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ORIGINAL PAPER

Paraprofessional-Delivered Video Prompting to Teach Academics to Students with Severe Disabilities in Inclusive Settings

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Abstract
Video prompting is effective for teaching a variety of skills (e.g., daily living, communication) to students with autism and intellectual disability; yet, little research exists on the efficacy of these strategies on academic skills, in inclusive settings, and with typical intervention agents. Authors collaborated with paraprofessionals to select socially important academic skills (i.e., literacy, social studies, science, and math) aligned with students' IEPs and content taught in their inclusive classes. Results from the multiple probe across participants and skills design indicated a functional relation between the paraprofessional-delivered video prompting and correct responding to academic tasks for all three elementary students with autism and intellectual disability. Implications for practitioners, study limitations, and recommendations for future research are discussed.

Keywords Video prompting · Paraprofessionals · Core content academics · Autism · Intellectual disability · Inclusion

Introduction

Complex technologies that once required large, expensive equipment (e.g., personal computers) and were previously understood only by trained professionals now rest and run efficiently in the hands of children in the form of portable, affordable tablets and smartphones. In terms of education, technology is radically changing the way in which teachers instruct and students learn. Many schools are rapidly acquiring digital learning tools aimed at increasing student engagement, independence, and differentiating learning for students with varying ability. With the influx of technology comes many built-in accessibility features across platforms, allowing individuals with varying ability to access to the same information and learning opportunities once reserved only for those considered to be tech-savvy. As a result, even individuals with high support needs have seen impressive improvements across various domains of their lives including communication skills, daily living skills, and vocational skills, to name a few (e.g., Wehmeyer et al. 2006).

The use of technology to teach students with high support needs, including autism spectrum disorder (ASD) and intellectual disability (ID), has support in the literature (e.g., [Authors]; Root et al. 2017). Specifically, video modeling (VM) interventions, including video prompting (VP), have been used to teach social skills (e.g., Simpson et al. 2004), self-help and domestic skills (e.g., Mechling et al. 2008; Norman et al. 2001) to students with ASD (Domire and Wolfe 2014) and ASD and/or ID (i.e., ASD/ID; Banda et al. 2011). In fact, Wong et al. (2014) found enough empirical evidence to determine VM an evidence-based practice (EBP) for teaching social, communication, and play skills to students with ASD. Furthermore, reviews of the literature found VM to be an effective intervention in teaching daily living skills (e.g., cooking, setting the table, putting away groceries), vocational skills (e.g., operating a computer,

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mopping, cleaning kennels), and self-care skills (e.g., shoe tying; Banda et al. 2011; Domire and Wolfe 2014).

VMs use pre-recorded simulations of a targeted skill as a model for a student's behavior (Mason et al. 2013). Once VM are created, students watch the entire simulation and complete the skill based on the video with the goal of independence (Banda et al. 2007). The basis for VM stems from Bandura and Walters (1977) social learning theory, suggesting learning can occur through the observation of a model without having to experience the behavior for oneself (Bellini and Akullian 2007). VM provides a frame of reference for students with autism to observe and imitate targeted skills effectively (McCoy and Hermansen 2007). Recent studies confirm Bandura's social learning theory to support VM (e.g. Cihak and Schrader 2008; Ergenekon et al. 2014). For example, Ergenekon et al. (2014) compared live and VM on the acquisition, maintenance, and generalization of chained skills (e.g., daily living skills, play skills), finding that children aged 5–10 with ASD learned skills through both methods. Cihak and Schrader (2008) compared video self-modeling to video adult modeling with four adolescents with ASD on vocational and pre-vocational chained tasks, finding that while both were effective, video self-modeling was more efficient for two students, video adult modeling was more efficient for one student, and one student did not show a preference.

While VM is an established intervention for teaching a range of skills to students with ASD and ID, VP has less support in the literature, especially for teaching academic skills (Kellems et al. 2016). VP interventions extend upon VM as students view and complete incremental steps of the behavior before completing subsequent steps (Cannella-Malone et al. 2011). One potential reason is academic tasks may be more difficult to embed generalization than social and communication skills. For example, one topography for a learned social greeting (e.g., "Hello") can be programmed to generalize to many social situations (e.g., greeting a peer, greeting a teacher, greeting a stranger, addressing a large crowd). This is not the case for topographies of many academic skills. For instance, the ability to read one sight word (e.g., "cat") does not extend to most other words (e.g., "dog") without knowledge of phonics, and the ability to add 4 and 6 does not extend to the problem "5 + 2" without knowledge of computation. Due to the difficulty many students with ASD and ID have in skill generalization, it is important to identify a broad range of interventions suitable for teaching a range of skills, including academics.

Despite the possibilities that VM and VP have for increasing student engagement and skill in classrooms, a recent survey found that more than 60% of teachers report never using them (Authors). In addition to the specific challenges of teaching academic skills using VP, additional barriers exist. While Banda et al. (2007) outline 11 steps for developing and implementing a VM intervention, many are outdated or pose challenges for untrained personnel. First, authors recommend using digital or VHS camcorders to record the model's behavior, creating videotapes or DVDs using editing software. These components by themselves require many smaller steps and considerable technical savvy with multiple pieces of equipment (e.g., camcorders, software, DVD burners and players). Second, video and DVD players are often not portable restricting their use to secluded and unnatural settings. Carnahan et al. (2012) cite the lack of portability and the high cost of creating videos to be the two major obstacles in implementing a VM intervention. Recent advancements have made VM and VP more amenable to and affordable for instructors who do not have the tools and resources for a time intensive, difficult, and expensive production.

Technology (i.e., devices and software) that is quick, easy to use and implement, and inexpensive is critical if practitioners are expected to use methods such as VP in applied settings; however, staff who are untrained, technophobic, or who are not given the opportunity could prevent students with disabilities from having access to effective digital learning opportunities. Previous articles describe multiple devices required for creating, editing, and viewing VM such as camcorders, computer software, DVD players, and televisions that can be aversive to staff unfamiliar with each device (e.g., Banda et al. 2007). Using devices and software that are readily accessible and user-friendly is particularly important when paraprofessionals (e.g., teaching assistants, educational assistants)—generally required to have minimal relevant training—provide the most intensive support to students with the most complex needs (Giangreco and Broer 2005). Fortunately, the availability of commonplace devices (e.g., smartphones, tablets) and easy-to-use software applications could allow any staff member to create VP interventions to use with their students unobtrusively across settings minimizing resistance to the technology by using one familiar device. With new technology comes accessibility to both students and teachers, inviting new possibilities to incorporate VP into classrooms.

Recent studies provide some preliminary evidence for using VM as an effective intervention for teaching academic skills of: money skills (Burton et al. 2013; Weng and Bouck 2014), subtracting fractions (Yakubova et al. 2015), academic responses in science lessons (Hart and Whalon 2012), reading grocery store words (Mechling et al. 2002), and pronunciation and vocabulary (Morlock et al. 2015). Results of these studies indicate three key findings (a) increased independence and decreased need for adult support in skill acquisition, (b) decreased attention and language requirements necessary to access the intervention, and (c) observational learning and individualization was capitalized on to increase the likelihood of success (Morlock et al. 2015).

While promising, these studies are not without their limitations. First, interventions across all of the VM studies teaching academic skills were implemented in special education classroom or separate schools. Second, procedures were implemented primarily by researchers, rather than typical intervention agents. Third, multiple devices (e.g., camcorder to record and iPad to view) were used in the creation of the videos, and one study that used an outside production company (Morlock et al. 2015). Together these limitations suggest a need for an easy to implement technology package utilized by typical intervention agents (e.g., paraprofessionals) in various settings, including general education classrooms. To support this aim, studies show paraprofessionals can be trained to implement behaviorally-based interventions in general education classrooms (e.g., Brock and Carter 2015, 2016).

Although paraprofessionals have been trained to provide support in general education classrooms, VM should also be considered for use in general education contexts, as they are less stigmatizing than the use of paraprofessionals. Many children use tablets but most do not have an adult "assigned" to work closely with them. Further, VM are consistent, can be repeated as many times as needed for the student to learn skills, and can reduce over-reliance and prompt dependency from adults. When provided with supports such as VM, individuals can live more autonomous lives through the decreased dependence on caregivers (Spriggs et al. 2015).

The purpose of the study was to collaborate with paraprofessionals and train them to deliver a VP intervention to teach academic skills to elementary students with ASD/ID within general education classroom settings. In conducting this study, the researchers first met with stakeholders (i.e., paraprofessionals, assistant principal, general and special educators) to determine individualized skills that: (a) aligned with the students' Individualized Education Plans (IEPs); (b) stakeholders thought were socially valid; and (c) aligned with content currently taught to typically-developing peers in the general education setting. Second, we collaborated with paraprofessionals to create and deliver the VP package to students with ASD/ID. In doing so, the study sought to answer two research questions.

1. Is there functional relation between a paraprofessional-delivered VP intervention and grade-aligned, academic skill acquisition by three students with ASD/ID in general education settings?
2. What are paraprofessionals' and general education teachers' views toward using a VP intervention within inclusive classroom settings?

Method

Participants

Students

Three elementary students who met the inclusion criteria of: (a) documented eligibility for special education services with an educational disability of ASD/ID; (b) elementary aged; (c) inclusion within a general education class for at least one content area class per day; (d) eligible (or likely eligible if too young) for the alternate assessment; (e) the need to learn academic skills; and (f) no previous experience with VP. Each student had a one-to-one paraprofessional support assigned by the school district to work with them in the general education classroom.

Kingston was a 10 year, 6 month-old, Caucasian male diagnosed with an ID and Down Syndrome. Based on school records, he met educational eligibility under ID and autism in the mild to moderate range (total raw score = 35) based on the *Childhood Autism Rating Scale: Second Edition (CARS-2;* Schopler et al. 2002*)*. He obtained a full-scale IQ score of 52 (*Reynold's Intellectual Assessment Scales;* Reynolds and Kamphaus 2003). His reports did not indicate an ASD diagnosis. He spent 13.75 h per week in the general education classroom for academic instruction and attended all related arts, lunch, and special events with peers. One of his IEP goals in math was to compute single-digit addition and subtraction problems using visual supports. In his inclusive math class, students were identifying fractions with like denominators using visual supports. Kingston was ambulatory and very social but was sometimes unintelligible in conversations with novel partners. He frequently repeated information not on topic, and worked best when given clear directions and frequent attentional cues and reinforcement.

Mallory was a 10 year, 8 month-old Hispanic female served under the educational eligibility of autism. On the *Comprehensive Test of Nonverbal Intelligence: Second Edition (CTONI-2*; Hammill et al. 1997*)*, she scored 59 for the full scale evaluation. On the *CARS-2*, she received a total raw score of 40.5. Mallory also had an ASD diagnosis. She spent 12.5 h per week in the general education classroom for academic instruction and attended all related arts, lunch, and special events with peers. Mallory benefited from an established routine and would occasionally elope from a setting if left unattended. Mallory rarely initiated social interactions; however, when she did initiate communication with an adult, it typically pertained to reinforcement for her token board (which was used to promote on-task behavior) or to ask where a preferred adult was going. One of her IEP goals was to answer wh- questions to identify story elements. In her inclusive social studies class, students were learning about continents and countries of the world. In her inclusive science class, students were learning about ecosystems and habitats. In all areas, Mallory relied heavily on subtle prompts (e.g., eye gaze; pause in responding) from adults during instructional tasks.

Mateo was a 7 year, 8 month old–old, Hispanic male served under the educational eligibility of autism (*CARS-2* assessment). The available evaluation report, conducted prior to age three, did not include an IQ score or total raw score but indicated significant deficits consistent with a diagnosis of ID according to results of the Battelle Developmental Inventory—2nd Edition (Newborg 2005). Mateo had a diagnosis of ASD using the Autism Diagnostic Observation Schedule—2nd edition (ADOS-2; Lord et al. 2012). According to his IEP, two goals addressed receptively identifying 15 upper-case letters and numbers up to 20. He was included in general education classes for 2.5 h per week and attended all related arts, lunch, and special activities. Students in his inclusive classroom were expected to review previously learned content and/or journal based on teacher provided prompts. Mateo occasionally engaged in attention-seeking behaviors such as spitting and escape-maintained behaviors (e.g., crying) when presented with non-preferred activities. He rarely initiated social interactions with adults or peers and used gestures to most efficiently communicate his needs. During recreation time, Mateo preferred listening to songs, getting tickled, and swinging. When presented with novel tasks, he would engage in repetitive and ritualistic behaviors, such as picking up materials and tapping them to his chest or bouncing them on the desk, but would not ask for the help.

Classroom Teachers

Three general education classroom teachers: (a) were certified to teach (e.g., early childhood pre-K to 3rd grade; ESL pre-K -12; elementary K-6); (b) had completed or were working on a Master's degree; and (c) had more than one year of teaching experience. The number of years of experience working with students with ASD or ID is not available.

Paraprofessionals

Kingston's paraprofessional, Tammy, had worked as a paraprofessional for students with ASD and ID 4 years, and it was her first year at that school. She had an Associate's degree in an unrelated field and held no other certifications. Mallory's paraprofessional, Claudia, had worked three and a half years as a paraprofessional with Mallory, and it was her first year at that school. She had a Bachelor's degree in an unrelated field and held no other certifications. She reported having some experience in discrete trial training (DTT). Mateo's paraprofessional, Autumn, had worked three years as a paraprofessional for students with ASD and ID, and she was hired half way through the school year for that school. She had a high school diploma and did not have any other certifications. None of the paraprofessionals had experience working with VP or on previous educational research projects.

Setting

The study took place in an elementary, Title 1 school (i.e., at least 40% of students come from low income families as defined by the U.S. Department of Education), in an urban, southeastern school district in the United States. Fifty-three percent of students qualified for free and reduced price lunch as defined by the U.S. Department of Agriculture; 59% of students were Caucasian, 22% Black, 10% Hispanic, and 8% Asian. Sessions were conducted in the inclusive classroom unless there was a complication in which sessions were conducted in the special education classroom (e.g., paraprofessional absences, changes in schedule). The inclusive classrooms contained one general education teacher, 20–25 students, and the paraprofessional assigned to the student with ASD/ID.

Materials and Equipment

The materials included a Samsung tablet (7" Samsung Galaxy Tab 4–8 GB; $149.99) and a VivaVideo tablet application (VivaVideo, $2.99) used to create and deliver VP. The VP clip was a researcher and paraprofessional produced video using the first-person point of view (of an adult's hands completing the targeted skill) with narration of each step of the task analysis. The six videos (i.e., two videos per student) ranged in length from 1 min 2 s to 7 min with an average duration of 3 min and 48 s. Kingston's first video showed how to complete a worksheet with two rows of four double-digit addition problems using Touch Math (Bullock et al. 1989) on the numerals, which were faded from problem to problem. His second video illustrated the steps for completing a worksheet with a regular polygon divided into equal parts, directions to color the pieces three colors (red, green, blue), and three questions asking to generate the fraction for each color (e.g., "What fraction of the octagon is red?"). Generalization was assessed in each trial. Mallory's first video showed the steps to sort six example animal picture cards for each habitat (i.e., tundra and desert) and four non-example cards on each using a rule relationship (e.g., "This animal has white, fuzzy fur to keep it warm."). Her second video illustrated how to complete a five-page book, with each page including a statement about the geographic location (e.g., planets, continents, states), four response options, and an area to place the correct response. Mateo's first video showed how to spell his name using a book with five half pages (one for each letter) with four option cards from which to select the correct letter and one full page with five blank spaces at the bottom for him to order the correct letters. His second video showed two papers with a number on each (i.e., 1 and 5), number cards with the matching numeral and quantity of dots, and objects to place on each dot (i.e., unifix cubes). Each video was recorded and edited using the VivaVideo app, then saved to the tablet, which was used to show the VP.

Dependent Variable and Data Collection

The dependent variable was percent of independent, correct steps completed in the task analysis for the academic skill. For each step, students' responses were recorded as correct in any of three ways if he or she completed the step accurately (1) within 10 s of the task direction, or (2) within 10 s of the completion of the previous step. An incorrect response was recorded if the student did not initiate and/or complete a step correctly within 10 s or if the student did not respond to a behavioral prompt. If students gave an incorrect response, all subsequent steps were marked incorrect, and the trial was ended. During intervention, the videos could be re-watched, and allowable adult prompts included behavioral prompts (e.g., verbal prompts such as "Let's watch again"; "Now you try"; gestural prompts towards the video, pausing, or rewinding the video). Instructional prompts (i.e., prompts indicating the correct response) were not permitted during baseline or intervention conditions. No other prompts were used. During baseline, VP were not available to determine the skills students had in their repertoire. Data were collected using a step-by-step format where each step in the task analysis was evaluated. Percent correct was calculated by adding the number of steps completed independently, dividing by total number of steps, multiplied by 100. Only accurate completion of the steps demonstrating that learning the matching, spelling, or computation was counted as correct; neither engagement nor participation alone were counted as correct responses.

Skill Selection

Skills were selected based on consultation with paraprofessionals, general education teachers, and special education teachers, and determined based on student's IEP goals and content currently targeted to typically developing peers in his/her general education classroom. Appropriate skills were observable and measurable chained skills within students' skill repertoire indicating they were well suited for VP. Students had exposure to skills prior to the study as they were similar to skills from the inclusive classroom. Researchers developed task analyses (TAs) for each skill with feedback from paraprofessionals and teachers (see Table 1). Kingston added two digit numbers as his first skill and wrote out the fractions from a figure as his second skill. Mallory sorted pictures of animals into one of two habitats as her first skill and answered geographical questions by selecting the correct picture card as her second skill. Mateo selected the correct letters to spell his name as his first skill and counted out quantities for numbers to identify which number was "more than" as his second skill. For Kingston's first skill and Mateo's first skill, steps needed to be completed in the specified order (e.g., numerator in the ones' place had to be added before the numerals in the tens' place).

Experimental Design

A single subject, combination design using a multiple probe design across participants and behaviors was used to evaluate effects of VP on percent of steps completed independently and correctly on the task analysis (Gast and Ledford 2014). This was implemented by collecting baseline data until a stable or contratherapeutic trend was established for all participants. When baseline data were stable, we introduced the intervention to the first participant's skill one (i.e., tier one). Once the first participant reached criteria on skill one, all participants' skills were probed. Skills to be introduced were probed a minimum of three trials in baseline, continuing until data were stable. Intervention for the first participant's skill two and the second participant's skill one began simultaneously and continued until mastery criteria were reached. These procedures continued in a staggered approach until all participants had been exposed to the intervention for all skills. Authors selected this design to reduce testing effects and frustration experienced by students who had not previously been exposed to many of the academic skills.

Procedures

General Procedures

Trials were held daily for a range 5–30 min during academic periods in the school day. We embedded generalization into the procedures for all skills (i.e., setting, interventionist, or materials). We also used non-examples to sharpen stimulus control in teaching a rule relationship for Mallory's science skill of habitat selection. Experimenter conditions (e.g., interventionist, location, time of day) between the last baseline trial and first intervention trial of each skill were similar with the exception of adding the VP as the intervention procedure. After the task direction (e.g., "Let's add numbers," "Let's learn about habitats," "Spell your name") was delivered by the interventionist, multiple-opportunity probes were conducted to determine

Table 1 Task analyses for student's academic skills using video prompting

Kingston's skill 1 Double-digit addition		Kingston's skill 2 Generating fractions	
1	Count dots on 1st numeral	1	Color red pieces
2	Continue counting dots on 2nd numeral	2	Color blue pieces
3	Say the answer	3	Color green pieces
4	Write the answer under the answer line	4	Count number of red pieces
5	Count on the 1st numeral without dots OR say numeral	5	Write number of red pieces as the numerator
6	Continue counting dots on 2nd numeral	6	Write red pieces' denominator
7	Say answer	7	Count number of blue pieces
8	Write answer under answer line	8	Write number of blue pieces as the numerator
9	Count on 1st numeral without dots OR say numeral	9	Write blue pieces' denominator
10	Count on 2nd numeral without dots	10	Count number of green pieces
11	Say answer	11	Write number of green pieces as numerator
12	Write answer under answer line	12	Write green pieces' denominator
13	Solve generalization problem without dots		
14	Write answer under answer line		
Mallory's skill 1 Habitats		Mallory's skill 2 Geographical locations	
1	Select picture 1	1	Select picture 2
2	Place in correct habitat	2	Correctly place planet on the page
3	Select picture 2	3	Select the correct continent
4	Place in correct habitat	4	Correctly place continent on the page
5	Select picture 3	5	Select the correct country
6	Place in correct habitat	6	Correctly place the country on the page
7	Select picture 4	7	Select the correct state
8	Place in correct habitat	8	Correctly place the state on the page
9	Select picture 5	9	Select the correct city
10	Place in correct habitat	10	Correctly place the city on the page
11	Select picture 6		
12	Place in correct habitat		
Mateo's skill 1 Spelling name		Mateo's skill 2 Number recognition	
1	Select "M"	1	Select the first number card
2	Correctly place "M"	2	Match to number on paper
3	Select "A"	3	Place number card on paper
4	Correctly place "A"	4	Select the second number card
5	Select "T"	5	Match to number on paper
6	Correctly place "T"	6	Place number card on paper
7	Select "E"	7	Place objects on circles for 1st number
8	Correctly place "E"	8	Place objects on circles for 2nd number
9	Select "O"	9	Pick up "more/less" icon
10	Correctly place "O"	10	Place icon on the larger number

the percent of steps they could complete independently in the task analysis. Mistakes were ignored, but marked as incorrect, except for two skills that required students to complete the task in sequential order; for these skills, trials concluded after the first error. Pre-existing behavior interventions plans and reinforcement systems (e.g., First-Then and token systems) were used across all conditions and all students and were not systematically manipulated with the VP intervention. Table 2 outlines the similarities and differences across conditions of the study.

Table 2 Similarities and differences across conditions of the study

	Baseline	Video prompting intervention	Maintenance	Generalization
Setting	General education class/sped class/hallway	General education class/sped class/hallway	General education class/sped class/hallway	**Programmed across settings** (General education class/sped class/hallway)
Implementers	Paraprofessional/researchers	Paraprofessional/researchers	Paraprofessional/researchers	**Programmed across implementers** (Paraprofessional/Researchers)
IV	**N/A**	Video prompting (VP)	Video prompting (VP)	Video prompting (VP)
DV	% correct on a task analysis	% correct on a task analysis	% correct on a task analysis	% correct on a task analysis; **programmed for novel skills & materials**
Target skills assessed	Kingston Skill 1: Double digit addition Skill 2: Generating fractions		Both skills assessed after mastery criteria met	Assessed within each trial for both skills
	Mallory Skill 1: Habitats Skill 2: Geographical locations		Both skills assessed after mastery criteria met	**Programmed skill 1 using a rule relationship;** Assessed within each trial for both skills
	Mateo Skill 1: Spelling name Skill 2: Numeral recognition		**Not assessed** (due to medication changes)	**Not assessed** (due to medication changes)
Steps of the procedure	1. **Researchers met with paras/assistant principal; consulted with special & general education teachers**	1. Researchers shared materials with paras (e.g.,Mallory's materials were made into a book)		
	2. **Determined skills aligned with IEP goals & same aged peers**	2. Measured the same skills as determined in baseline	2. Measured the same skills as determined in baseline	2. **Measured novel skills**
	3. **Paras & researchers created a task analysis for all skills**	3. Used the same task analysis for skills as in baseline	3. Used the same task analysis for skills as in baseline	3. Used the same task analysis for skills as in baseline **applied to novel skills**
		4. Researchers created script for VP for skill 1; paras & researchers created script for skill 2	4. Researchers created script for VP for skill 1; paras & researchers created script for skill 2	
		5. Researchers created VP for skill 1; paras & researchers created VP for skill 2	5. Researchers created VP for skill 1; paras & researchers created VP for skill 2	
Error correction	Behavior prompts ("**keep working**"); None provided for the target skill	Behavioral prompts ("**watch the video**"); None provided for the target skill	Behavioral prompts ("**watch the video**") None provided for the target skill	Behavioral prompts ("**watch the video**") None provided for the target skill
Reinforcement	Provided based on students' token economy already in place	Provided based on students' token economy already in place	Provided based on students' token economy already in place	Provided based on students' token economy already in place
IOA	37% of trials IOA = 100%	53% of trials IOA = 100%	81.97% of trials IOA = 100%	94.10% of trials IOA = 100%

Table 2 (continued)

	Baseline	Video prompting intervention	Maintenance	Generalization
Procedural fidelity (expected interventionist behaviors)	1. **No VP used** 2. Necessary materials were present 3. Task direction was given 4. Prompts were behavioral & not instructional	1. **VP set up for students' use** 2. Necessary materials were present 3. Task direction was given 4. Prompts were behavioral & not instructional	1. **VP set up for students' use** 2. Necessary materials were present 3. Task direction was given 4. Prompts were behavioral & not instructional	1. **VP set up for students' use** 2. Necessary materials were present 3. Task direction was given 4. Prompts were behavioral & not instructional

Bold used to illustrate differences across conditions

VP video prompting, *paras* paraprofessionals, *IOA* interobserver agreement, *IV* independent variable

Probe Conditions

Probe condition procedures followed general procedures. These continued for a minimum of three trials before the introduction of the VP until data were stable or contratherapeutic for all participants.

Video Prompting Condition

For each skill, scripts were developed based on the TA (See Table 1). After input was gathered from all stakeholders, researchers recorded and edited the video for each students' first skill, and paraprofessionals assisted with recording, narrating, and editing the video for all students' second skills. Special interests (i.e., preferred songs and commercials) were added to the end of Kingston and Mateo's videos respectively, and materials were presented as a book for Mallory as embedded reinforcers, based on the feedback from the paraprofessionals.

After probe data stabilized for all participants, one student began intervention. The target participant sat at his/her workspace and was given the task direction, "Watch this" by the interventionist. Next, the student was shown the video on the tablet. Students performed each step of the task along with the video and were able to rewind and pause the video as needed. If students' attention drifted or they missed a step in the video, interventionist prompted students to watch again by stopping, pausing, or rewinding the video and repeating the task direction. Some students could rewind and pause independently, and others required assistance from the interventionist.

Generalization and Maintenance

Researchers programmed for generalization across settings (i.e., general education classroom; special education classroom; hallway), interventionists (i.e., paraprofessionals, substitutes, and researchers), problems (i.e., novel problems embedded in each trial), and materials (e.g., crayons on paper or markers on laminate). Further, examples and non-examples including a rule relationship were used in Mallory's habitat skill. The rule relationship was based on the animal's adaptations for its habitat (e.g., "[this animal; e.g., polar bear] has white, fuzzy fur to keep it warm from the cold. So I know it goes in the tundra because the tundra is very cold."). In some cases, the exemplar shown did not 'belong' in either habitat based on the "rule" and was placed to the side of the laminated habitat cards (e.g., "A fish does not have white, fuzzy fur to keep it warm from the cold, so I know it does not belong in the tundra. A fish does not have scaly skin to protect it from the sun, so I know it does not belong in the desert."). Generalization of learned skills was assessed for both of Kingston's skills and for Mallory's second skill; maintenance was recorded upon mastery of skills for Kingston and Mallory. Neither maintenance nor generalization data for Mateo was collected due to the end of the school year and medication changes causing behavioral changes (see Fig. 1).

Inter-observer Agreement and Procedural Fidelity

Inter-observer agreement (IOA) was collected for 37% of baseline trials; 53% of VP trials; 81.97% for generalization trials and 94.10% for maintenance trials for all students (i.e., 64% of all trials across all conditions and all participants). Researchers collected procedural fidelity for 97.5% of all sessions across conditions (including

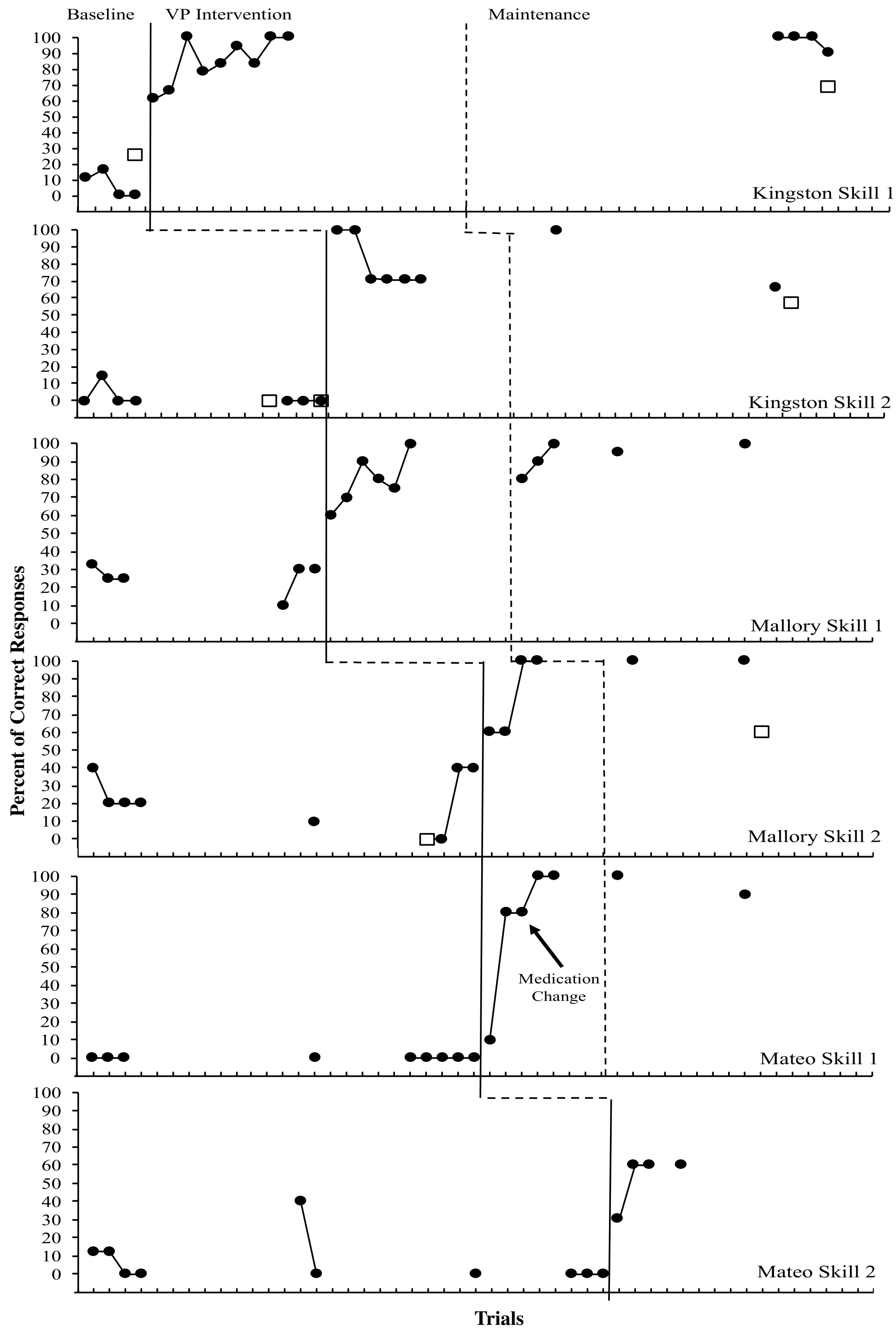

Fig. 1 Percentage of the steps of the task analysis completed correctly across three participants and two skills for each participant. Closed circles represent baseline, intervention, and maintenance data. Open squares represent generalization mean data within that condition. Kingston refused to use the video during skill 1, trials 10–12 and skill 2, trials 17–21

maintenance and generalization). Procedural fidelity (PF) data were measured for all trials, in all conditions, and for all students, except for one trial for one participant in which the paraprofessional forgot to video record the trial. Authors trained in data collection procedures collected data on student performance (i.e., completion of steps in the task analysis) using identical data sheets either in vivo or from video recordings of trials; paraprofessionals were asked to video sessions if an observer was not available to collect in vivo data collection. IOA was calculated using the point-by-point method where scores on each step in the task analysis were compared; number of agreements was divided by number of agreements plus number of disagreements and multiplied by 100. To measure PF, each data sheet included a checklist of expected instructor behaviors (i.e., video was/was not set up for viewing on the tablet, necessary materials were present, task direction was given, prompts were behavioral and not instructional). Expected responses for the first item depended on the condition (e.g., the video should not have been present under baseline conditions). The number of instructor behaviors observed by an independent observer was divided by number expected and multiplied by 100 to determine PF. IOA averaged 100%, and procedural fidelity averaged 97.2% (some prompts indicated a correct response rather than re-directing to the task).

Social Validity

Social validity measures were collected using an anonymous online survey. At study completion, social validity questionnaires were given to all paraprofessionals and general education teachers who took part in the study. Each person rated each item on a five-point Likert-type scale with a range of 1 (strongly disagree) to 5 (strongly agree). General education teacher questionnaires included 11 questions with the same rating scale. The questionnaires also included one or more open-ended questions where teachers and paraprofessionals could leave feedback about the study. Table 3 displays survey items and responses.

Table 3 Social validity survey items

Items	Scores		
	Respondent 1	Respondent 2	Respondent 3
Paraprofessional items			
The VP intervention focused on important behaviors (i.e., academic behaviors)	5	5	5
The VP resulted in positive student outcomes for the student with disabilities	3	4	5
The VP intervention was easily incorporated into the classroom	5	5	4
I could assist in the use of the VP intervention into my classroom in the future	5	5	5
The time requirement of using VP to teach academic skills was reasonable	5	5	5
I would encourage other paraprofessionals to use VP to teach academic skills	3	5	4
The VP intervention was practical and easy to use	3	4	5
The VP intervention was cost effective	5	4	5
The VP intervention was not disruptive to the other students, teachers, or to me	5	5	5
I enjoyed contributing to the discussion of which skills to target for instruction	5	5	5
I enjoyed creating the VP for the student	5	5	5
I enjoyed delivering the VP intervention to the student	5	5	5
I feel confident in my ability to create and deliver VP intervention to students with disabilities	4	5	5
I would use VP again to teach students with disabilities	3	5	5
Teacher items			
VP focused on important behaviors	4	5	
VP resulted in positive student outcomes for the student with disabilities	3	4	
VP was easily incorporated into my general education classroom	5	5	
I believe I could assist in the use of VP in into my classroom in the future	4	5	
Time requirement of using VP to teach academic skills was reasonable	4	5	
I would encourage paraprofessionals to use VP to teach academic skills again	4	5	
VP was practical and easy to use	4	5	
VP was cost effective	4	5	
VP was not disruptive to the other students or to myself	4	5	

Results

Effectiveness of Video Prompting Strategy

Visual analysis indicated that all students performed all skills at higher levels in the intervention condition than in the baseline conditions. In baseline conditions, all participants performed each skill at low levels with little variability. Upon introduction of the VP intervention, each participant completed the skills at consistently higher levels. Figure 1 shows the percentage of steps completed independently for each student.

Kingston

During the baseline probes, Kingston completed an average of 7% of the steps in the task analysis for skill one (range 0–17%) and 75.78% of steps in intervention (range 61–100%). For skill two, he completed an average of 1% of steps in baseline (range 0–7%) and an average of 80.67% of steps in intervention (range 71–100%). Upon introduction of the intervention for skills one and two, there was an immediate and abrupt change in level and an accelerating trend. For each skill, a generalization problem was included in each trial. For skill one, he completed an average of 25% of generalizations problems correct in baseline and 68.4% correct in intervention. For skill two, he completed 0% of generalization problems correct in baseline and 57.1% correct in intervention. Kingston maintained the targeted skills (i.e., 67–100%) in follow-up sessions after intervention.

Mallory

During the baseline probes, Mallory completed an average of 25.5% of the steps in the task analysis for skill one (range 10–33%), while in intervention she completed an average of 82.78% (range 60–100%). For skill two, she completed an average of 21.22% of steps in baseline (range 0–40%), while in intervention she completed an average of 84% of steps for skill two (range 60–100%). There was an abrupt and immediate change in level from baseline to intervention conditions after the onset of the treatment phase for skill one. During a generalization probe for skill two, Mallory completed the task at 60% accuracy. Mallory maintained high levels of accuracy (i.e., 95–100%) in follow-up sessions after intervention.

Mateo

During the baseline probes, Mateo completed an average of 1% of the steps in the task analysis for skill one (range 0–10%), while in intervention he completed an average of 74% of steps (range 10–100%). Further, he maintained skill one at high levels of accuracy (i.e., 95%) in follow-up sessions after intervention. For skill two, he completed an average of 7.9% of steps in baseline (range 0–40%), while he completed an average of 52.5% of steps in intervention (range 30–60%). After introduction of VP, data show an immediate change in trend (stable in baseline; accelerating during IV) from baseline to intervention for skill one and an immediate change in level for skill two. Maintenance and generalization probe for Mateo's skills were not assessed due to time constraints and medication changes.

Social Validity

Paraprofessionals universally *agreed* or *strongly agreed* on all 17 survey items except four items in which one paraprofessional provided neutral responses (e.g., "I would encourage other paraprofessionals to use VM to teach academic skills."). All paraprofessionals indicated VP (a) focused on important, academic behaviors; (b) was acceptable, feasible, and effective; and (c) resulted in positive outcomes for students. One paraprofessional noted, "The most helpful part of the VM intervention was that it was specifically targeted, customized for my student's needs." Another commented, "It was great to watch my student respond to the video and be able to accomplish the task at hand."

General education teachers agreed or strongly agreed with all items on the social validity survey except for one item (i.e., "The VP resulted in positive student outcomes for the student with disabilities") where one teacher selected *neither agree nor disagree*, noting that she had not viewed the data prior to completing the survey. One teacher wrote the intervention really helped the paraprofessional and that it was not a disruption to her general education class.

Discussion

The purpose of the study was to demonstrate a functional relation between a paraprofessional-delivered VP strategy and students' correct completion of grade-aligned, core content skills while working in the general education classroom Results demonstrate a functional relation between VP and the percentage of steps completed correctly on the individualized academic task analysis for two of three elementary students with ASD/ID. Kingston learned how to complete double digit addition problems with greater accuracy and was also able to generate fractions; Mallory could correctly identify three animals living in each of two habitats and could identify personally relevant geographical information (e.g., which city, state, country she lived in). Mateo was able to spell some of his first name and could usually match numbers; showed some correspondence between a numeral and the amount of objects but continued to have difficulty recognizing more and less. Further, generalization of skills for Kingston's and Mallory's skills were demonstrated, but authors did not seek to determine a functional relation for this aspect of the study. Findings from the current analysis support and extend data from previous studies on the effectiveness of video-based interventions (VBI) to teach math, science, and ELA skills aligned to the general education curriculum (e.g., Hart and Whalon 2012). In addition, this study evaluated a social studies skill; a focus on social studies for this population is lacking in the literature.

After demonstrating low percentages of correct responding on the TA during baseline, all students increased percentages for both skills while in intervention. All students demonstrated maintenance of skills; however, the combination of the end of the school year and medication changes for one student restricted the ability to collect maintenance data for Mateo's second skill. Although the authors of the current study programmed for generalization of skills by including multiple exemplars and stimulus fading (e.g., Kingston's fraction skill) as well as modeling examples and non-examples and application of rule relationships across materials (e.g., Mallory's science skill), students' maintenance data were variable.

Kingston reliably used the steps on the video to complete novel 2-digit, addition problems in his first skill, but he had challenges generalizing fraction identification to a new problem in his second skill. One reason may be that Kingston had been exposed to addition problems since the beginning of the school year, but fractions were introduced to him at the time of the study (based on feedback from his teacher and paraprofessionals to align skills with those taught in the general education classroom to typically-developing peers). Additionally, Kingston refused to use the video during several trials (i.e., skill 1, trials 10–12; skill 2, trials 17–21). One possible reason may have been the tablet was stigmatizing for him, since most of his peers were not using them in the classroom. He also appeared confident during baseline probes (e.g., saying "I got this."); however, this confidence was not commensurate with his ability, which may have also played a role in his refusal to use the VP during intervention. Initially, Mallory had difficulty applying the rule relationship for the habitats to novel exemplars of animals, but this ability improved over time (i.e., "[this animal; e.g., polar bear] has white, fuzzy fur to keep it warm from the cold. So I know it goes in the tundra because the tundra is very cold."). Due to Mateo's complex communication needs combined with parent-reported medication changes in the middle of the study, we did not assess generalization of his skills or maintenance of his second skill. Overall, programming for generalization from the onset of instruction by delivering the VP procedure by a range of instructors and in a range of contexts may have accounted for the abrupt and immediate changes from baseline to intervention conditions for the majority of skills.

The current study supports previous studies finding positive effects using VBI teach students with ASD or ID. For example, Weng and Bouck (2014) used VP to teach price comparison in community settings to three secondary students with ASD. Yakubova et al. (2015) used a VBI to teach fraction word problems to three high school students with ASD in resource room of an educational center, but was limited because it did not assess generalization of fraction word problems. Moreover, there is a limited amount of research conducted in general education classrooms with natural supports to teach academic skills; and especially for paraprofessionals as intervention agents. In a review of academic interventions for students with severe disabilities in inclusive classrooms, Hudson et al. (2013) indicate a total of 19 published studies since 1975. None included VP, and paraprofessionals served as interventionists in four. In addition, limited information exists for collaborative models for including paraprofessionals as stake holders/scientist-practitioners in the decision making process when designing an intervention study. The current study extends the literature on VP to teach academic skills to this population by (a) collaborating with members of the IEP team to gain feedback for socially valid skills that were on the students' IEP and aligned with core academic content taught in the general education classroom and (b) by collaborating with paraprofessionals to use, create (e.g., edit, narrate), and implement VP in inclusive classrooms.

Implications for Practitioners

This study illustrates several implications for practitioners. First, paraprofessionals reported that they enjoyed being part of the intervention. With paraprofessionals providing the most supports to students with the most complex needs with little training (Giangreco et al. 2005), it is important to consider instructional strategies that are easy and enjoyable for paraprofessionals to create and implement while minimizing student dependency. One paraprofessional seemed resistant to the intervention during the initial planning stages, and while creating videos. She did not give as much input into the selection of skills and was more hesitant to actively engage in the planning of the intervention than the other two paraprofessionals. During intervention, she mentioned how "proud" she was of the student and how quickly she was acquiring the skill without prompts, noting that she would like to continue to use VP with her students in the future.

Second, general education teachers stated that the intervention was not a disruption their classes and led to positive outcomes for their students with disabilities. Teachers' views on inclusion vary, and many general education and special education teachers believe self-contained settings are more appropriate for students with disabilities (e.g., Causton-Theoharis et al. 2011), and especially for students with more severe disabilities. One reason for the positive belief in the current study may have been the collaboration and training the paraprofessionals received on implementing VP. Often, when paraprofessionals are not equipped with the skills or training to teach students with ID and ASD, they can become a burden in inclusive classes (e.g., students with disabilities become dependent; paraprofessionals' proximity interferes with friendships). Third, advancements in technology minimized barriers to creating and viewing VMs. Previously, technology needed to create even simple VM and VP consisted of multiple, bulky pieces of equipment (e.g., camcorder, television, DVD player) and required user proficiency with complex editing software. This study exemplified how current technology allows for the simple creation of videos and smoother implementation by using an affordable application and tablet device.

Limitations and Future Research

The limitations of this study indicate the needs of future research. First, since participants were in elementary school and diagnosed with ID and ASD, future research should broaden the scope of participants and skills. Second, due to the unique features of this research design, intervention for Kingston's second skill was introduced at the same time as Mallory's first skill. When baseline was stable for at least one of the two tiers, we began intervention for both skills (e.g., Kingston's skill 2 and Mallory's skill 1). Future research could require stable baselines for both skills before beginning intervention. Third, generalization and maintenance were limited due to time constraints at the end of the school year; methods to program for the systematic fading of the VP over time could be evaluated. Fourth, paraprofessionals did not have the opportunity to create a VM independently and relied on some coaching throughout the study. Despite this, paraprofessionals displayed high fidelity and positive feedback, indicating an aptitude for the technology. Finally, pacing of the general education curriculum was slightly faster than the pace with which students with ID and ASD acquired the targeted skills. From a teaching standpoint, new videos could be created quickly and easily to keep up with content as it is presented; therefore, future research could focus on teaching strategies that can be used within and across content areas (e.g., note-taking, sequencing, comprehension strategies) to ensure students with disabilities are full participants while in general education classes (Authors).

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Author Contributions VFK conceived of the presented idea and created measurement/data collection tools. EMK and MB collected data. VFK outlined the procedures and the unique contributions of the study (e.g., Table 2). VFK determined the analytical methods. VFK encouraged EMK to investigate the role of paraprofessionals, and supervised the findings of this work. All authors contributed to the results, writing, revisions, and the final manuscript.

Compliance with Ethical Standards

Conflict of interest Victoria Knight, Emily Kuntz, and Melissa Brown declares that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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