, 1983). An example of recombinative generalization would be teaching a student to accurately measure ¼ cup flour, 1 cup vegetable oil, and 2 cups sugar, and then assessing whether they could accurately measure other variations such as 1 cup sugar, ¼ cup sugar, 2 cups flour, and 2 cups vegetable oil. Toglia (1991) proposed a degrees of generalization scale for identification of near and far transfer with near generalization representing a difference of one characteristic, intermediate transfer representing more than one physical difference, far transfer representing completely different components than the original task, and very far transfer representing use in everyday life away from the treatment task. Examples of transfer tasks for the original task of washing a small blue plate with a dishrag include: (a) near-washing small red plate during instruction; (b) intermediate-washing large red plate during instruction; (c) far-washing large red bowl during instruction; (d) very far-would be washing red and/or blue plates and/or bowls at home.

Application of generalization to daily living skills has to move beyond just thinking about it, to providing opportunities for practicing generalization of daily living skills, and providing supports that will allow continued performance of the skill. Despite findings evidencing the significant benefits of programming for generalization, very few studies on improving daily living skills address generalization. In a systematic literature review, Neely et al. (2016) identified several limitations in the current research on daily living skills. First, only 12 out of 32 (37.5%) of the studies assessed generalization effects. None of the studies assessed generalization effects systematically throughout the study. Only seven (32%) of the studies evaluated generalization tasks both before and after the intervention. Most of the studies reviewed focused on teaching isolated skills, rather than teaching individuals with IDD in a way that would enable their independence in natural settings (Neely et al., 2016).

An instructional method that can effectively increase the acquisition, maintenance, and generalization of both daily living skills and self-determination is self-prompting. Specifically, self-prompting is a form of self-management in which the individual utilizes an antecedent prompt to signal themselves as to what they need to do to complete a task.

Self-prompting includes textual prompts, picture prompts, video prompts, and computer-based self-instruction (Briggs et al., 1990; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010). Self-prompting has been effective in helping young adults learn and generalize daily living skills. Self-prompting eliminates the dependence on others because the cues can be utilized wherever the individual is and does not require another person to present the cues.

Increasingly, the use of mobile technology has emerged as an effective tool for self-prompting that allows instruction on daily living skills to occur in the natural environment (Bereznak, Ayres, Mechling, & Alexander, 2012; Mechling & Stephens, 2009). Additionally, the use of mobile technology provides young adults with IDD equitable access and opportunities to fully participate in and benefit from all areas of their communities (Bereznak et al., 2012). In an alternating treatments design study, video prompts were compared with picture prompts in teaching folding laundry and cooking pasta to two middle school students with IDD (Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010). The participants were able to complete the tasks more independently with fewer external prompts when using video prompting. In a similar adapted alternating treatments design study that compared video prompting to video modeling, Cannella-Malone et al. (2011) found that video prompting was more effective for teaching daily living skills to adolescents with IDD. Video prompting consisted of presenting the task in a step-by-step format where the individual watched a step, then completed the step, then watched the next step.

Programming for generalization of skills learned with self-prompting has occurred in limited ways, most often with varying the setting or altering materials used in the task. For example, Briggs, Alberto, Sharpton, Berlin, Mckinley, and Ritts (1990) utilized self-prompting to teach the use of a washer or dryer at school, and then assessed generalization of the device use at home. Similarly, Hansen and Morgan (2008) used three different supermarkets in their intervention for purchasing skills to assess whether participants could generalize the skill to new settings. Van Laarhoven et al. (2010) utilized a variety of brands of food, utensils, and appliances within the intervention to assess generalization of materials. In all of these examples, the same skill was assessed, with minimal differences. Only one study has looked at assessing the generalization of the skill learned to new skills (e.g., Trask-Tyler, Grossi, & Heward, 1994). Trask-Tyler et al. (1994) used an auditory prompting system to teach cooking skills and then assessed generalization by utilizing component skills of instructed recipes in new recipes or recombinative generalization.

In sum, young adults with IDD lack independence due to deficits in personal development and self-determination. Self-prompting using mobile technology is an effective intervention in help young adults with IDD in the acquisition, maintenance, and generalization of daily living skills. Previous research on self-prompting in teaching daily living skills to individuals with IDD has lacked in planning for, promoting, and assessing generalization.

To address some of these limitations, the purpose of this study was to determine the effects of self-directed video prompting on the acquisition and generalization of cleaning tasks to increase the independence of young adults with IDD. Specifically, the following research questions were addressed: (a) What are the effects of using self-directed video prompting to prompt acquisition and completion of cleaning cooking tasks by young adults with IDD who are striving to live independently?; (b) What are the effects of training a three element cleaning task (tool, cleaning solution, surface) on the generalization of three untrained cleaning tasks that differ by one (near generalization), two (intermediate generalization), and three components (far generalization)? (c) What do participant's say about the procedures, goals, and effects of using self-directed video prompting to learn cleaning tasks?

2 | METHODS

2.1 | Participants

Three adult males with an intellectual or developmental disability, ages 20–24 years old, were participants in this study (see Table 1 for characteristics of participants). The participants were selected for the study because they were in a postsecondary program for individuals with IDD, living in supported living or an apartment, away from parents/guardians, and were designated as lacking basic cleaning skills by program staff. None of the participants had participated in previous video modeling or video prompting interventions.

TABLE 1 Characteristics of participants

Name	Age	Race	Disability	IQ	Adaptive Behavior
Sid	22	Caucasian	Autism	74[a]	90
Allen	20	Caucasian	Intellectual disability and visual impairment	76[b]	72
James	24	Caucasian	Intellectual disability and TBI	70	68

[a]Differential Abilities Scale.
[b]Wechsler Abbreviated Scale of Intelligence.

Sid was a 22-year-old male with autism spectrum disorder. He was in his first year of the postsecondary program, and was sharing an apartment with a younger, college-age sibling and another participant in the postsecondary program. His IQ was below average, but he had higher than indicated adaptive behavior scores for intellectual disability, with a score of 90 on the Adaptive Behavior Assessment Scale. He was eligible for services from the County Board of Developmental Disabilities, based on significantly low independent living and self-care skills, as indicated by the state eligibility assessment for services.

Allen was a 20-year-old male with Down syndrome, who was in the first year of the postsecondary program. He was serviced under the category cognitive disability when in school, Ohio's equivalent category for intellectual disability that allowed IQ scores of up to 75 if deficits in adaptive behavior were also observed. Allen also had a mild visual impairment with corrected vision of 20/60. He received enlarged text for print, and he utilized settings on his computer to enlarge text on the screen. Allen was sharing an apartment with another participant in the program, and they had provider support for 20 hours per week in their home.

James was a 24-year-old with an intellectual disability and traumatic brain injury. He received services from his County Board of Developmental Disabilities. He had been out of school for 2 years, and he was in his first year in the postsecondary program. He alternated living with friends and a group home over the course of the study.

2.2 | Setting

The study was conducted in a break room at a classroom and medical building at a university in the Midwest. The break room consisted of five square tables arranged intermittently in the room and a counter high table along the back wall with stools. The food preparation area in the room consisted of a refrigerator, a sink, an L-shaped counter with cabinets below and above the counter. A built-in microwave was located above the counter. All cleaning supplies were located in the lower cabinet to the right of the sink. The setting was used by other individuals, but no one used the cabinet where the cleaning supplies were located. There were zero to six other individuals present across sessions other than the participants and staff.

2.3 | Materials

2.3.1 | Task analyses

One original cleaning task was selected (cleaning the table with Mr. Clean and a sponge). A task analysis for each task was developed from one researcher completing the task, whereas the second researcher wrote down the steps (see Table 2). Three variations that have one, two, or three components different were created from the original task (see Table 3). The task analyses were utilized in the creation of video prompts and in creating forms for recording-dependent variable data, procedural integrity, and interobserver agreement (IOA).

2.3.2 | Technology

An iPad 4 standard size was used throughout the study with the app MyPicsTalk, which allows video prompts to be easily recorded, combined, and adapted. Each step of the task was recorded using the iPad camera. The movies were then imported into the MyPicsTalk app. The videos were recorded from the viewpoint of a spectator, showing a model

TABLE 2 Original task and generalization adaptations

Task	Description
Original task	Cleaning a table with Mr. Clean and a sponge
One component different	Cleaning a table with Mr. Clean and a towel
Two components different	Cleaning a countertop with Mr. Clean and a towel
Three components different	Cleaning a microwave with dish soap and paper towels

TABLE 3 Matrix of original task components

Cleaning Tool	Sponge	Towel	Paper Towel
Cleaning product	409	Mr. Clean	Dish soap
Surface	Counter	Microwave	Table

performing the task with a one-sentence voice-over instruction that was recorded within the video-prompting clip (Legrice & Blampied, 1994). The main direction of the task was also shown in words using titles in the video. To use the MyPicsTalk app, the user must select the app from the home screen; navigate to the correct task and select it; touch the first step of the task; and then click play to start playing the step. Finally, after watching the video, the user can navigate to the next step by swiping or tapping the arrow with one finger.

2.3.3 | Cleaning supplies and debris

The cleaning supplies needed to complete the original task and variations were purchased prior to the study, and they remained in the same location throughout the study. The supplies used were 409, dish soap, Mr. Clean, paper towels, a cleaning towel, and a sponge. A counter, table, and microwave were already located in the setting where the study was conducted. A variety of items to use for debris were kept in a Rubbermaid container in a different cabinet than the cleaning supplies and restocked as necessary. Debris was used during sessions so that quality of cleaning could be assessed during a step. Otherwise, it would be difficult to determine if a participant had adequately wiped the surface. The debris items used in each session consisted of crumbs created from crushing four to five chips, crackers, or cookies, napkins (unused but crumpled up), clean plastic silverware, and food wrappers.

2.4 | Design

A single subject, multiple probe across subjects design was utilized to examine the effects of self-directed video prompting on the acquisition and generalization of daily living skills. Baseline condition data were collected on all participants over three to five trials. A multiple probe design across participants is appropriate when the same target behavior is being used across the participants, and it would be impractical to conduct a continuous baseline (Horner & Baer, 1978). In this study, it would have been impractical to have the participants complete the original cleaning task, plus the three variations of the task in each session. The first participant entered the experimental condition following three to five stable baseline points, whereas the other two participants continued with baseline condition. Each subsequent participant entered the experimental condition (staggered fashion) when the previous participant achieved three consecutive trials of 80% or greater steps completed correctly on the original cleaning task.

2.5 | Dependent variable

The dependent variable in the study was the percentage of steps of the targeted cleaning task completed correctly. The percentage of steps completed correctly was calculated by taking the number of steps completed correctly divided by the total number of steps. Participants were assessed on the original task in every session. The participants also completed one or two of the task variations in each session to measure the progress on acquiring the generalization

tasks. A step was counted correct if it met the time requirement, was completed correctly according to the task analysis (see Table 4), and was thorough in its completion (e.g., did not leave debris when wiping). A step was counted incorrect if it exceeded the time allotted, was not completed, was not thorough enough to be counted correct (e.g., left debris or did not wipe all the way to the edge), or was not completed correctly according to the task analysis. During intervention, the participant also had to begin a step within 5 seconds of the end of the video clip.

The time allotted for each step was calculated by video recording a college student without disabilities completing the task, calculating the time it took them to complete the step, and doubling the amount of time it took for each step. The time allotments for each step are included in the task analyses for the tasks (see Table 4). If the time for a step exceeded the allotted time, the step would have been counted incorrect, but this did not occur in the study. A secondary analysis of the percentage of steps of navigation of the iPad completed correctly was measured in intervention, to document any navigation challenges with the iPad or app.

2.6 | Procedures

2.6.1 | Baseline

Prior to the participant entering the break room, a handful of debris was placed on the surfaces to be cleaned. When participants entered the room, they were asked to clean (surface) with (cleaning solution) and (tool), with the items in parentheses being taken from whether they were completing the original task, one component different, two components different, or three components different. A multiple opportunity baseline procedure was used with the participant being asked to turn around when they missed a step or skipped a step, and the experimenter completing the step with the direction to continue cleaning. This method was used to prevent all of a task being counted wrong if they missed a step at the beginning.

2.6.2 | Preintervention training

Preintervention training was used to train the participants on how to use the device and app. The practice of using the iPad and MyPicsTalk app continued until the participant demonstrated the eight key aspects of usage and navigation for this intervention that included turning on the device, moving the arrow to access the home screen, selecting the app, navigating to the specified task, playing a clip, advancing sequentially through the clips until the task was completed, exiting the app, and turning off the iPad. After baseline data were stabilized, and the participants were ready to enter intervention, least to most prompting was paired with the completion of a training task (e.g., Mechling & Stephens, 2009).

The training task consisted of a series of steps for an assembly task. The task consisted of six steps in which the participant placed items in a specific order on an index card, including a standard size yellow post-it note, paper clip, a small post-it note flag, and a box of staples. This task was used because participants were unlikely to have a history of completing this exact task, so learning how to use the iPad to complete the task was likely to not be impacted by previous knowledge of the task. Participants had to correctly navigate the iPad and complete the training task with 90% accuracy across two trials. A task analysis checklist was developed that included steps for iPad usage and navigation. An error in navigation was defined as failing to complete any of eight steps. Error correction of task completion consisted of having students rewatch the video, then using least-to-most prompting to correct errors. An error in task completion was identified as failing to begin the first step of a task within 5 seconds of watching the video prompt, failing to complete the step within the maximum time allotted, failing to complete a step as specified in the task analysis, or completing a step out of sequence. A final phase of preintervention training involved the participant selecting the first task targeted for intervention from the task selection screen of MyPicsTalk for two of three trials.

2.6.3 | Intervention

During intervention, debris was placed on the table prior to the participant entering the break room. When participants entered the room at their scheduled time, they were asked to use the iPad in cleaning the table with Mr. Clean and a

TABLE 4 Task analyses for all tasks with allotted time per step in seconds

Original Task	One Component Different	Two Components Different	Three Components Different
Cleaning a Table with Mr. Clean and a Sponge	**Cleaning a Table with Mr. Clean and a Towel**	**Cleaning a Countertop with Mr. Clean and a Towel**	**Cleaning a Microwave with Dish Soap and Paper Towels**
1. Go get the sponge and the Mr. Clean-22	1. Go get the towel and the Mr. Clean-22	1. Go get the towel and the Mr. Clean-22	1. Get the paper towels and dish soap-28
2. Set items on the table-12	2. Set items on the table-12	2. Set items on the counter-8	2. Set items on the counter-6
3. Throw out trash or large pieces of food and move items before spraying or wiping-36	3. Throw out trash or large pieces of food and move items before spraying or wiping-36	3. Throw out trash or large pieces of food-20	3. Remove the glass turntable from the microwave and set on the counter-26
4. Make sure the spray nozzle is turned to "on" or "spray"-7	4. Make sure the spray nozzle is turned to "on" or "spray-7	4. Move the condiment items, coffee pot, and any items that are not trash off the counter-38	4. Throw out trash or large pieces of food-18
5. Spray the right half of the table with three to six squirts-14	5. Spray the right half of the table with three to six squirts-14	5. Make sure the spray nozzle is turned to "on" or "spray"-7	5. Tear off three paper towels-12
6. Start at the middle; go side to side until you have wiped the half of table you have sprayed. Stop when you reach the edge-42	6. Start at the middle and wipe side to side until you have wiped the half of table you have sprayed. Stop when you reach the edge-42	6. Spray the right half of the L-shaped counter with three to six squirts, starting at the line in the counter-22	6. Wet your paper towels with water from the sink tap-10
7. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-22	7. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-22	7. Start at the back, go side to side until you have wiped the half of counter you have sprayed. Stop when you reach the line on the counter-52	7. Open dish soap and squeeze three drops of dish soap onto your towel-36
8. Go to the other side of the table-3	8. Go to the other side of the table-3	8. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-22	8. Squeeze the towel two to three times or until you see foam-36
9. Spray the left half of the table with three squirts-13	9. Spray the left half of the table with three squirts-13	9. Go to the other side of the counter-8	9. Wipe the turntable side to side until you have wiped the entire turntable-32
10. Start at the middle, go side to side until you have wiped the half of table you have sprayed. Stop when you reach the edge-42	10. Start at the middle and wipe side to side until you have wiped the half of table you have sprayed.Stop when you reach the edge-42	10. Spray the left half of the counter with three squirts	10. Sweep any crumbs into one hand and throw them in the trashcan-14
11. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-22	11. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-22	11. Start at the back of the counter, go side to side until you have wiped the half of counter you have sprayed. Stop when you reach the edge-48	11. Wipe entire inside of microwave and be sure to pick up any crumbs with towel-92
12. Put your cleaning materials away-24	12. Put your cleaning materials away-24	12. When you get to the last row, sweep the crumbs into one hand and throw them in the trashcan-6	12. Wipe inside of door-18
		13. Put your cleaning materials away-20	13. Wipe outside of door and close it-20
		14. Put the coffee pot and condiments back on the counter-42	14. Rinse your towel until there is no more foam-28
			15. Wipe the entire turn table two more times to make sure there is no soap left on it-16
			16. Open door and wipe inside of microwave to make sure there is no soap left on it-50
			17. Wipe inside and outside of door to make sure there is no soap left on it-19
			18. Carefully place the turntable back in the microwave-33
			19. Close the microwave door-4
			20. Close the dish soap and put in cabinet-24
			21. Throw away paper towels-8

sponge. The same time allotments indicated previously were used (see Table 2). A system of least-to-most prompting was used for error correction of usage and navigation or for errors in task completion.

2.6.4 | Generalization

Performance on generalization tasks that varied by one, two, or three components of the original task was assessed in all phases of the study. Participants were asked to complete one to three of the generalization tasks depending on the time available for participation in the study that day, up to 25 total minutes for the session. Participants were also able to indicate after completion of any task or generalization task that they were ready to stop for the day. During generalization tasks, a single opportunity method was used with participants. The same directions as the baseline, "please clean (surface) with (cleaning solution) and (tool)" were used on the generalization tasks. The items in parentheses were replaced with the appropriate direction appropriate to the target task, dependent on which task variation they were completing. In a single opportunity method, no steps were completed by the experimenter for participants as they were completed in baseline. These procedures were varied for generalization tasks in intervention, because we wanted to assess the effectiveness of the video prompting for the original tasks on the performance of the generalization tasks.

2.6.5 | Maintenance; self-directed video prompting three component

After several sessions of stable intervention data with Sid where his performance of the original task was stable at 90–100%, a new phase was implemented at Sid's request. He was struggling with the three component task, as evidenced by a stagnant level of performance. The original task was put into maintenance with no further video prompting on that task. Self-directed video prompting with the three component different task was implemented for one session.

3 | RESULTS

Video prompting was effective in assisting all three participants in improving the accurate completion of cleaning tasks (see Figure 1). Data collected showed improvements for the original task, as well as the tasks that were one component different, two components different, and three components different. Data were also collected on the percentage of navigation steps each participant completed correctly. The percentage of steps of navigation completed correctly during the intervention was 99.6%. The only person who had incorrect steps in navigation was Sid. He skipped watching a step and navigated past it without watching it on two occasions.

For Sid, his performance during baseline on the original task was 50%. When intervention began, his accuracy improved to 90% and stayed at 90–100% throughout the intervention. Sid showed improvement in generalization of the one, two, and three component different tasks. Specifically, his baseline means improved from 35% to 90% during intervention for one component, from 35% to 75% for two component, and from 50% to 63% for three component. However, his performance on three component different tasks was stagnant, whereas for one and two component different tasks he continued to improve across sessions in intervention. Sid then asked why he couldn't learn to do the task using the iPad, and the researchers recorded video prompts for this task and implemented it in the next session. A resulting improvement occurred in the three component different task in the first session to 90% accuracy and performance continued to be 90–100% without any further video prompting sessions. Further improvement in the one and two component different tasks also occurred.

For Allen, his performance during baseline on the original task was 58–67%. When intervention began, his accuracy improved to 75–100% and stayed at 90–100% throughout the intervention. Allen showed gradual improvement in generalization of the one and three components different tasks, and a slight improvement in the two component different task. Specifically, his baseline means improved from 56% to 76% during intervention for one component, from 66% to 85% for two component, and from 32% to 71% for three component.

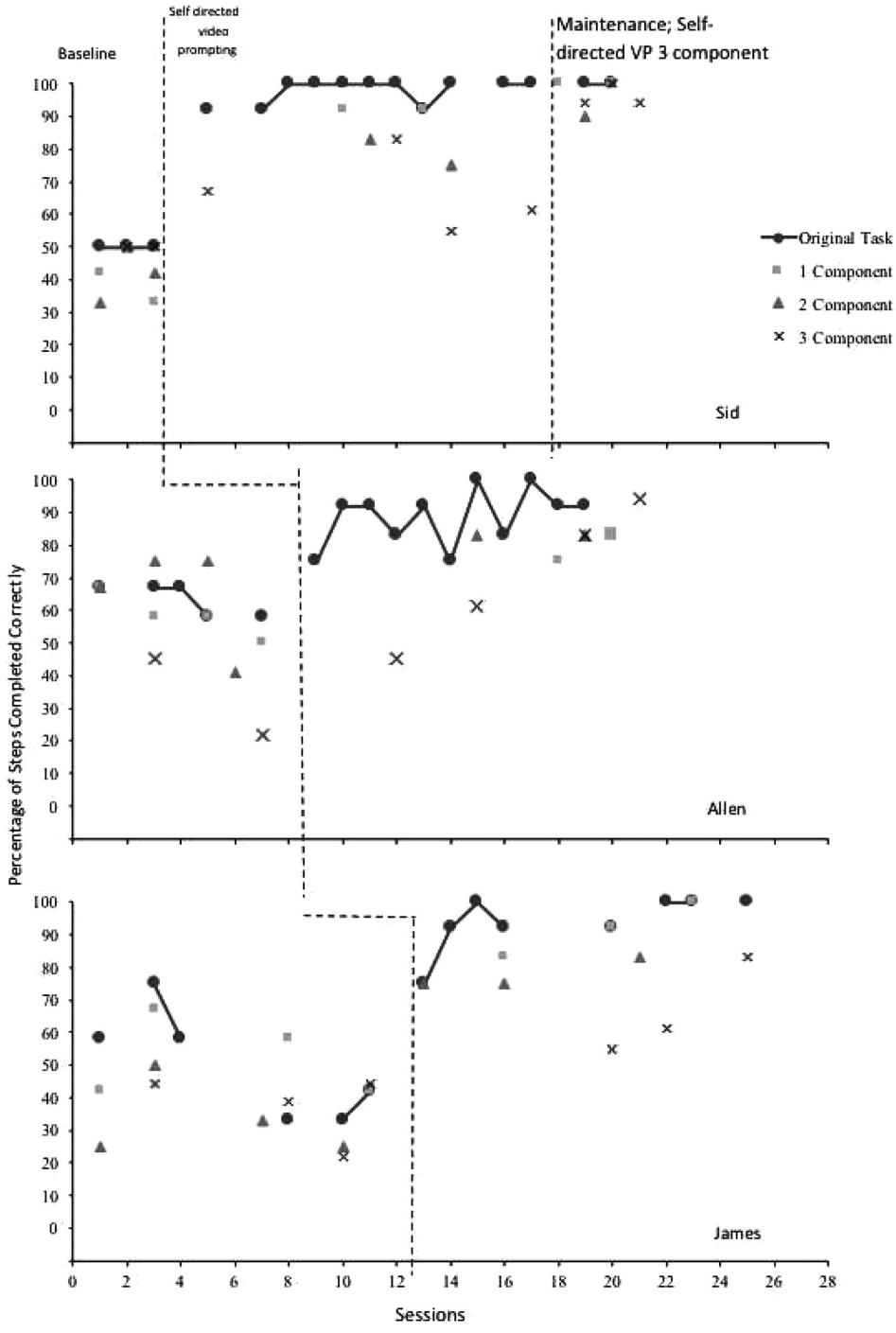

FIGURE 1 Percentage of steps completed correctly on original and generalization cleaning tasks

For James, his performance during baseline on the original task was 33–78%. When intervention began, his accuracy improved to 75% on the first intervention session and remained at 90–100% beginning with the second session. James showed gradual improvement in generalization of the one, two, and three component different tasks during the intervention. Specifically, his baseline means improved from 52% to 90% during intervention for one component, from 32% to 83% for two component, and from 39% to 70% for three component.

3.1 | Interobserver agreement

IOA is used in single-subject research to assess measurement quality and to increase the believability of the data (Cooper, Heron, & Heward, 2007). Specifically, IOA is the degree to which two or more observers independently reporting the same values or data for the dependent variable (Cooper et al., 2007). IOA was calculated across all phases of the study for all participants. IOA was measured using trial-by-trial IOA for the percentage of steps completed correctly on tasks navigation accuracy. The number of agreements was divided by the total number of trials and then multiplied by 100 to give a percentage of agreement. Two doctoral students, one in occupational therapy and the other in special education performed the duties of experimenter and interobserver, depending on their availability and corresponding availability of students. The experimenter directed sessions and provided prompts and interventions. Video data and in-person data collection were used for IOA. IOA was assessed in 25% or more of each participant's sessions in baseline and in intervention. The individual participant's IOA was 89–100% with an overall IOA of 93% for the study.

3.2 | Treatment integrity

Treatment integrity is the extent to which the intervention as implemented in the study matched the procedures identified in the methods and demonstrates internal validity (Cooper et al., 2007). Treatment integrity was assessed through a procedural integrity checklist used to document how closely the experimenter followed the procedures for baseline, intervention, and generalization. The number of steps completed correctly was divided by the total number of steps to determine the percentage of steps completed correctly. The mean treatment integrity score for the study was 97% and was assessed in 25–34% of sessions for each participant.

4 | DISCUSSION

The purpose of this study was to examine the effectiveness of self-directed video prompting on the acquisition and generalization of cleaning tasks to increase the independence of young adults with IDD. The results of this study support previous research that found that self-directed video prompting is an effective method for improving the acquisition of daily living skills (e.g., Bereznak et al., 2012; Mechling & Stephens, 2009; Van Laarhoven et al., 2010). However, this study extends previous research because it programmed for near, immediate, and far generalization of tasks and promotes the development of self-determination

4.1 | Effectiveness of self-directed video prompting on acquisition

The results of this study indicate that self-directed video prompting is effective at promoting the acquisition of daily living tasks. All three participants acquired the initial daily living skills task of cleaning a table with Mr. Clean and a sponge. A functional relationship between the introduction of the intervention and improvement in daily living skills was demonstrated. One way to assess the effectiveness of single-subject research studies is to examine the overlap between baseline and intervention. Determining the percentage of nonoverlapping data (PND) points between baseline and intervention is a way to assess the effectiveness of an intervention (Scruggs & Mastropieri, 1998). Specifically, the percentage of intervention data points that do not exceed the highest baseline data is calculated for each participant and the mean of those scores is the PND study score (Scruggs & Mastropieri, 1998). The mean PND for this study was 97%, which meets established criteria for being considered very effective (Scruggs & Mastropieri, 1998).

4.2 | The effectiveness of self-directed video prompting on generalization

The findings from this study demonstrate that self-directed video prompting is effective at promoting generalization of daily living tasks. Generalization probes demonstrated improvement across all tasks during intervention, with near generalization tasks that differed by one component having the most immediate improvement. There was also a gradual improvement in intermediate and far generalization tasks of two and three components different. Even though

Sid required one session of video prompting for the three component different task, this was much less than what was needed to learn the original task. However, generalization was still demonstrated because it took fewer sessions to learn this task than it did to learn the original task through video prompting (Alessi, 1987). Given the findings from this study, the use of self-directed video prompting has the potential to have a positive impact on the lives of young adults with IDD. By facilitating them in acquiring the necessary daily living skills essential to adulthood, young adults have the opportunity to participate in all aspects of their community, including employment and recreation. Maximizing the use of effective interventions that program for generalization and promote self-determination minimizes barriers in the acquisition of tasks and transfer of skills to natural environments by individuals with IDD. This is critical because the time period of 3–4 months or more that it typically takes to acquire daily living tasks by individuals with IDD is not practical in school settings (Alwell & Cobb, 2009).

4.3 | Social validity of self-directed video prompting

Individuals with IDD in this study who utilized self-directed video prompting indicated that it was an intervention that they thought was beneficial to them. Social validity is the extent to which the target behaviors, intervention procedures, and effects of the intervention are acceptable to the participants of the study (Cooper et al., 2007). Social validity was assessed through a social validity questionnaire given to the participants and was read orally to them to eliminate any reading challenges with the questionnaire. The questionnaire consisted of questions about the task, the procedures, and the effect. The participants indicated that they liked using the iPad to complete the cleaning task and that they thought it helped them to do better on the cleaning tasks.

4.4 | Limitations and future research

There are several limitations in this study that need to be addressed in future research studies. First, this study had only three participants and although it demonstrated effectiveness among those participants, replication of single-subject studies is essential to demonstrate the effectiveness of interventions. Replicating this study across more populations, settings, and levels will provide additional evidence of video prompting as an effective intervention for daily living skills. Furthermore, it will demonstrate that it is effective at not only teaching acquisition of tasks, but also in promoting generalization of tasks.

This study focused on daily living tasks, but vocational and academic tasks also have components that could be varied to see if self-directed video prompting will also promote near, intermediate, and far generalization of tasks. Future research should examine effects of self-directed video prompting on vocational and academic tasks. In addition, to the previously mentioned limitations, prompts were not faded in this study. Participants continued to utilize self-directed video prompting throughout this study for the original cleaning task until the study concluded. However, when Sid began self-directed video prompting for the three component different task, he moved into a maintenance phase with the original task where he completed the task without the video prompts. Future research studies should determine the best procedures for fading video prompts, and evaluate the extent to which participants successfully maintain skills over time and across environments.

4.5 | Implications and recommendations for practice in schools

This study supports previous research that demonstrated benefits for the use of video prompting for teaching daily living skills (e. g., Bereznak et al., 2012; Van Laarhoven et al., 2010). However, several considerations for practice are important when implementing the procedures of this study. First, implementing video prompting with one task can promote the acquisition of additional tasks. Actively planning with participants for the selection of tasks and setting goals for acquiring future tasks of daily living skills can be a part of supporting participants developing self-determination skills, and should be included in the transition planning of young adults with disabilities. In secondary and postsecondary settings, a bank of tasks could be created and individualized for facilitating the acquisition, generalization, and maintenance of key daily living skills. This type of innovative instruction can be implemented across tasks

and environments to allow students to have the opportunity to not only generalize the skills to include a wide range of tasks, but also to allow them to act in a self-directed manner using mobile technology to support them, rather than waiting for others to prompt them on what to do. Programming for generalization using tasks that differ by single and multiple components and actively measuring whether generalization occurs can help maximize learning and instructional resources, to ultimately support young adults with IDD to achieve their personal goals. This intervention has the potential to decrease demands on caregivers, and thus increase self-esteem and self-reliance of individuals with IDD.

5 | CONCLUSION

This article described the results of a self-directed video prompting research study. The results of the study found that the intervention was effective in helping three male participants with IDD, in a postsecondary program, acquire needed daily living skills for living independently in an apartment. Prior to beginning intervention, participants were trained to use an iPad with the MyPicsTalk app through a training package of a training task paired with least to most prompting. Participants were also able to generalize to both near and far generalization tasks. This research can have a positive impact on the lives of young adults with IDD, as well as service providers and educators serving transitioning age youth and young adults with IDD. By helping them acquire, generalize, and maintain the necessary skills for independent living in an instructionally efficient manner, transitioning youth and young adults with disabilities have the opportunity to act in a self-determined manner, which has been correlated with improved quality-of-life outcomes.

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REFERENCES

Alessi, G. (1987). Generative strategies and teaching for generalization. *Analysis of Verbal Behavior*, *5*, 15–27.

Alwell, M., & Cobb, B. (2009). Functional life skills curricular interventions for youth with disabilities: A systematic review. *Career Development for Exceptional Individuals*, *32*, 82–93.

American Occupational Therapy Association (AOTA). (2014). Occupational therapy practice framework: Domain and process (3rd ed.). *American Journal of Occupational Therapy*, *68*(Suppl. 1), S1–S48.

Axe, J. B., & Sainato, D. M. (2010). Matrix training of preliterate skills with preschoolers with autism. *Journal of Applied Behavior Analysis*, *43*, 635–652.

Bambara, L. M., Koger, F., Burns, R., & Singley, D. (2016). Skills for home and community. In F. Brown, J. McDonnell, & M. Snell (Eds.), *Instruction of students with severe disabilities* (8th ed., pp. 438–473). Upper Saddle River, NJ: Pearson.

Bereznak, S., Ayres, K., Mechling, L., & Alexander, J. (2012). Video self-prompting and mobile technology to increase daily living and vocational independence for students with autism spectrum disorders. *Journal of Developmental and Physical Disabilities*, *24*, 269–285.

Briggs, A., Alberto, P., Sharpton, W., Berlin, K., Mckinley, C., & Ritts, C. (1990). Generalized use of a self-operated audio prompt system. *Education and Training in Mental Retardation*, *25*, 381–389.

Cannella-Malone, H., Fleming, C., Chung, Y. C., Wheeler, G., Basbagill, A., & Singh, A. (2011). Teaching daily living skills to seven individuals with severe intellectual disabilities: A comparison of video prompting to video modeling. *Journal of Positive Behavior Interventions*, *13*, 144–153.

Chiang, H. M., Ni, X., & Lee, Y. S. (2017). Life skills training for middle and high school students with autism. *Journal of Autism and Developmental Disorders*, *47*(4), 1113–1121.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Cullen, J. M., & Alber-Morgan, S. R. (2015). Technology-mediated self-prompting of daily living skills for adolescents and adults with disabilities: A review of the literature. *Education & Training in Autism and Developmental Disabilities*, *50*, 43–55.

Finn, D., Getzel, E. E., & McManus, S. (2008). Adapting the self-determined learning model of instruction for college students with disabilities. *Career Development for Exceptional Individuals*, *31*, 85–93.

Goldstein, H. (1983). Recombinative generalization: Relationships between environmental conditions and the linguistic repertoires of language learners. *Analysis & Intervention in Developmental Disabilities*, *3*, 279–293.

Hansen, D. L., & Morgan, R. L. (2008). Teaching grocery store purchasing skills to students with intellectual disabilities using a computer-based instruction program. *Education and Training in Developmental Disabilities*, *43*, 431–442.

Higher Education Opportunities Act of 2008, Public Law 110-314, 20 U.S.C. §§ 1001 et seq.

Horner, R. D., & Baer, D. M. (1978). Multiple-probe technique: A variation of the multiple baseline. *Journal of Applied Behavior Analysis*, *11*, 189–196.

LeGrice, B., & Blampied, N. M. (1994). Training pupils with intellectual disability to operate educational technology using video prompting. *Education and Training in Mental Retardation and Developmental Disabilities*, *29*, 321–330.

Mechling, L. C., & Stephens, E. (2009). Comparison of self-prompting of cooking skills via picture-based cookbooks and video recipes. *Education and Training in Developmental Disabilities*, *44*, 218–236.

Moore, E. J., & Schelling, A. (2015). Postsecondary inclusion for individuals with an intellectual disability and its effects on employment. *Journal of Intellectual Disabilities*, *19*, 130–148.

Neef, N. A., Iwata, B. A., & Page, T. J. (1978). Public transportation training: In vivo versus classroom instruction. *Journal of Applied Behavior Analysis*, *11*, 331–344.

Neely, L. C., Ganz, J. B., Davis, J. L., Boles, M. B., Hong, E. R., Ninci, J., & Gilliland, W. D. (2016). Generalization and maintenance of functional living skills for individuals with autism spectrum disorder: A review and meta-analysis. *Review Journal of Autism and Developmental Disorders*, *3*, 37–47.

Newman, L., Wagner, M., Knokey, A. M., Marder, C., Nagle, K., Shaver, D., … Schwarting, M. (2011). The post-high school outcomes of young adults with disabilities up to 8 years after high school. *A report from the National Longitudinal Transition Study-2 (NLTS2) (NCSER 2011–3005)*. Menlo Park, CA: SRI International. Retrieved from www.nlts2.org/reports/

Nota, L., Ferrari, L., Soresi, S., & Wehmeyer, M. L. (2007). Self-determination, social abilities and the quality of life of people with intellectual disability. *Journal of Intellectual Disability Research*, *51*, 850–865.

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing single-subject research: Issues and applications. *Behavior Modification*, *22*, 221–242.

Simmons-Reed, E., Cullen, J. M., Day, K., Izzo, M., & Colebaugh, L. B. (2013). Voices of self-determined students with intellectual and developmental disabilities in postsecondary settings. *National Gateway to Self-Determination*, *6*, 2–5.

Snyder, T.D., de Brey, C., and Dillow, S.A. (2016). Digest of Education Statistics 2015 (NCES 2016-014). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Steere, D. E., & DiPipi-Hoy, C. (2012). When you can't get out: Strategies for supporting community-based instruction. *TEACHING Exceptional Children*, *45*, 60–67.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, *10*, 349–367.

Test, D. W., Mazzotti, V. L., Mustian, A. L., Fowler, C. H., Kortering, L., & Kohler, P. (2009). Evidence-based secondary transition predictors for improving postschool outcomes for students with disabilities. *Career Development for Exceptional Individuals*, *32*, 160–181

Toglia, J. (1991). Generalization of treatment: A multi-context approach to cognitive perceptual impairment in adults with brain injury. *American Journal of Occupational Therapy*, *45*, 505–515.

Trask-Tyler, S. A., Grossi, T. A., & Heward, W. L. (1994). Teaching young adults with developmental disabilities and visual impairments to use tape-recorded recipes: Acquisition, generalization, and maintenance of cooking skills. *Journal of Behavioral Education*, *4*, 283–311.

Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R., & Valentino, J. (2010). A comparison of picture and video prompts to teach daily living skills to individuals with autism. *Focus on Autism and Other Developmental Disabilities*, *25*, 195–208.

Verdugo, M. A., Navas, P., Gómez, L. E., & Schalock, R. L. (2012). The concept of quality of life and its role in enhancing human rights in the field of intellectual disability. *Journal Of Intellectual Disability Research*, *56*, 1036–1045.

Wehmeyer, M. L., & Schalock, R. L. (2001). Self-determination and quality of life: Implications for special education services and supports. *Focus on Exceptional Children*, *33*, 1–16.

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