

Using AAC Video Visual Scene Displays to
Increase Participation and Communication within a Volunteer Activity for Adolescents with
Complex Communication Needs

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Abstract

Volunteer activities can provide opportunities to learn new skills, build social networks, and contribute to enhanced self-esteem. Volunteering also provides a positive contribution to society, and an opportunity to participate in activities that may differ from those in paid employment. People with severe disabilities and complex communication needs, however, may face significant barriers in participating and communicating in volunteer activities. A multiple-probe-across-participants, single-case experimental design was used to evaluate the effectiveness of videos with integrated visual scene displays (video VSDs). The video VSDs were presented using a tablet-based augmentative and alternative communication (AAC) app, as an intervention to increase the percent of steps completed independently within a volunteer activity. Participants were four adolescents with autism spectrum disorder or Down syndrome, all of whom had complex communication needs. Each participant met the mastery criterion for the activity -- completion of the volunteer work activities and communication exchanges with co-volunteers -- with the use of the video VSDs. The results provide preliminary evidence that video VSDs may be an effective assistive technology for individuals with severe disabilities and complex communication needs to increase participation in volunteer activities, both as an instructional support in learning new skills, and as an AAC technique to support interaction with others.

Keywords: Video prompting; Volunteer; Autism spectrum disorder; Down syndrome; Vocational training; Video visual scene display

**Using AAC Video Visual Scene Displays to Increase Participation and Communication
Within a Volunteer Activity for Adolescents with Complex Communication Needs**

Volunteering is strongly associated with a higher quality of life (Trembath, Balandin, Stancliffe, & Togher, 2010; Wehman et al., 2014), and 25% of people in the United States volunteer annually (U.S. Bureau of Labor Statistics, 2016). Volunteer activities are not just work for which no pay is provided – rather, it has been suggested that the term *volunteering* should be reserved for an activity which takes place for the common good (e.g., with a not-for-profit organization), of an individual's own free will, and without expectation of financial gain (United Nations, 2016). Individuals can use volunteer activities to learn new skills, enjoy interactions with others, and develop feelings of increased self-esteem (e.g., from contributing to the welfare of others) in ways that may be difficult in paid employment settings (Balandin, Llewellyn, Dew, & Ballin, 2006; Miller et al., 2002). For example, behaviors that may be discouraged in the workplace, such as social communication, may be more welcomed in a volunteer setting. In addition, volunteer sites may be more accepting of a range of abilities and work performance (Balandin et al., 2006).

In recognition of the unique value of volunteer activities, researchers have begun to investigate supports for the participation of persons with severe disabilities and complex communication needs in volunteer settings. Trembath et al. (2010) explored the experiences of 24 adult volunteers with complex communication needs who engaged in a wide variety of activities (e.g., youth group leader, committee member, educational assistant). Through interviews, the participants reported several benefits of volunteering, including the positive effects their volunteer work had on their own life and the lives of others (including increases in social networks). Similarly Miller et al. (2002) reported on the experiences of 10 individuals with

disabilities, including two with complex communication needs, who volunteered with university students to maintain a nature trail at a local museum. Identified benefits included increased self-confidence and an enhanced sense of belonging to the community.

Despite these reported benefits, individuals with disabilities, including those with severe disabilities and complex communication needs, are less likely to participate in volunteer activities than those without disabilities. For example, although 13% of Americans have a disability (Kraus, Lauer, Coleman, & Houtenville, 2018), only 5% of volunteers report having a disability and only 1% report having a developmental disability (Miller et al., 2002). To date, research has focused on the volunteer activities of individuals who were already highly competent communicators via AAC before the volunteer intervention began. For example, all 24 participants described in Trembath et al. (2010) had an established AAC system such as a speech-generating device ($n = 19$), a communication board ($n = 4$), or both ($n = 1$).

At present there is only a limited understanding of the development of meaningful volunteer activities for individuals with severe disabilities and complex communication needs. For these individuals, there may be numerous barriers to volunteering, including the need to learn new skills to participate in a volunteer activity as well as new strategies to communicate in the volunteer setting (Hidalgo & Moreno, 2009). Too often, individuals with severe disabilities and complex communication needs are not considered as potential volunteers by others, and are denied the opportunity to participate by volunteer agency personnel (Miller et al., 2002; Rak & Spencer, 2016).

Although instruction for volunteer activities has received limited attention, there is a significant body of research on teaching task participation to individuals with severe disabilities (Cannella-Malone & Schaefer, 2017). A growing number of studies have demonstrated the

benefits of providing video models of the target task as a method of instruction. In one particular type of video modeling, called *video prompting*, a video is made of a sequenced task (e.g., preparing a meal). The instructor breaks the activity into smaller, more manageable steps using task analysis (Cooper, Heron, & Heward, 2007) and edits the video to create a series of short video clips, each illustrating a step in the task. The learner then watches the video clip for each step (e.g., on a tablet computer), performs that step, and then moves on to the next step. The use of video prompting has been reported to be effective in teaching individuals with developmental disabilities to complete tasks such as clerical services in offices, cooking activities, and cleaning services at an animal shelter (e.g., Bennett, Gutierrez, & Honsberger, 2013; Mechling, Ayres, Foster, & Bryant, 2013; Van Laarhoven et al., 2009). Video prompting may be a particularly useful approach for individuals with intellectual and developmental disabilities (e.g., ASD, Down syndrome) who are at risk for prompt dependency because minimal adult instruction and prompting is required to teach the skills (Banda, Dogoe, & Matusznyi, 2011).

Although video prompting has been effective in teaching new skills, intervention is often needed to support the communication of individuals with ASD or Down syndrome during activities such as volunteering. For example, van Gameren-Oosterom et al. (2013) found that adolescents with Down syndrome frequently experienced breakdowns in communication with others in community settings: Over 50% of parents in that study reported that their children's speech was not intelligible to anyone other than close caregivers. Similar findings have been reported in Wodka, Mathy, and Kalb (2013), who found that 20%-30% of individuals with ASD do not develop functional speech.

For individuals with complex communication needs, the use of sign language, picture communication boards, SGDs, and other forms of AAC can provide important supports to interaction (Beukelman & Light, in press). Recent reviews offer evidence of the benefits of AAC for adolescents with Down syndrome (McNaughton, Babb, & Holyfield, in press; Therrien, Light, & Pope, 2016) and ASD (Logan, Iacono, & Trembath, 2017; Ganz, 2015). There is, however, wide variation in the use of AAC by both of these groups (Meuris, Maes, & Zink, 2015; Ganz, 2015), as a result of individual communication needs, skills, and preferences (Beukelman & Light, in press) and limited AAC services made available to these populations (Mirenda, 2014).

Volunteer settings may provide special challenges to AAC interventions. Volunteer activities, as with vocational activities, may require a wide range of vocabulary to support participation (Balandin & Iacono, 1999). As Creech (1992) stated, "The workplace requires an expanded vocabulary because in the workplace employees use words they do not use anywhere else" (p. 105). In addition, communication partner training is often limited and staff turnover is typically high (Scherer, Allen, & Harp, 2016), which may result in additional challenges for the individual with complex communication needs (Mirenda, 2014).

To support the learning of new skills and provide supports for communication for individuals with complex communication needs, Light, McNaughton, Jakobs, and Hershberger (2014) proposed the use of videos with embedded visual scene displays (video VSDs). A visual scene display (VSD) is a photograph of a meaningful event that has been programmed on a tablet computer to support communication (Beukelman & Light, in press). Using a VSD app, "hot spots" (i.e., highlighted areas within the scene) can be added to the VSD to support expressive communication (Light, McNaughton, & Caron, 2019). When selected, the hot spot produces

speech output for a recorded word or phrase. For example, an adolescent with complex communication needs at a volunteer site might have a VSD showing the adolescent and a staff member outside the storage room. When the programmed hotspot is activated, the phrase, “*Can you please let me in the storage room?*” is generated. (See <https://tinyurl.com/rerc-on-aac-vVSD> for an example of video VSDs).

Two previous studies have explored the use of video VSDs as a support for adolescents with complex communication needs in pre-vocational/volunteer activities. In a pilot study, O’Neill et al. (2017) reported that the introduction of video VSDs resulted in significant increases in targeted skills for a 16-year old girl with ASD. Increases were observed both for completion of the pre-vocational activities (e.g., performing clerical duties, riding public transportation) and communication (e.g., greeting office staff). Babb, Gormley, McNaughton, and Light (2018) utilized video VSDs to support an adolescent with ASD in the successful completion of three work-related tasks (checking in books, putting books away, making dye cuts) during a pre-vocational experience in a school library. The participant successfully completed both the task requirements and the communication opportunities within each activity, requiring only a small number of intervention sessions to reach high levels of independence (i.e., greater than 90% accuracy).

Due to the limited information on the impact of video VSD interventions with adolescents with complex communication needs, the current study provides a systematic replication (Gast, 2010) of the previous two studies (O’Neill et al., 2017; Babb et al., 2018). In order to obtain a better understanding of the impact of a video VSD approach in real-world contexts (Light & McNaughton, 2015; Shadish et al., 1997), this study made use of (a) a heterogenous sample (i.e., individuals with ASD, individuals with Down syndrome) with a wide

range of communication skills, (b) a sophisticated task involving a large number of task-completion and communication opportunities, (c) and an existing volunteer activity in a community setting.

Key goals for a successful volunteer intervention for individuals with severe disabilities and complex communication needs include increased independence in the completion of the targeted activities as well as appropriate communication with a variety of communication partners in the volunteer setting (McNaughton, Bryen, Blackstone, Williams, & Kennedy, 2012). Video VSDs offer an integrated approach to supporting both participation and communication for individuals with complex communication needs in volunteer settings (Light et al., 2019). The purpose of the current study, therefore, was to determine the effect of video VSDs on the number of steps completed successfully by four adolescents with severe disabilities and complex communication needs in a small group volunteer activity (i.e., packing backpacks with food) that included a variety of target skills and communication opportunities. Three research questions were addressed: (a) What is the effect of video VSDs on the percentage of steps completed (including communication opportunities) during the volunteer activity for four adolescents with complex communication needs? (b) Are the effects maintained overtime? (c) Is the video VSD intervention deemed effective, efficient, and socially valid by key stakeholders?

Method

Participants

The participants were four male adolescents -- Ivan, Jerry, Keith, and Martin (all names are pseudonyms) who attended a middle/high school in a rural school district in the northeastern United States. They were identified by their classroom teachers based on reported dependence on prompts to complete tasks within the classroom and community and a need for additional

training on vocational skills. Each met the following inclusion criteria: (a) had been diagnosed with ASD, intellectual and/or developmental disability, or Down syndrome; (b) were between the ages of 13-21 years old; (c) had complex communication needs; (d) experienced difficulty completing routine tasks independently; (e) lived in homes in which English was the first language; and (g) demonstrated unimpaired or corrected vision, motor, and hearing that was functional to view videos and participate in daily activities per IEP or parental/teacher report.

Ivan was a 16-year-old with a diagnosis of moderate ASD (confirmed through assessment with the Childhood Autism Rating Scale Second Edition, CARS-2; Schopler, Van Bourgondien, Wellman, & Love 2010). He typically communicated with 2- to 4-word spoken phrases when prompted by an educational professional. Ivan was provided with visual schedules to support his understanding of daily routines but did not make use of AAC for expressive communication.

Jerry was a 19-year-old with a diagnosis of severe ASD (determined through assessment with the CARS-2). He typically communicated only in response to short questions from others and relied on gestures and a small number of signs and gestures to communicate with others: pointing to items in the environment to communicate requests, or signaling with a thumbs up or thumbs down to indicate yes/no responses.

Keith was a 20-year-old with a diagnosis of Down syndrome. Typical communication included speech approximations for words and brief phrases; however, his speech was only intelligible to familiar partners. Keith also was given visual schedules to support participation in daily routines in his special education classroom. According to school reports, both Jerry and Keith had been introduced to AAC technology (i.e., a tablet with a communication app) approximately 6 years prior to the current study, but use was discontinued shortly thereafter. These AAC devices were not used by Jerry nor Keith at the time of the study.

Martin was a 14-year-old with a diagnosis of Down syndrome. He communicated through speech and speech approximations for words and brief phrases; however, his speech was only intelligible to familiar partners. As with Ivan and Keith, Martin was provided with visual schedules in his classroom to support completion of daily routines.

All of the participants typically received their instruction in special education classrooms, except for one (Ivan, Jerry, Keith) or two (Martin) elective classes with their general education peers each semester. Hearing, vision, and motor skills were reported to be within functional limits for participation in the volunteer activity for each participant by parents and/or the school speech language pathologist (see Table 1 for participant information). Though each participant presented with complex communication needs, none of the participants used any type of AAC to support their expressive communication at the time of the study. Each participant's family provided consent for their child's participation in the research project, and each participant provided assent for participation in the study. Additionally, the human research ethics committee at the first author's university, and the participating school district, provided approval for the study.

Setting. The study took place in an elementary school located next to the middle/high school attended by the participants. The participants completed tasks in the main office, cafeteria, and storage room of the elementary school.

Insert Table 1 About Here

Target Activity

As part of their pre-vocational transition plans, all participants were expected to participate in school or community-based work experiences for approximately 90 min, 1 or 2 days per week. Based on a discussion between the researchers and the classroom team prior to the start of the study, it was decided that a volunteer work experience activity sponsored by the

school district -- packing food backpacks for students who participated in free or reduced-cost lunch programs -- would serve as the target activity for the study. This activity met the following six pre-determined criteria: (a) provided a meaningful service that was valued by the community, (b) taught skills that could potentially be used in a variety of vocational activities, (c) did not replace the need for paid workers, (d) could be broken into discrete steps that could be modeled using video, (e) occurred within close proximity to the participants' school, (f) included both tasks to be completed manually as well as communication opportunities, and (g) included behaviors that the participants could not currently complete independently.

Task analysis. The first author performed a task analysis for the activity by identifying the component steps and the most natural sequence of those steps (Snell & Brown, 2006). See Supplemental materials, Table 1, for the complete task analysis.

Research Design

This study used a single-case multiple-probe-across-participants experimental design (Kazdin, 2013) to determine the effects of video VSDs on the completion of the steps within a volunteer activity. In this design, the researcher measures a target behavior for multiple individuals. After establishing a stable baseline for each participant (i.e., minimal to no increasing trend; Smith, 2012), the independent variable is introduced to the first participant while the other participants remain in baseline. When the first participant meets the set criterion for an intervention effect (i.e., two consecutive data points of at least three steps in the task analysis above the highest baseline probe) for the activity, the researcher conducts baseline observations for all remaining participants and the independent variable is then introduced to the next participant who demonstrates a stable baseline (the other participants remain in baseline). The sequence continues until the independent variable has been introduced to all participants

(Cooper et al., 2007). This design investigates whether the behaviors (i.e., dependent variable) of the participants changed upon introduction of the intervention (i.e., the independent variable), thereby showing the relationship between the intervention and the targeted skill (Kazdin, 2013). The study comprised three phases: baseline, intervention, and maintenance. Trained graduate students video recorded all sessions (including all probe activities) for data collection purposes. Sessions were conducted approximately 3 times per week and were led by the first author.

Independent variable. The independent variable was the video VSD app (videos with integrated VSDs and embedded hotspots). In addition, the first author provided instructional activities during the intervention phase to teach the use of the video VSD app. Each session in the instructional phase was approximately 5 min - 10 min in length.

Dependent variable. The dependent variable was the percentage of task analysis steps (including both communication acts and motor task activities) completed independently by each participant. The target activity (packing backpacks of food for students who participated in the free or reduced-cost lunch program) had 25 steps. Of these steps, 15 were motor-task activities (e.g., carrying the backpacks to the cafeteria) and 10 were communication acts (e.g., asking the secretary for the key to the storage room). Independent completion of a task step (either motor task or communication act) was operationally defined as completing the step within 5s of the naturally occurring environmental stimulus. An incorrect step was defined as completing a step out of sequence, completing a step incorrectly, or failing to initiate the step within 5s. Steps that included communication acts could be completed by using speech, touching the tablet to activate the hotspot, or a combination of both. As in past research on adolescent participation in pre-vocational/volunteer activities (O'Neill et al., 2017; Babb et al., 2018), the dependent variable included both motor and communication acts to reflect the full range of behaviors needed for

successful participation in the activity. The dependent variable was calculated by dividing the number of steps completed independently by the total number of steps within the activity (i.e., 25), and multiplying by 100.

Materials and Procedures

A 30.5 cm Samsung Galaxy Note Pro 7[®]1 tablet that contained the EasyVSD2 app, a hand-held Sony camcorder,³ and iMovie[®]4 with 10.12 software were used to create the video VSDs used in this study. Figure 1 provides a screenshot of a VSD created in the EasyVSD2 app for the target volunteer activity of packing the backpacks.

Insert Figure 1 about here

Programming the VSDs. Prior to the intervention, the first author and two trained graduate students programmed the video VSDs for the target activity. To create a video VSD, separate videos of one of the students performing each step in the activity were recorded to enable detailed editing. The model in the videos was similar to the participants in gender - in this case, a male graduate student. Next, the videos from the camcorder were transferred to a desktop computer and edited in iMovie[®]. Each video was trimmed to create short clips of video that paralleled the steps identified within the task analysis for the activity. Then, the videos were uploaded to the video VSD app on the tablet. The video was then paused at the end of each step in the task, which automatically created a VSD at these junctures. Each video clip averaged approximately 10s - 20s in length and depicted one of the target steps within the activity (see Supplemental Materials, Table 1). When a step involved a communication act, the graduate student who served as the video model created a hotspot on the VSD and recorded the relevant communication message. As participants viewed the video, it would pause automatically wherever a VSD had been made. When a VSD depicted a communication act (i.e., the phrase “I

am going to put the backpacks in the storage room”), the outline of the hot spot displayed momentarily in blue in order to indicate the opportunity for communication (see Figure 1).

Social Validity. The first author developed a 15-item questionnaire to assess the intervention (Schlosser, 1999). The questionnaire included 12 items to be answered using a 5-point Likert scale and four open-ended questions (see Supplemental Materials, Table 2, and Excerpts of responses). A total of 6 educational professionals provided written and/or oral responses to the question: the participant’s paraprofessionals (2) and classroom teachers (2), as well as the participant’s speech-language pathologist, and the district’s special education director.

Study phases. This study had three phases of investigation: baseline, intervention, and maintenance, each of which began with a probe activity. At baseline, five sessions at a minimum were conducted separately for each participant (Kazdin, 2013). Intervention sessions continued until the participant demonstrated mastery, defined as three consecutive probes with 90% or greater independent task completion. After a participant achieved mastery, a maintenance phase was introduced. In maintenance, the participant had access to the video VSD app but did not receive any additional instruction. To maintain experimental control, the participants had access to the video VSD app only during intervention and maintenance phases.

Probe procedures. For each probe, the first author provided an initial cue at the start of the activity (e.g., the phrase *It’s time to pack the backpacks*), followed by a 5 s wait time. Next, following the procedures of a multiple-opportunity method of task analysis (Cooper et al., 2007), if the participant successfully completed the step in the task analysis for the activity, the first author provided a 5 s wait time to complete the next step in the activity. If, at any point, the participant did not initiate action within 5 s, completed the step incorrectly, or completed a step

out of sequence, the first author blocked the view of the participant and completed the targeted step (e.g., Berezna, Ayres, Mechling, & Alexander, 2012).

Baseline. In baseline sessions, only the previously described probe activities were completed. The participants did not have access to the video VSD app (as was typical in their school program) and no instruction was provided.

Intervention. Sessions in the intervention phase included both a probe and an instructional activity; each participant had access to the video VSD app during both probe and instructional activities. The probe activity was identical to the probe activity in baseline, with the exception that the tablet with the video VSD app was given to each participant at the start of the probe activity. Immediately after completion of the probe activity, the first author provided an instructional activity.

Instructional activities. Two types of instructional activities were provided during the intervention phase: a review of the video VSD app to illustrate how it worked, and guided practice on using the app to complete the activity. To review the app, the first author and the participant sat in a quiet area and she directed the participant to attend while she demonstrated navigation of the app on the tablet. The first author played each video and activated each communication hotspot. After the first author navigated the activity one time, the participant was cued to hold the tablet, press the play button for each of the videos in order, and activate each communication hotspot as it appeared. Each time a video was played, the first author provided a brief oral description of the behavioral expectation demonstrated in the video clip (e.g., *Now you enter the office*). This review lasted approximately 5 min.

In the remaining intervention phase sessions, the first author provided guided practice in the use of the app. Each intervention phase session contained two guided practice instructional

activities, provided consecutively, and lasted a total of approximately 10 min in length. As part of this instructional sequence, she provided the cue for the start of the activity (i.e., *It's time to pack the backpacks*) and then used a least-to-most prompting hierarchy (Cooper et al., 2007) to ensure that the participant completed all steps in the activity successfully (i.e., selecting and viewing the video step, performing the step modeled in the video, and proceeding to the next clip until the activity was completed). The least-to-most prompting hierarchy included four possible prompts after the delivery of the initial cue and were always delivered (as needed) in the following order: (a) time delay of 5 s, (b) gestural prompt, (c) oral prompt, and (d) physical prompt. For example, after providing the initial cue (i.e., *It's time to pack the backpacks*) and the predetermined 5 s of wait time, if the participant did not press the play button to watch the first video, the researcher would gesture to the tablet. If the participant still did not press the play button, the researcher would provide an oral prompt for the participant to press the play button. If the participant still did not press the play button after the gestural and oral prompt, the researcher would move to a physical prompt. If the participant made an error at any time, the first author interrupted the error and continued the prompt sequence, modeling the step correctly. The intervention phase continued until the participant met the mastery criterion.

Maintenance phase. When a participant achieved mastery in the activity, the participant entered the maintenance phase. Maintenance was evaluated in order to determine if the participants' skills were retained over time. During maintenance, no instructional sessions were provided; each student only participated in probes (with access to the tablet with video VSD) at 2 and 4 weeks after the date on which mastery was initially observed. They did not have access to the video VSD app for the activity in the time between maintenance probes.

Each participant demonstrated mastery for the activity, and therefore maintenance data were collected for all participants. Due to the end of the school year, maintenance data for Keith and Martin only occurred at week two. Procedures for booster instructional sessions were available if any participant demonstrated a performance below 90% during a maintenance probe. However, performance remained at or above 90% on all maintenance probes for all participants, so booster sessions were not needed.

Procedural reliability. To ensure the correct implementation of procedures, the first author developed a checklist to assess procedural reliability for a minimum of 20% of randomly selected sessions for each of the four participants, and for each of the three phases (Kazdin, 2013). A trained graduate student in communication sciences and disorders (Graduate Student 1) evaluated and scored the reliability of procedural implementation. Training for this student consisted of scoring a randomly selected video against the procedural standards (i.e., checklist) with the first author. When agreement exceeded 90%, the student scored the remaining videos independently. Procedural integrity was calculated with the following formula: number of steps implemented correctly divided by the total number of steps implemented correctly plus steps omitted plus steps implemented incorrectly. The average procedural reliability was 98% (range: 95% - 100%) for baseline, 99% (range: 98% - 100%) for intervention, 100% for instructional model sessions, 94% (range: 84% - 100%) for instructional-guided practice sessions, and 99% (range: 98% - 100%) for maintenance sessions.

Data collection and analysis. A second graduate student (Graduate Student 2) reviewed and coded participant performance on the video recordings for all probe sessions. In order to prevent bias in the data analysis process, this student was blind to the goals and conditions of the study and scored all data in a randomized order. The number of steps completed correctly for

each probe were summarized and graphed separately for each participant. The first author conducted a visual analysis of the data for changes in trend, slope, variability, immediacy of effect, and overlap to examine the effects of the video VSD app on the independent completion of the activity (Kazdin, 2013). Additional analyses included calculation of Tau-U, an effect size score which measures data nonoverlap between two phases (i.e., baseline and intervention) (Rakap, 2015).

Interobserver agreement. Graduate Student 1 calculated interobserver agreement for the scoring of participant behavior for 100% of the sessions for each phase of the study (i.e., baseline, intervention, and maintenance). Training followed the same procedures as for procedural integrity. Interobserver agreement was calculated by taking the number of agreements between the two coders divided by the number of agreements plus disagreements plus omissions and multiplying by 100. Prior to consensus, average baseline agreement was 98% (range: 82% - 100%); for intervention and maintenance data, mean inter-observer agreement was 97% (range: 88% - 100%). Agreement was 100% after consensus building between the first author and first graduate student.

Results

All four participants successfully used video VSDs to complete both targeted tasks and communication acts during the volunteer activity. The results (see Figure 2) provide evidence that the use of video VSDs supported participants both in learning to complete the volunteer activity independently and to communicate with others as they participated in the activity. Increases from baseline to intervention were observed for all participants, with each demonstrating an immediate change in performance following the introduction of the app.

During baseline, Ivan completed an average of 5% (0% - 8%) of the steps correctly. After the first instructional session, he increased to 48% correct on the first intervention probe, and to 84% on the second intervention probe. Jerry averaged 2% (0% - 8%) of steps completed correctly during baseline and increased to 80% or above during intervention probes. Keith averaged 8% (0% - 12%) of steps completed correctly during baseline, increased to 52% after the first instructional session, and remained consistently above 80% in subsequent intervention probes. Martin had the highest averaged baseline, with 20% (8% - 32%) steps completed correctly; however, there was a large change in level after the introduction of the app and Martin increased to 92% steps correct and was at 100% for his remaining intervention probes.

Insert Figure 2 About here

Each participant reached mastery for the activity. Ivan reached mastery at the end of eight instructional sessions, Jerry at the end of six instructional sessions, Keith at the end of eight instructional sessions, and Martin at the end of four instructional sessions. Maintenance probes were conducted for all participants at 2 and 4 weeks (depending on student availability). All four participants continued to demonstrate mastery 2 weeks post-intervention. Ivan and Jerry also demonstrated mastery on the 4-week maintenance probe (Keith and Martin were not available due to the end of the school year).

Effect sizes were calculated for each participant using Tau-U. As a non-parametric effect size measure, Tau-U calculates nonoverlapping data with baseline, and controls for baseline trend (Rakap, 2015). Each participant had a weighted Tau-U score of 1.0, $p = .000$ with a 95% CI [0.56-1.0] indicating a large effect (Rakap, 2015).

In summary, Ivan, Jerry, and Keith exhibited generally low levels of performance with limited variability and a stable trend during baseline. Martin showed some variability during

baseline and a slightly increasing trend; however, the final baseline data point for Martin was trending downward and the overall performance was low (less than 35% of steps completed). For all four participants, a significant change in level was observed from baseline to intervention and maintained during maintenance.

Social Validity

All six education professionals who completed the social validity questionnaire viewed pre- and post- video clips of the participants participating in the volunteer activity. They scored 12 statements on a 5-pt Likert scale questionnaire with the following options: 1 (*strongly disagree*), 2 (*disagree*), 3 (*neutral*), 4 (*agree*), and 5 (*strongly agree*). Each education professional either strongly agreed or agreed that the goals of independent participation and communication were important; that the intervention effectively supported the participants in achieving those goals; and that the intervention was effective, efficient, and appropriate. Most notably, all six strongly agreed with the statements, “Learning to communicate with others is an important goal”, “The student’s communication skills improved as a result of the intervention”, “The intervention provided an effective way for the student to complete the task”, and “I would implement this intervention/suggest it to others in the future.” For the statement “Learning to perform activities for others (such as loading food into backpacks) is an important goal” five strongly agreed, and one agreed.

In response to the four open-ended questions (see Supplemental materials, Excerpts) the education professionals stated they believed the participants enjoyed the task and that they would implement the intervention with other students with disabilities in the future. Education professionals made comments such as “...those kids were able to feel success. I think they felt like they were productive adults within this building. I think it built a whole lot of self-esteem

with those kids.” Another education professional said, “You could see the pride in the videos ... that the kids were feeling very successful,” and “It exceeded our expectations. I didn’t know that the kids would be able to completely do it independently by the end.”

Discussion

Meaningful community participation for individuals with severe disabilities and complex communication needs, including participation in volunteer activities, requires appropriate support for both participation and communication skills (McNaughton, Light, Beukelman, Klein, Nieder, & Nazareth, 2019; Mirenda, 2014). To date, a variety of video modeling approaches have been demonstrated to be successful in teaching new participation skills to adolescents with developmental disabilities (Cannella-Malone & Schaefer, 2017). Providing appropriate communication support during volunteering or other community activities is, however, a well-recognized challenge (Richardson, McCoy, & McNaughton, 2018). The current study provides evidence that video VSD technology can be an effective, efficient, and socially valid support to participation and communication for adolescents with severe disabilities and complex communication needs in a volunteer activity.

Effectiveness

The video VSD app for the current study supported acquisition of new skills for all four participants. Although video prompting has been effective in teaching a range of individuals with disabilities to complete vocational tasks (e.g., Bennett et al., 2013; Van Laarhoven et al., 2009), this traditional approach does not address the need for communication supports. The current study addressed supports for not just participation but also communication, both of which are critical for adolescents with severe disabilities and complex communication needs.

Similar to Babb and colleagues (2018) and O’Neill and colleagues (2017), the participants in this study learned both task and communication skills, with a notable difference being the number of steps in the task: 25, including 10 communication opportunities. Both Babb et al. and O’Neill et al. targeted activities with a smaller number of steps (16 and 20, respectively) and a smaller number of communication opportunities per activity (three and four, respectively). Furthermore, the participants in the current study learned to interact with multiple communication partners while navigating between three different rooms in a large building, and appropriately performed communication acts such as greetings, requesting assistance, and sharing information, all through the use of the VSD supports within the app.

Efficiency

As in Babb et al. (2018) and O’Neill et al. (2017), the participants in the current study demonstrated an immediate increase in steps completed independently upon the introduction of the video VSD app. Each participant reached mastery for completion of the activity, with only a small number of intervention sessions needed to demonstrate an intervention effect and achieve mastery. All participants demonstrated maintenance of the targeted skills over time (2 - 4 weeks).

Social Validity

Key elements of social validity include the extent to which an intervention addresses valued outcomes, makes use of appropriate intervention techniques, and achieves valued goals (Schlosser, 1999). As in the studies by (Babb et al. (2018) and O’Neill et al. (2017), key stakeholders (e.g., teachers, paraprofessionals, the participant’s speech-language pathologist, and the district’s special education director) commented positively on the importance of the targeted instructional activities, the appropriateness of the intervention, and the achieved outcomes.

Beyond the data that was formally collected, there is anecdotal evidence that the education professionals at the participating school district valued the outcomes of the study. The study was concluded at the end of the school year but the school district continued with the volunteer program when school resumed the following year. In addition, students with disabilities now participate in the volunteer program 2 days per week (rather than one, as was the case during the present study) and more than six students participate in the work experience without additional adult supports. Of special interest to the school's educational team was that, as a result of the video VSD app, the need for one-on-one paraprofessionals to prompt individuals to perform tasks was greatly reduced.

Clinical Implications

This study adds to the growing evidence that video VSD interventions can increase independent participation and communication in real-world contexts for individuals with severe disabilities and complex communication needs (Babb et al., 2018; Caron, Holyfield, Light, & McNaughton, 2018). There are two key benefits to video VSD technology in comparison with past technological approaches such as video prompting. First, although video prompting can support completion of a task, video VSDs provide AAC supports in one integrated app, this is of particular value given how communication within the volunteer setting/workplace is viewed as a valuable skill by employers (Bryen, Potts, & Carey, 2007). A video VSD can be a highly effective means of teaching volunteer/vocational skills to individuals with complex communications needs (Richardson et al., 2018) because the communication supports (i.e., VSDs) are embedded directly within the videos used to prompt task completion (i.e., the video models). In terms of the current study, this meant that the participants did not have to use multiple devices or different apps (e.g., one for video prompting and one for communication).

The use of a single integrated app ensured that the individual with complex communication needs did not have to deal with the additional challenge of shifting attention between multiple systems while also trying to learn new skills (Light et al., 2014). The application used in this study (EasyVSD₂) is only available for research purposes, however GoVisuals is a commercially available app that supports the use of video VSDs.

Second, the automatic pausing of the videos at key junctures in the video model provides a natural prompt for the completion of both motor and communication steps (Light et al., 2014). This greatly reduces the need for adults to prompt students through completion of the task (or to cue students to communicate within a task). In the current study, the provision of needed specialized vocabulary (e.g., “*I closed the storage room door*”) as hotspots at the appropriate moment in the video increased the likelihood that the individual would be able to quickly access needed vocabulary. The ability to make use of precise vocabulary items in an efficient manner is key to successful participation in many educational and vocational settings (McNaughton et al., 2019). Video VSDs provide support for accessing the correct word or phrase at the moment when the vocabulary is needed, rather than adding to the learning demands on the individual (e.g., recognizing a communication opportunity exists, determining an appropriate message, navigating the AAC system to retrieve the message, etc.).

Meaningful participation. This project also provides evidence of the benefits of providing AAC supports for meaningful participation in socially valued activities – in this case, a needed community service. The volunteer activity provided over 160 students with needed food backpacks each week and was clearly valued by community members. As noted by Trembath, Balandin, & Togher (2009), participating in volunteer activities provides a way for individuals with disabilities to take on the role of a contributor to an organization, rather than as a recipient

of services. As Trembath et al. (2010) found, participating in a volunteer activity not only provides opportunities to engage in meaningful tasks but also may lead to greater participation within the community as individuals cultivate new skills, interact with new people, and increase their self-confidence. These benefits were observed in the current study, as participants developed skills in sorting and packing items from a menu, stocking and restocking packing items, organizing the backpacks, and accessing the materials.

Finally, participants not only increased their interaction with key adults during the activity but their efforts also had an impact on education professionals as well as visitors to the school who were interested to know more about the project. As one education professional stated:

A lot of teachers stopped by to check it out, not just special education teachers...there were other teachers that came by that were interested... Even the parents that were coming in the door were checking it out. We got a lot of people...it's like a little community all involved in it. It wasn't just us, it was other people cheering them on and wanting them to do well.

As noted by McNaughton and colleagues (2019), it is essential to build society's expectations for the participation of individuals with complex communication needs. The comments in this study were similar to those from college students who volunteered alongside individuals with severe disabilities (Miller et al., 2002) and provide anecdotal evidence that demonstrating the ability of the volunteers to contribute to a valued communication service changed perceptions about their abilities and raised expectations. Indeed, the school continued with and even expanded the program in the following school year, even though the research project had formally concluded.

Limitations and Future Directions

A number of limitations should be considered when interpreting the results of this study. First, it did not assess for generalization across work environments: Only one multi-step activity (which occurred across multiple rooms in a single large building) was assessed for each participant; however, the activity did vary each week as the menu (i.e., items and number of items) changed. Future studies should include plans to evaluate generalization across work environments at the start of the study. Second, though social validity was measured for six education professionals, this data was not formally collected for the participants. Although educational professionals and other observers reported that participants enjoyed the activity, reports of social validity from the participants themselves would have strengthened the interpretation of the study, and this data should be collected in future studies.

Finally, this study made use of a heterogeneous sample recruited from among individuals nominated for this intervention by education professionals at the participants' school. As a result, the participants demonstrated differences in age, disability, and communication status, which limits the ability to generalize about the potential impact of this intervention for any particular disability or age group. For example, there were only small samples of individuals with ASD ($n=2$) or Down syndrome ($n=2$), and the participants varied in age (from 14 to 20 years old). While the use of a heterogeneous sample does provide important information on the impact of the intervention under the conditions most typically experienced by AAC team members working in school settings (Light & McNaughton, 2015), future research should examine the impact of video VSD interventions with larger, more homogeneous, samples.

Future research should also seek to increase community awareness of the positive contributions of people with disabilities as a volunteer resource (Rak & Spencer 2016). Just as

one key step in increasing employment opportunities is meeting with key community stakeholders to raise awareness of the skills of people with disabilities (Carter & Bumble, 2018), it may be valuable to do the same with traditional volunteer organizations with regard to potential volunteer contributions.

Conclusion

This study provides evidence that the use of video VSD technology by adolescents with severe disabilities and complex communication needs can result in both increased independence for task completion and successful interaction with a variety of communication partners. The participants learned to participate and communicate within a socially valued volunteer activity. While instructional supports (e.g., a job/volunteer coach) may be needed at the beginning, results of this study show that individuals with severe disabilities and complex communication needs can learn to participate independently and communicate effectively with others in a volunteer setting when provided with appropriate AAC supports. For many, the greatest challenge may be the identification and development of the initial opportunity to participate. As noted by Light and McNaughton (2015), “Communication is not an end goal in and of itself; rather, it is a tool to allow individuals to participate effectively and attain their goals at home, at school, at work, or in the community (p. 88)”. Video VSD technology appears to be a promising approach to providing effective, efficient, and socially valid supports for individuals with severe disabilities and complex communication needs to increase participation and communication in valued societal activities.

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End Notes

¹ Samsung Galaxy Note Pro 7[®] is an Android tablet computer, developed by Samsung Electronics. <http://www.samsung.com>.

² EasyVSD is an AAC application created by InvoTek, Inc. <http://www.invotek.org/>. Although the application used in this study (EasyVSD) was only available for research purposes, GoVisual is a commercially available app that supports the use of video VSDs.

³ Sony CX405 Handycam is a handheld camcorder.

<https://www.sony.com/electronics/handycam-camcorders/hdr-cx405>

⁴ iMovie is a video editing software application created by Apple.

<https://www.apple.com/imovie/>

⁵ GoVisual is an AAC application created by Attainment Company

<https://www.attainmentcompany.com/govisual>

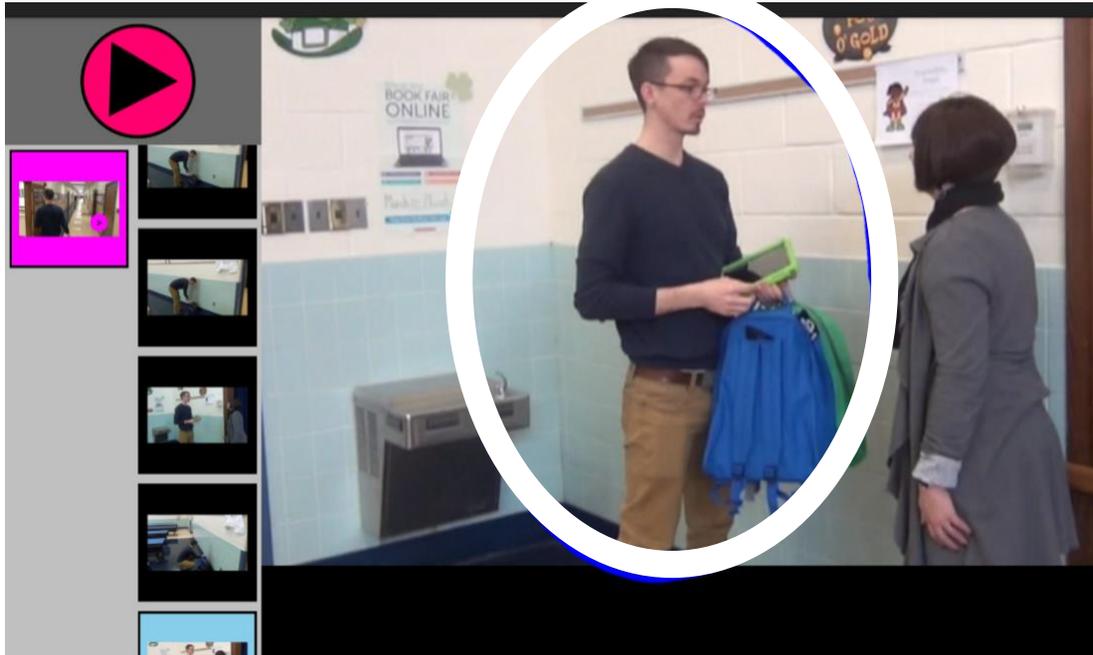
Table 1

Participant Demographics

Participant	Age	Gender	Disability	Adaptive behavior assessment (Vineland - 3)	Receptive vocabulary (PPVT- IV) – standard and percentile score	Communication modes and supports
Ivan	16	Male	ASD	Communication: 45 Daily living skills: 41 Socialization: 57	26; >1%	Delayed echolalia and limited spoken utterances; visual schedules
Jerry	19	Male	ASD	Communication: 38 Daily living skills: 47 Socialization: 48	40; >1%	No spoken utterances, minimal use of signs/gestures
Keith	20	Male	Down syndrome	Communication: 37 Daily living skills: 31 Socialization: 55	20; >1%	Limited spoken utterances; visual schedules
Martin	14	Male	Down syndrome	Communication: 59 Daily living skills: 59 Socialization: 63	20; >1%	Limited spoken utterances; visual schedules

Note. ASD = autism spectrum disorder; PPVT - IV = Peabody Picture Vocabulary Test (4th ed.)

Figure 1: EasyVSD application with VSD and hotspot.



Note. A screenshot of the EasyVSD app with VSDs containing highlighted hotspot. When the hotspot was activated by touch, the following spoken message was produced by the tablet *I am going to put the backpacks in the storage room.*

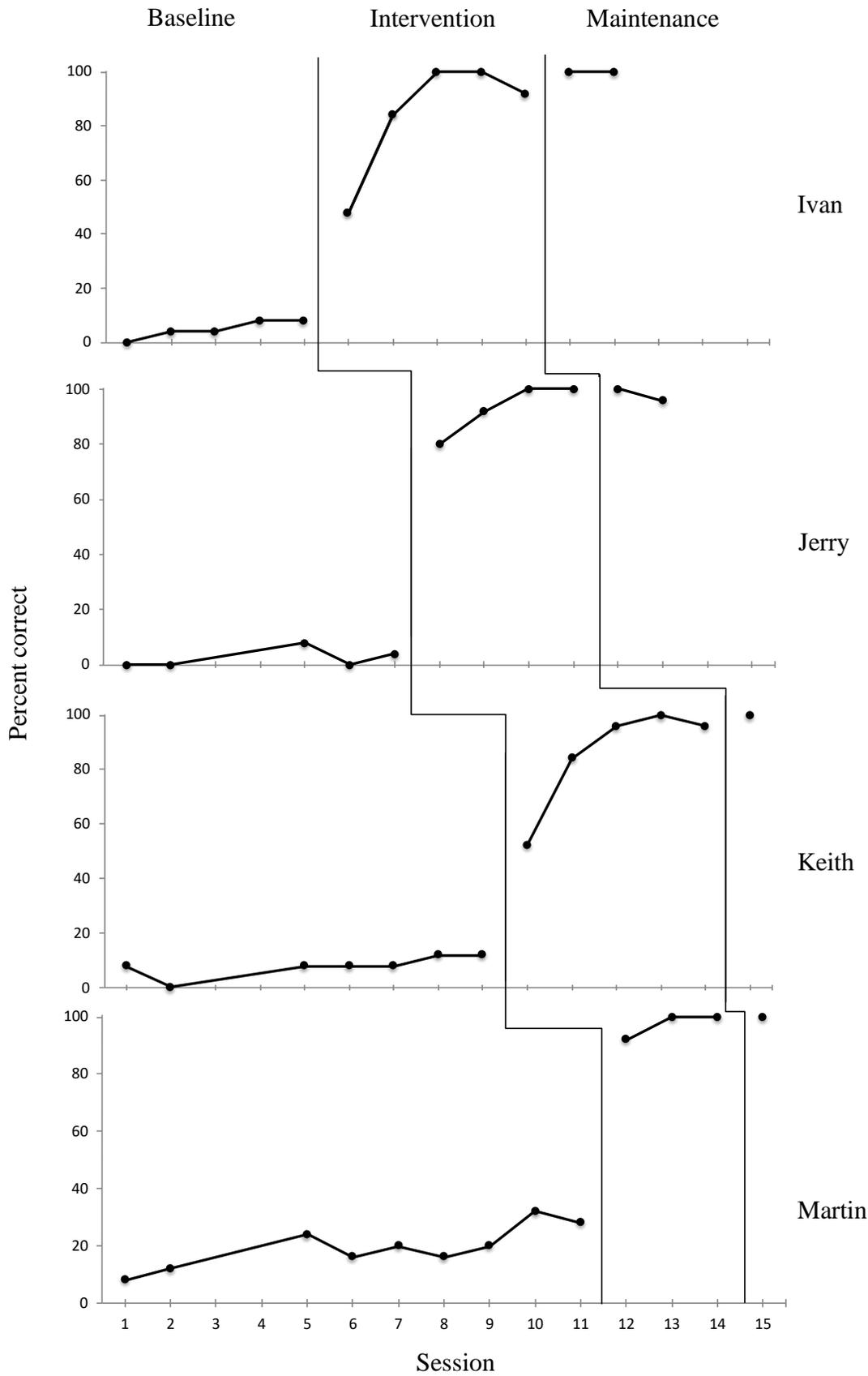


Figure 2. Percent of steps completed independently by participants during baseline, intervention, and maintenance