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Personalized AAC Intervention to Increase Participation and Communication for a Young Adult With Down Syndrome

Salena Babb, Sojung Jung, Ciara Ousley, David McNaughton, and Janice Light

Many adults with Down syndrome (DS) experience difficulty with speech production, and intelligibility challenges and communication breakdowns are common. Augmentative and alternative communication (AAC) intervention can provide important supports for persons with these complex communication needs but must be customized to address the goals, strengths, and needs of the individual. This article provides a description of a personalized AAC intervention for a young adult with DS whose speech was frequently unintelligible. The AAC intervention made use of a video visual scene display (VSD) approach and was investigated in 2 separate studies in 2 key community settings: An inclusive post–secondary education program (a single-case reversal ABAB design), and a community shopping activity (a nonexperimental AB case study design). The participant demonstrated sharp increases in successful communication and participation in both settings following the introduction of the video VSD, and both the participant and the key stakeholders viewed the intervention positively. The results provide preliminary evidence that personalized AAC intervention, including the use of a video VSD approach, can provide important supports for communication and participation in community settings for adults with DS and complex communication needs. **Key words:** *adult*, *augmentative and alternative communication*, *Down syndrome*

TODAY'S SOCIETY offers new opportunities for adults with Down syndrome (DS) to engage in work and volunteer activities, attend post–secondary education, and participate in community activities (Channell & Loveall, 2018). Too often, however, communication barriers limit the participation of adults with DS in society. Many individuals with DS are described as having *complex communication needs*, as they experience difficulties in both speech production and pragmatic skills (McNaughton et al., 2021). In a recent survey, more than 50% of parents of adolescents and adults with

Author Affiliations: *Departments of Educational Psychology, Counseling, and Special Education (Drs Babb and McNaughton and Mss Jung and Ousley) and Communication Sciences and Disorders (Dr Light), The Pennsylvania State University, University Park.*

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Corresponding Author: *Salena Babb, PhD, Department of Educational Psychology, Counseling, and Special Education, The Pennsylvania State University, 125 Cedar Bldg, University Park, PA 16802 (babb.salena@gmail.com).*

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DS reported that their child's speech was unintelligible to anyone other than close caregivers (Van Gameren-Oosterom et al., 2013). In addition to difficulties with speech intelligibility, many individuals with DS also experience challenges in pragmatic skills such as establishing and developing a topic of conversation (Martin et al., 2009). These difficulties with speech and language skills often result in communication breakdowns and challenges in community interactions (Graaf et al., 2019).

Augmentative and alternative communication (AAC) can provide important supports for individuals with DS who have complex communication needs. AAC interventions for adults with DS can include both unaided (e.g., sign language; Meuris et al., 2015) and aided AAC approaches (e.g., picture supports; Cameron & Murphy, 2002). To date, however, the majority of published reports of AAC interventions for adults with DS describe group trainings for residential home staff; this intervention approach offers limited attention to the unique communication goals, strengths, and needs of the individual adult with DS (McNaughton et al., 2021; Meuris et al., 2015).

Augmentative and alternative communication has the potential to provide an important method to augment the use of speech by adults with DS and thereby enable higher levels of community participation. In a *personalized* AAC intervention approach, the communication team draws on two key sources of information to guide goal setting, assessment, and intervention activities (Beukelman et al., 2016). First, the communication profile for a particular disability group is used to alert the team to any issues that may be of clinical importance in assessment and intervention activities. For example, it is well established that adults with DS frequently experience difficulty in their use of speech, especially with unfamiliar communication partners, and these difficulties often worsen with age (Martin et al., 2009). Second, while incorporating information from group trends, the goals, strengths, and needs of the individual are used to develop an AAC intervention that is personally relevant and impactful. This may include, for example, preparing for communication contexts known to be especially important to the individual with DS (e.g., community shopping), so as to ensure easy access to the specific vocabulary needed at those times (Beukelman et al., 2016; Light, Wilkinson, et al., 2019).

In addition to supports for communication, adults with DS may also require supports for participation in community settings—assistance in remembering and performing the steps in a task such as shopping in a grocery store, or ordering a meal in a restaurant. Although memory supports such as visual schedules and video modeling provide benefit (Gilson & Carter, 2018; Spriggs et al., 2017), these aids typically do not provide communication supports. Although individuals with DS can be taught to make use of separate supports for participation and communication, the need to make coordinated use of multiple apps or strategies during community interactions imposes additional cognitive and linguistic demands on the individual (Light, Wilkinson, et al., 2019).

VIDEO VISUAL SCENE DISPLAY

One AAC technique that offers integrated supports for communication and participation is *video visual scene displays* (*VSDs*). Video VSDs combine the strengths of video (which conveys the dynamic movement found in real-world interaction) and *VSDs*—easily recognized images within the video that have been programmed with communication hot spots (Light, McNaughton, & Caron, 2019). Video VSDs are created by using an app on a tablet computer to (a) capture video of motivating activities or download preferred videos from the Internet; (b) pause the video at key junctures, automatically creating VSDs (i.e., still images within the video); and (c) add hot spots to the VSDs with relevant vocabulary to support communication about the video (Light et al., 2015). When used by the person with complex

communication needs during an interaction, the video automatically pauses at key points in the activity and provides a VSD with hot spots. In this way, the individual is cued to the opportunity for participation, with the VSD providing the appropriate vocabulary for communication. (See https://tinyurl.com/rerc-on-aac-vVSD for a demonstration of video VSDs.)

Recent research provides initial evidence that video VSDs may assist individuals with complex communication needs during a variety of communication contexts. For example, Babb, McNaughton, Light, and Caron (2020) reported that a video VSD intervention increased communication between adolescents with autism spectrum disorder (ASD) and their peers with typical development during social interactions. Video VSDs also can be used to provide participation and communication supports during a wide range of community activities, including interactions with unfamiliar communication partners. O'Neill et al. (2017) reported that a video VSD intervention resulted in significant increases in communication and participation skills for a 16-year old girl with ASD. Increases were observed for both completion of community-based activities (e.g., working in a printshop, riding public transportation) and communication (e.g., greeting office staff). In a study with four adolescents with developmental delays, Babb, McNaughton, Light, Caron, et al. (2020) described how the use of video VSD supports resulted in increases in communication and participation for all four participants as they worked as volunteers at a food bank.

Although video VSD interventions have been demonstrated to provide important supports for communication and participation for persons with complex communication needs, much of the research to date has been conducted with younger individuals with ASD (Babb, McNaughton, Light, Caron, et al., 2020; Caron et al., 2018; Laubscher et al., 2019). There is a need to understand better the impact of a video VSD approach with adults with DS, who typically present with substantially different communication and participation profiles than that with individuals with ASD (Esbensen et al., 2010; Loveland & Kelley, 1988). In addition, there is a need to better understand the impact of video VSD interventions in a wide variety of communication contexts, including those community activities of personal relevance to adults with DS.

To support full engagement in desired activities of daily life, adults with DS need access to individualized supports for both participation and communication (Babb, McNaughton, Light, Caron, et al., 2020; McNaughton et al., 2021). As suggested by a personalized approach to AAC (Beukelman et al., 2016), intervention should be based on the goals of the individual, and evaluation of the intervention should include not only traditional performance measures (e.g., accuracy of performance) but also outcomes-based measures that evaluate the success of the intervention in meeting the unique needs of an individual (Light, McNaughton, Beukelman, et al., 2019).

In this article, we describe two separate case studies using a personalized AAC intervention approach, both with the same participant: Sean, a young adult with DS. We examined the impact of a video VSD intervention for Sean in two personally relevant community settings. In Study 1, we investigated the impact of a video VSD intervention on communication during structured social interactions at an inclusive post–secondary educational program at a local university. In Study 2, we examined the impact of a video VSD intervention on communication and participation during an independent shopping activity at a grocery store.

DESCRIPTION OF PARTICIPANT

At the time of the two studies, Sean was a 19-year-old man with DS, who lived at home with family members. Sean attended an inclusive educational program that supported adult students with disabilities in auditing college courses—in Sean's case, Introduction to Sign Language, and Fitness Walking. While

attending class, Sean was accompanied by a peer mentor, a college student who supported Sean in participating in the classes. Sean also spent part of his day in a self-contained special education classroom with a high school special education teacher.

Sean relied upon speech in communication with family members and educational staff. His use of speech was typically successful for obtaining well-known needs and wants and brief communication on familiar topics (e.g., Star Wars movies, football games). Even regular partners, however, sometimes experienced communication breakdowns when Sean attempted to establish a new topic of conversation or provide additional information on a familiar topic.

While on the college campus, Sean frequently initiated interactions with other students using his natural speech. These relatively unfamiliar communication partners, however, often were unable to understand Sean. A formal assessment using the Assessment of Intelligibility and Dysarthric Speech (Yorkston et al., 1984) revealed that Sean was less than 20% intelligible to unfamiliar partners.

At the time of the studies, Sean made some use of natural gestures (e.g., "thumbs-up" for OK, head nod/shake for yes/no) during interactions with others. A generic communication binder, containing symbol representations for common vocabulary items (e.g., graphic symbol pictures for vocabulary such as school, home, bus), was available to Sean in his special education classroom. The binder did not contain any individualized vocabulary specifically chosen for Sean. Educational staff reported that Sean relied on his natural speech and a small number of gestures at school and was not observed to make use of the communication binder. Sean demonstrated the ability to read familiar single words, and he was also able to spell a small number of familiar words (e.g., his name, the names of family members). Sean could not, however, reliably use spelling as a method of clarification when his speech was not understood.

Both Sean and his guardian were interested in Sean increasing his level of community participation and interaction; however, Sean's difficulties with speech frequently resulted in communication breakdowns. As a first step, the research team decided to investigate a method to support Sean's peer interactions while attending college classes. At these times, Sean would benefit from access to appropriate, personally relevant vocabulary and visual supports for establishing and developing a topic of conversation. The AAC technique should also augment Sean's use of speech, which Sean preferred as his primary method of communication. Finally, the device should pose minimal operational demands to learn and use, as Sean had no prior experience with AAC technology. Based on these required system features, a decision was made to investigate the use of video VSDs[1] as a personalized communication support for Sean when sharing information[2].

STUDY 1: VIDEO VSD INTERVENTION TO SUPPORT COMMUNICATION AT A POST–SECONDARY PROGRAM

Methods

In Study 1, we investigated the impact of a personalized AAC intervention using a video VSD approach on the communication of a young adult with DS during social interactions in a post–secondary setting. Study 1 made use of a single-case reversal ABAB

[1]In Study 1, we investigated the video VSD approach using a prototype app developed for research purposes, EasyVSD. EasyVSD is an AAC app developed by Invotek (https://www.invotek.org) for research purposes (Light et al., 2015). In Study 2, we used GoVisual, a commercial realization of a video VSD approach. GoVisual is an AAC application created by Attainment Company (https://www.attainmentcompany.com/govisual).

[2]Both the Human Research Ethics Committee at the first author's university and the participating school district provided approval for Studies 1 and 2. The participant provided assent and the participant's family provided consent for participation in studies. A pseudonym is used to protect the privacy of the participant.

design (Kazdin, 2010). The independent variable was the video VSD app and brief instruction in the use of the app. The dependent variable was the mean number of intelligible words per minute spoken by the participant (or produced by VSD app) during structured social interactions with a researcher. Generalization sessions were conducted with a college peer and Sean's special education teacher.

The study took place at a large university campus in the northeastern United States, at which Sean attended a sign language class three times per week. Probe sessions occurred in a lobby area outside of the Sean's special education classroom on campus.

Materials

During the intervention phases of the study, the research team provided Sean with a 12-in. Samsung Galaxy Note Pro 7 tablet that contained the video VSD app, Easy VSD, and four video VSDs (including embedded hot spots). Four new video VSDs were prepared and reviewed with Sean each day during intervention in three steps. First, during the class, the research assistant recorded four 20- to 30-s video clips of key events from the day's class (e.g., two to three students practicing a new sign, or communicating with each other using signs). Next, the research assistant left the classroom (approximately 10 min before the end of class) to add hot spots to the videos that had been recorded. The vocabulary for the hot spots was single words (e.g., "dancing"), or short phrases (e.g., "What did you do this weekend?") appropriate to the context of the video (i.e., the label for the sign). After each class, Sean sat with the research assistant to review the videos and activate each hot spot. Figure 1 provides a screenshot of an example VSD for the activity of communicating about the sign language class.

Procedures

The study included two baseline phases and two intervention phases, as well as a generalization phase. All probe sessions occurred

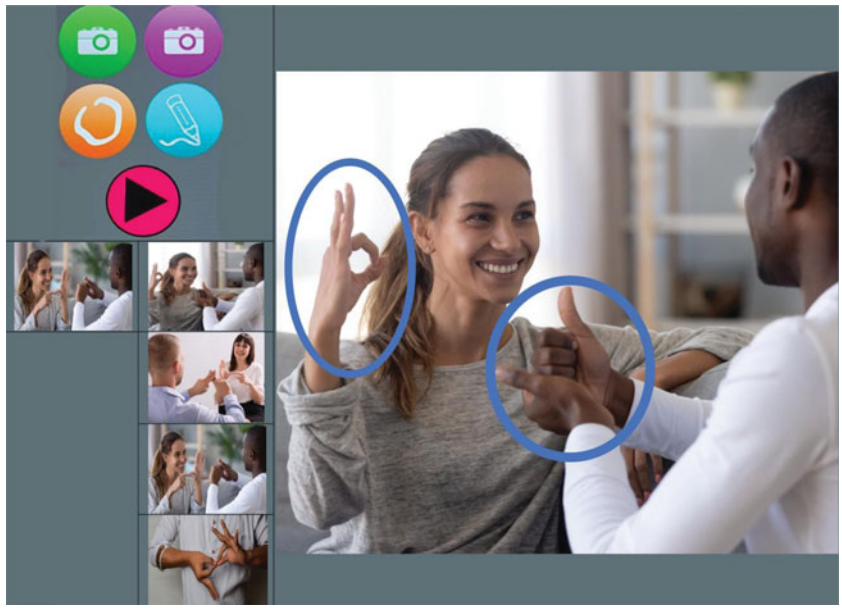

Figure 1. Example visual scene display (VSD) from Study 1. Screenshot of the video VSD app (EasyVSD) as used in Study 1. It depicts a VSD with two embedded hot spots used to label the signs ("OK," "Help"). The app included editing icons (e.g., for taking a video, for adding a hot spot) and a navigational menu on the left-hand side of the screen. This figure is available in color online (www.topicsinlanguagedisorders.com).

in a quiet area outside of the Sean's classroom with the first author and Sean seated next to each other. At these times, the first author followed a conversation protocol in order to provide a consistent number of communication opportunities for Sean. To begin each probe session, the first author greeted Sean and said, "Let's sit and talk for a few minutes." Then, every 20 s, the first author asked a variation of "What did you do today?" (e.g., "Tell me more about your day", "What else did you do today?"). If Sean was speaking at the 20-s mark, the first author waited for Sean to finish speaking and then asked another question based on the conversation protocol. As Sean spoke, the first author showed engagement with eye contact and facial expression (e.g., smiles, head nods) but did not comment on (or ask a follow-up question related to) the content of the Sean's message. Although the first author never explicitly addressed the content of Sean's message, the questions asked were always logical extensions to Sean's response (e.g., "Did you do anything else this morning?" and "What other things did you do today?"). Each probe session lasted 5 min and 30 s, and sessions were conducted approximately three times per week. Each session was video recorded for data collection. To calculate the number of intelligible words per minute, the total number of intelligible words spoken by Sean was divided by the number of minutes in each session (i.e., 5). Thirty seconds was subtracted from the duration of the session (i.e., 5 min 30 s) to account for the time in which the first author asked questions.

Baseline

In the baseline phases (A^1 and A^2), Sean did not have access to the video VSD app to support communication during probe activities.

Intervention

Intervention probe sessions were conducted as in baseline, except that the tablet with the video VSD app was now placed in close proximity to the student. The video VSD app contained the four video segments (each approximately 20–30 s in length) described previously. Sean participated in the intervention probes approximately 75 min after the review of the video VSDs with the research assistant.

During the first intervention phase (B^1), the first author also provided additional instructional sessions in the use of the app. Sean made limited use of the video VSD app in the first two intervention sessions of the first intervention phase (B^1). The team therefore decided to provide instruction during the final five intervention sessions of the first intervention phase (B^1). For these instructional activities, the first author and a research assistant began each intervention session (after the review of vocabulary with the research assistant, and prior to the probe) with a brief role play demonstrating the use of the video VSD as a communication support. During these demonstrations, the first author played the role of Sean and modeled how the video VSD app could be used to provide information in response to questions. The research assistant played the role of the communication partner by asking questions approximately every 20 s. For example, after the research assistant asked a question, the first author responded by playing the video in the app, touching the hot spot to produce voice output, and then elaborating (with speech) on the action depicted in the video clip. After a maximum of three models from the first author and the research assistant, Sean took his typical role in the interaction and was provided with an opportunity to respond to a question from the first author using the app. If Sean did not perform one of the three steps (e.g., play a video, press a hot spot, elaborate with speech), he was provided with additional support to perform the skill correctly for a maximum of two additional trials. If Sean correctly selected the video using the app, activated the hot spot, and elaborated on the hot spot with speech, the first author ended the instructional session. After a 5-min break, the first author then conducted a probe session. No role play

instruction was provided in the second intervention phase (B^2).

Procedural fidelity

Procedural fidelity was calculated for a minimum of 20% of randomly selected sessions across each phase (Kazdin, 2010) using a checklist of the required procedures. A trained graduate student evaluated the procedural fidelity by watching a video of the session. Procedural fidelity 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 fidelity was 97% across all phases (range: 90%–100%).

Measures, data analysis, and interobserver agreement

The dependent variable was the number of intelligible words produced by Sean (using natural speech or the video VSD app). Three graduate students (who had no prior interactions with the participant) each listened to the audio track for the probe session a single time and recorded all intelligible words. Each coder was instructed to only record words that were intelligible through the standard English pronunciation of the word (i.e., no word approximations). To calculate an estimate of Sean's intelligibility under real-world conditions with unfamiliar partners, only words that were agreed upon by all three coders were counted.

Social validity

We obtained information on social validity from Sean, Sean's guardian, and Sean's classroom teacher. Social validity was assessed for Sean by using a Talking Mats procedure (Cameron & Murphy, 2002). In this approach, Sean was given photographs representing familiar activities, events, or items and asked to sort the items into three areas labeled with symbols representing "like," "not sure," and "don't like." Sean's guardian provided information on known likes and dislikes in order to confirm that Sean was making appropriate use of the Talking Mats technique. Two pictures representing the study and intervention were included in the selection process (i.e., picture of Sean and the first author with the tablet, and a picture of the tablet showing a VSD on the screen). The first author also developed procedures to gather social validity data from the classroom teacher and parental guardian. Both respondents viewed randomly selected pre-/postvideos, and then answered questions about the importance of the intervention goal (i.e., communication about social events); the effectiveness, efficiency, and appropriateness of the video VSD intervention; and their preference for communicating with Sean (i.e., would they prefer to use or not use the video VSD when interacting with Sean).

Results

The results of Study 1 provide evidence that the introduction of the video VSD app was associated with a large increase in the number of intelligible words used by Sean (see Figure 2). The increases were observed both for Sean's natural speech and for the speech output provided by the video VSD (see Figure 3). Sean demonstrated this pattern of performance during probe activities with the first author, as well as with the two generalization partners.

In the baseline phases (A^1 and A^2), Sean did not have access to the video VSD app to support communication during probe activities. At these times, Sean produced approximately one intelligible word per minute (see Figure 3).

In the first probe sessions of the first Intervention phase (B^1), Sean made only limited use of the hot spots and the research team decided to implement a phase change and provide additional instruction in the use of the video VSD app to support social interaction (see the "Procedures" section). Following the role play training, Sean made increased use of the video VSD app and produced 3.5 intelligible words per minute. Increases were observed both for Sean's use of the VSD and for his own speech.

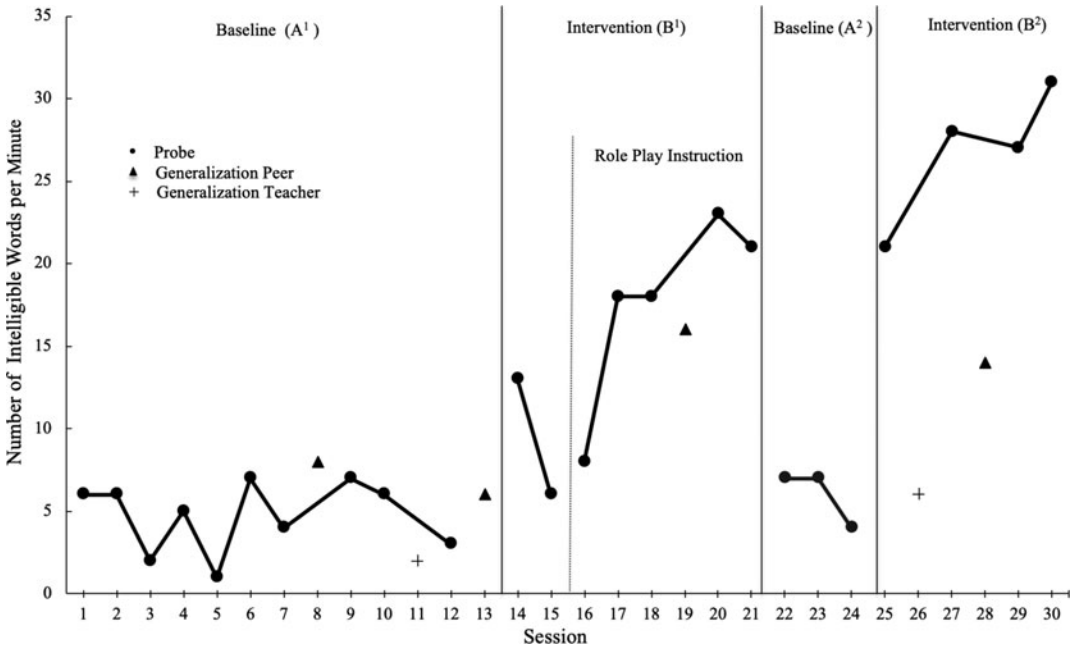

Figure 2. Number of intelligible words per minute by Sean during baseline and intervention in Study 1.

After a total of seven intervention sessions, the video VSD app was removed, creating a return to baseline conditions (A^2) and a sharp reduction in intelligible word per minute. When a stable or decreasing trend was observed in the second baseline phase, the intervention phase was reintroduced.

During the second intervention phase (B^2), Sean was again provided with access to the video VSD app with programmed videos; however, no additional instructional sessions (i.e., role play sessions) were provided. As in the first intervention phase, the tablet was placed in close proximity to Sean. Sean regularly demonstrated effective use of the video VSD app in B^2, with sharp increases both in the use of intelligible natural speech and the speech produced by the video VSD app for a total of 5.4 intelligible words per minute (see Figures 2 and 3).

Generalization

Generalization probes were conducted in separate interactions with an unfamiliar peer partner and Sean's classroom teacher in the baseline and intervention phases (see Figure 2). The unfamiliar peer partner was directed to follow the same procedures as were used by the first author (e.g., asking questions approximately every 20 s, acknowledging Sean's response with general affirmations). During these interactions, Sean made use of 0.7 intelligible words per minute in baseline and improved to three intelligible words per minute in intervention. For interactions with the classroom teacher, Sean improved from an average of 0.4 intelligible words per minute in baseline to an average of 1.2 intelligible words per minute following the video VSD intervention.

Social validity

Using the Talking Mats procedure, Sean placed two photographs of the intervention in the "like" category. As evidence of the validity of this approach, he also placed known dislikes (e.g., vegetables, losing a game) and known likes (e.g., Star Wars, pizza, friends) into the appropriate categories. In addition, in response to the questions posed as part of the social validity procedures, both Sean's teacher and guardian agreed that the goal

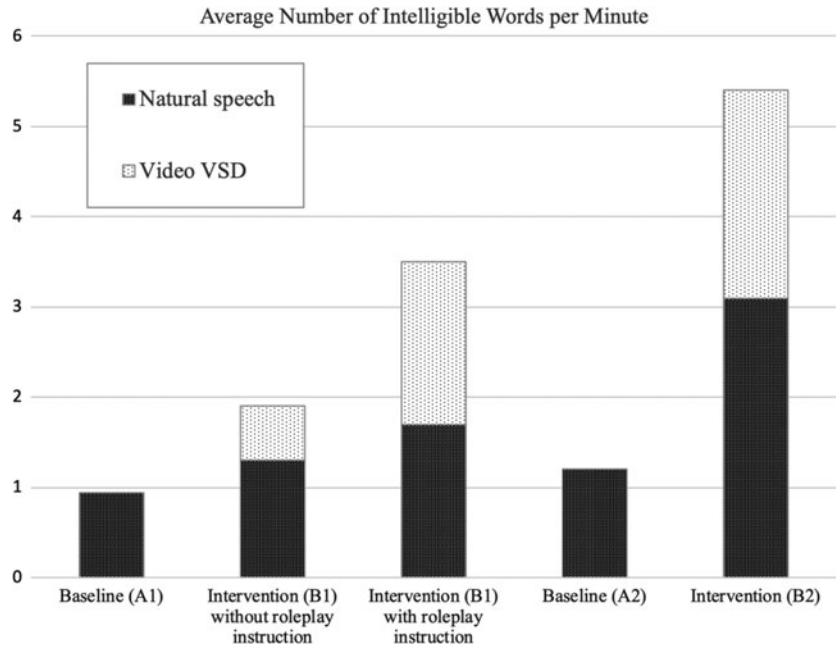

Figure 3. Proportion of intelligible words per minute communicated using natural speech and the video VSD app by Sean during baseline and intervention in Study 1. VSD = visual scene display.

of communication was important for Sean; that the personalized intervention was effective, efficient, and appropriate; and that they would prefer to make use of the video VSD when interacting with Sean about social content in the future. Comments included, "It helped him have the opportunity to create more language for himself and to put things in context" (Teacher), and "I really liked seeing Sean's level of confidence. He would smile, his speech would actually improve when he was hearing the word, he would repeat it back. So I thought that was very good for him." (Guardian)

Conclusions

Study 1 provided preliminary evidence that a personalized AAC intervention using a video VSD approach could have a positive impact for an adult with DS who frequently experienced communication breakdowns with speech during social interaction. The video VSD intervention resulted in an increase from 0.9 intelligible words per minute to 5.4 words per minute and positive assessments of the social validity of the intervention from the participant (Sean), his teacher, and his guardian.

STUDY 2: VIDEO VSD INTERVENTION TO SUPPORT PARTICIPATION AND COMMUNICATION AT A STORE

Methods

Based on the positive results in one communication context (i.e., social communication at a post–secondary setting), the intervention team agreed to investigate the impact of a personalized AAC intervention using a video VSD approach in a new communication context: independent grocery shopping at a community store. At these times, Sean would need supports both for participation in the activity (e.g., locating needed items, paying at the cashier) and for communicating with store staff as needed (e.g., ordering items at the deli counter).

In Study 2, we investigated the effects of a video VSD intervention on Sean's

participation and communication during a grocery shopping activity, using a nonexperimental AB case study design. The independent variable was the video VSD app (i.e., GoVisual) and brief instruction in the use of the app. The dependent variable was the percentage of task steps (including steps that involved communication) completed independently during a grocery shopping activity.

Study 2 took place at a large grocery store. The store contained several distinct areas (e.g., bakery, fruit, vegetables) and 16 aisles of grocery items. Although Sean had accompanied his family when shopping in the past, he was not familiar with this store.

Based on discussions with the family, the second author developed a list of specific food items for purchase that (a) were known to Sean (e.g., a box of extra-large taco shells) and (b) provided opportunities for communication (e.g., ordering sliced meat at the deli counter). The targeted food items were then randomly assigned to the Instructional Shopping List or the Generalization Shopping List, with the provision that each list contained three items that could be obtained independently by Sean (e.g., two bananas in the fruit section) and one item that required assistance from a clerk (e.g., 1/4 pound of American cheese at the deli counter).

The first author then developed a task analysis for the purchase of food items, including both participation and communication steps. See Table 1 for an excerpt of the 24-item task analysis, as well as information on the video model, and the content of hot spots.

Materials

The materials used for this study included (a) a 9.7-in. Apple iPad tablet with the GoVisual app, (b) a store discount card, (c) a store gift card, and (d) a shopping bag. Using the task analysis as a guide, the second author created a series of videos in which an adult modeled the necessary steps to complete the shopping activity. As needed, hot spots were

Table 1. Excerpt of task analysis and description of video VSD for grocery shopping in Study 2

Participant Step	Video Footage	Hot Spot Location (Spoken Message)	Sample Partner Response
1. Get shopping cart, put shopping bag in cart, enter store	Model retrieves shopping cart, places bag in cart, enters store		
2. Navigate to aisle for taco shells	Model navigates to aisle for taco shells		
3. Locate taco shells on store shelf	Model locates taco shells on store shelf		
4. Pick up and check taco shells against list (video VSD), places shells in cart	Model checks taco shells, then puts shells in cart		
5. Navigate to deli counter	Model navigates to deli counter		
6. Greet the deli clerk	Model greets deli clerk	*Hi, how are you?*	Clerk: "Good, what would you like?"
7. Order cheese	Model requests cheese from deli clerk	*I would like a quarter pound of Dietz & Watson's American cheese sliced thin.*	Clerk: "Sure"

Note. VSD = visual scene display.

programmed on the VSDs (using the GoVisual app) to support communication. Figure 4 provides an example of a screenshot of a video VSD for communication with a deli worker. A total of 24 video clips, including 10 clips with communication events, were programmed using the GoVisual app, one for each step. The complete video was 4 min and 34 s in length and depicted the model (an adult male) demonstrating the needed steps to purchase and pay for food items.

Procedures

The study included four phases: baseline, intervention (including a phase change), generalization, and maintenance. All sessions were conducted by the second author at the store. The third author observed all sessions to check for interobserver agreement and treatment fidelity. Sean participated in the shopping activity three times per week over a 10-week period. A maintenance probe was conducted 12 weeks after the completion of intervention.

Each session began with a probe, conducted at the entrance to the store. At that time, the second author provided Sean with an iPad with the shopping list on the home page, a store discount card, a store gift card for paying, and a shopping bag. The second author told Sean, "It is time to go shopping." She then monitored Sean's performance of the steps for the task analysis. If at any time Sean took more than 1 min to complete any of the 24 steps in the task analysis (e.g., navigate to the fruit section to purchase bananas), the session was ended. At this time, the second author commented "Oh, I am sorry, I have to go now. Let's go shopping on another day" (this "excuse" was provided in order to prevent Sean from becoming embarrassed or frustrated). Task analysis steps could be performed out of order (e.g., Sean could, at any time, take his cart to the checkout line). Also,

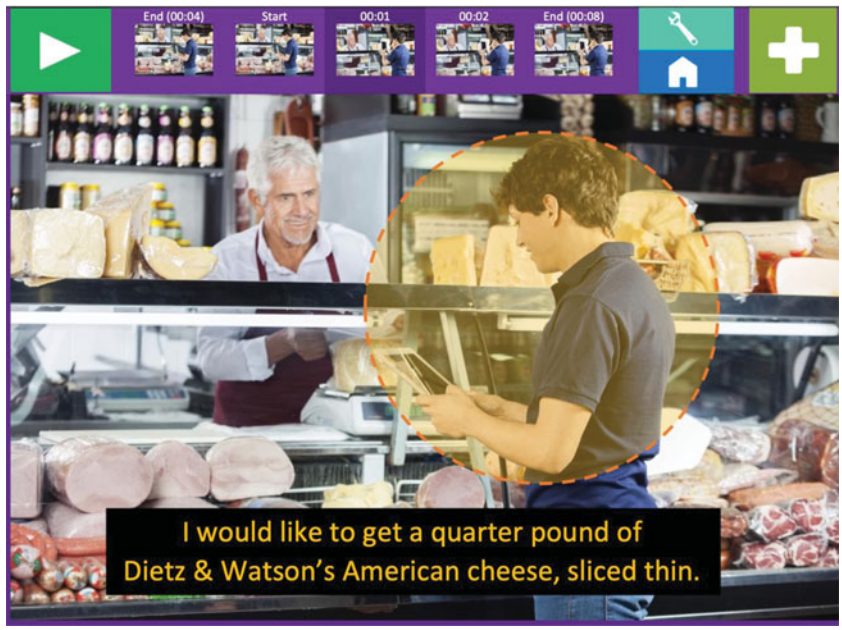

Figure 4. Example visual scene display (VSD) from Study 2. Example of a screenshot of the video VSD app (GoVisual) as used in Study 2; It depicts a VSD with an embedded hot spot ("I would like . . . ") used to order at the deli counter. The VSD includes a text caption to support communication in noisy environments. The thumbnails on the top menu are used to navigate the video segments, and a dark purple color box highlights the video that is currently playing. This figure is available in color online (www.topicsinlanguagedisorders.com).

time spent waiting for service (e.g., waiting to be served at the deli counter) was not counted against the 1-min limit.

Baseline

In baseline, Sean was provided with an iPad with the shopping list for that day's probe session visible on the home page. Sean did not have access to the video VSD app. The research team conducted probes for both the Instructional Shopping List ($n = 6$) and the Generalization Shopping List ($n = 3$) during baseline.

Intervention

During intervention, Sean was provided with access to a tablet with the video VSD application. Intervention also included four instructional sessions: one model session, followed by three guided practice sessions. Each of the four sessions started with a probe and was immediately followed by an instructional session (i.e., a model or guided practice session). During the model session, the second author demonstrated how to use the video VSD app to complete all steps (including both participation and communication steps) in the shopping activity for the Instructional Shopping List. During the three guided practice sessions, the second author assisted Sean in using the video VSD app to successfully complete all of the steps in the shopping activity. During guided practice, Sean learned the operational steps for the device (e.g., pushing the green play button to view a video clip, communicating with other people by touching the hot spot on the screen of the app).

One phase change was needed during intervention. During the early intervention sessions, it was noted that Sean regularly experienced a communication breakdown at the deli counter. Although Sean touched the appropriate hot spot accurately, the deli worker was unable to hear the speech produced by the tablet (a request for a $\frac{1}{4}$ pound of cheese) because of background noise. The research team therefore added written text for the target phrase to the app so that it was visible on the VSD (see Figure 4). Sean then completed another eight sessions over a 24-day period, during which he had access to the video VSD, but with no additional instruction or corrective feedback.

Maintenance

Maintenance data were collected 12 weeks after the completion of intervention. Two probes were conducted with the Instructional Shopping List, and one probe with the Generalization Shopping List.

Procedural fidelity

Procedural fidelity was calculated for 22 of the 23 (96%) of the baseline, intervention, and maintenance sessions by the third author, who used a checklist of the required steps in vivo. Procedural fidelity was calculated using the same formula as Study 1 and was 99.8% (range = 95.8%–100%).

Measures, data analysis, and interobserver agreement

The dependent variable was the percentage of the task analysis steps completed correctly by the participant. Among the total of 24 task analysis steps, 14 were task behaviors (e.g., selecting a box of Ortega extra-large taco shells) and 10 were communication opportunities (e.g., asking for a 1/4 pound of American cheese at the deli counter). The dependent variable was calculated by dividing the number of steps completed independently by the total number of steps (e.g., 24-step) and multiplying by 100 (see the "Results" section). Procedures for interobserver agreement followed the same procedures as those for procedural fidelity. The average interobserver agreement for scoring of participant behavior was 98.3% (range = 88.9%–100%).

Social validity

We asked Sean a small number of questions to explore his opinion regarding the video VSD intervention. We also gathered more detailed information from his two habilitation aids using a 6-item open-ended questionnaire

(developed by the second author). The questionnaire addressed topics such as the impact of the video VSD on Sean's participation and communication in the shopping activity, the appropriateness and efficiency of the intervention, and Sean's enjoyment of the shopping activity.

Results

The results of Study 2 provide evidence that a personalized AAC intervention using the video VSD app resulted in improved independent participation and communication in a grocery store setting. The percentage of completed steps is represented in Figure 5. In the baseline phase, the participant, Sean, did not independently perform any of the shopping behaviors successfully. After the introduction of the video VSD and a short training, Sean showed a sharp increase in the number of steps performed. As noted in the "Procedures" section, a phase change was needed in the early stages of intervention. The addition of written text to one VSD used in a noisy area with a variety of untrained communication partners (i.e., the staff at the deli counter) supported perfect performance by Sean in the remaining eight intervention sessions.

Generalization

After Sean demonstrated success at 100% for three probes in a row with the Intervention Shopping List, the research team probed using the Generalization Shopping List, which featured a video model of new items located in previously unused sections of the store (e.g., the diary section). Sean successfully completed each step within the 1-min time limit, scoring 100% for the three Generalization Shopping List probes during the intervention phase. Sean also demonstrated successful performance of the communication and participation skills at the maintenance data session, collected 12 weeks after the initial intervention.

Social validity

Sean was asked three questions about the video VSD intervention after all sessions were completed: "Do you enjoy shopping?", "Do you like the iPad and this app?", and "Do you want to try using the iPad and this app to buy other items?" For all three questions, Sean made a gesture (i.e., thumbs-up) and answered "Yes, woo hoo!" while nodding his head. Two of Sean's habilitation aides also provided information regarding social validity. Both aides reported that the use of video VSD resulted in improvements in Sean's communication and participation skills while shopping. Both aides also reported that they viewed the video VSD intervention as appropriate and efficient, and that Sean appeared

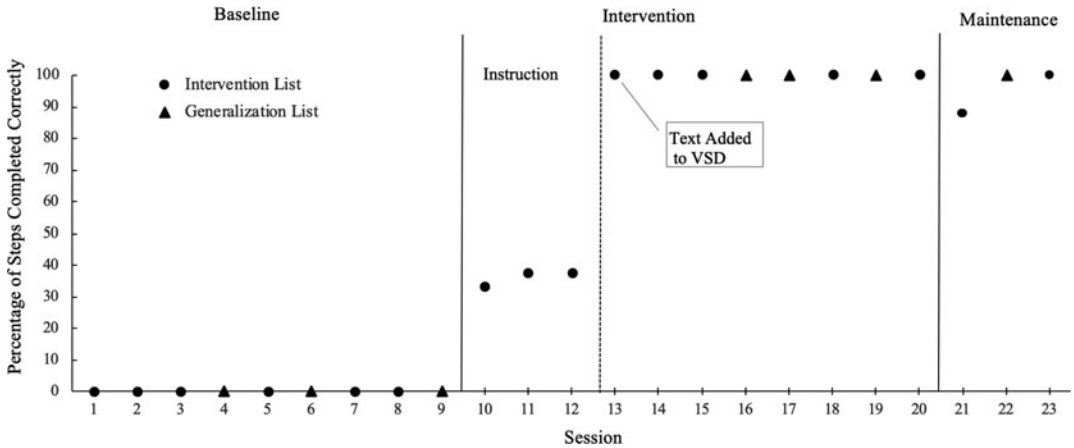

Figure 5. Percentage of steps completed independently by Sean during baseline, intervention, and maintenance in Study 2. VSD = visual scene display.

to enjoy the shopping activities when it included use of the video VSD app. One aide also stated that the app increased Sean's independence at the store, especially at the deli counter and the cash register.

Conclusions

The results of Study 2 provide initial evidence that the introduction of a personalized VSD app and a brief training can improve the participation and communication of a young adult with DS during interactions with untrained communication partners (e.g., deli clerk, cashier) in a community activity (i.e., shopping). Although the case study did not make use of a design that provided experimental control, alternative explanations for the change in performance are unlikely. Sean demonstrated 100% completion of the shopping activity (including successful communication) with two different shopping lists: one for which he received a model and guided practice (the Instructional Shopping List), as well as one that listed items for which no additional instruction was provided (the Generalization Shopping List).

DISCUSSION

These studies add to the growing evidence that a video VSD approach can be used to provide an effective personalized AAC intervention for young adults with developmental disabilities and complex communication needs in a wide variety of settings (Babb et al., 2019, Babb, McNaughton, Light, Caron, et al., 2020; O'Neill et al., 2017). In both of the studies reported here, the personalized AAC intervention (using a video VSD approach) not only resulted in improved performance on traditional measures of communication outcomes (i.e., number of intelligible words per minute, percentage of steps completed successfully) but was also viewed by the participant, and key stakeholders, as an effective method to address key participation and communication goals.

Although the video VSD intervention provided important supports in two important contexts, it should be noted that the use of the video VSD app did not address a full range of communication functions (e.g., greetings and closing, acceptance, and rejection) at these times. Rather, the video VSD app was used as a compliment to existing strengths for the individual and to provide assistance in specific areas of need in specific contexts. For example, Sean preferred the use of speech with family members and familiar partners and could successfully use speech for acceptance and rejection (e.g., "yes," "no"), greetings and closings (e.g., "hi," "bye"), and familiar vocabulary (e.g., "pizza"). It was in exchanges to share novel information (i.e., describing a recent activity), or to make use of specific vocabulary with unfamiliar communication partners (e.g., ordering an item at a deli counter), that Sean was most likely to experience difficulty. The video VSD approach provided an effective personalized communication support at these times, as it includes support for such communication goals as establishing a topic of conversation (Caron et al., 2018), and accessing specific vocabulary items and phrases during a community activity (Babb, McNaughton, Light, Caron, et al., 2020). It also provides structured support for participation in new activities, therefore, creating new opportunities for communication. Based on the success of the video VSD intervention in the post–secondary and shopping settings, a decision was made to investigate the use of video VSDs to support social communication at Sean's place of work, a pizza store. This intervention was interrupted by the COVID-19 pandemic but will be resumed in the future.

It is also of interest to consider these findings within a communicative competence framework (Light & McNaughton, 2014). Although the participant (Sean) quickly learned to operate the device (e.g., navigate the different videos, activate hot spots), he required additional instruction in order to make appropriate strategic use of the app—to use it to establish a topic of conversation, and to repair communication breakdowns. Once he learned the skills needed to operate

and make strategic use of the app, Sean used the video VSD app to independently communicate with members of the research team and the community.

Limitations and future research directions

This article describes two studies with one young adult with DS. Additional research, with strong experimental designs, and additional participants, is needed to better understand the impact of video VSDs as personalized AAC interventions for individuals with complex communication needs. For example, it is anticipated that individuals like the current participant will always require AAC supports to augment natural speech; however, future research should investigate whether the video models to support participation (e.g., the steps in the shopping task) could be faded as the individual becomes more familiar with the sequence of the task, leaving only the VSDs to support communication. Future research studies should also investigate questions related to the generalization of video VSD interventions across multiple community partners and contexts and the maintenance of these effects across time. Finally, future research should provide more detailed information regarding the social validity of personalized AAC intervention using a video VSD approach, with special attention to the gathering of information from the participant, key stakeholders (e.g., family members, education professionals), and community communication partners (McNaughton et al., 2019; Schlosser, 1999).

SUMMARY

Personalized AAC intervention must consider the knowledge base available from past research with individuals with complex communication needs, but it also must be guided by the unique goals, skills, and needs of the individual. In the two case studies reported here, the use of a personalized AAC intervention, using a video VSD approach, resulted in increased communication and participation in two key settings: an inclusive post–secondary educational program and a community grocery store. As noted by McNaughton et al. (2019), "the full success of AAC intervention is best evaluated not by a single performance under controlled conditions, but rather by the extent to which it improves access and participation in valued activities and experiences of everyday life. (p. 65)." The AAC intervention must be developed for, and evaluated by, the individual with complex communication needs during interactions for a wide variety of communication functions, in a wide variety of communication contexts, with a wide variety of communication partners (Beukelman et al., 2016; Light, McNaughton, & Caron, 2019; Meuris et al., 2015).

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