Abstract: This study aimed to contribute to the secondary-tier evidence of the three-tier video modeling intervention model (3TVM), using a group-based generic video, and to explore a new form of augmentative and alternative communication (AAC) intervention using a Chinese-language interface for teaching children with developmental disabilities. A multiple baseline across participants design was used in this study to assess the success of the intervention among three individuals ages 9–12 with developmental disabilities. The results indicate that the group-based VM intervention using an iPad® successfully increased the participants’ ability to communicate during snack time. As the participants’ communication improved, anecdotal records showed that their inappropriate behaviors decreased. A discussion of future research is provided.

Individuals with developmental disabilities, especially autism spectrum disorders (ASD), are often characterized by social-communication skill deficits and restricted repetitive behaviors (American Psychiatric Association, 2013), which may have significant impacts and challenges to their lives. For individuals with developmental disabilities who have limited verbal skills, augmentative and alternative communication (AAC) is the most common method of (1) improving their quality of life, (2) improving their personal relationships by increasing interaction with others, (3) increasing their independence, and (4) satisfying their basic needs (Henderson & Doyle, 2002). Using speech generated devices (SGDs), as a form of AAC, is one of the ASD evidence-based practices (EBPs) (National Autism Center, 2015; National Professional Development Center on Autism Spectrum Disorder, 2014). Existing literature shows that the application of portable SGDs increases the communication outcomes of learners with developmental disabilities. On the other hand, many studies have also demonstrated that learners have mastered various different target skills using video modeling (VM), which is also an ASD EBP. Nevertheless, evidence of both practices is limited among Mandarin Chinese learners, and of the newly established three-tier VM intervention model (3TVM; Wang & Koyama, 2014), studies addressing secondary-tier group-based intervention is lacking. This study therefore aims to implement secondary-tier group-based VM using a portable SGD to enhance the communication of learners with developmental disabilities.

Speech Generated Devices for AAC

The definition of an AAC system is “an integrated group of components, including symbols, aids, strategies and techniques used by individuals to enhance communication” (Henderson & Doyle, 2002, p. 127). Various types of AAC modes, such as manual signs, picture-exchange, and electronic-generating devices, are available to teach systematic communication to individuals with developmental disabilities (Lancioni et al., 2007; Mirenda,
Rispoli, Franco, van der Meer, Lang, and Camargo (2010) and van der Meer and Rispoli (2010) specifically reviewed the literature on utilizing SGDs, sometimes referred to as voice output communication aids (VOCAs), with learners with developmental disabilities and with ASD and found that most studies provided conclusive positive evidence. In addition, interest has increased in employing portable media players and smartphones as SGDs and using them as media in communication interventions (Sennott & Bowker, 2009) because, first, these new mobile technologies are typically smaller and less expensive than traditional AAC devices and they make extensive mainstream smartphone applications accessible (Naughton & Light, 2013), and second, the peer and social acceptance of mobile technologies mitigates the stigma in the mainstream (Kagohara et al., 2013). Given these reported advantages, and having them configured with a software application such as Proloquo2Go™, these portable SGDs are educationally oriented and have become a new trend in the educational and rehabilitation fields involving individuals with disabilities.

In recent years, many researchers have employed devices such as the iPod® and iPad® to deliver instructional videos or to teach individuals to access stimuli with a single-subject design. Kagohara et al. (2010) taught an adult with ASD to be more successful in activating the speech output of his iPod Touch® through a behavioral intervention. The study of Kagohara et al. (2010) involved two baselines, two interventions, and a follow-up phase. In the initial baseline phase, despite the failure of activation, the participant was given access to snacks when he selected the correct icon. During the first intervention, if the participant failed to activate the speech output, the trainer immediately guided the participant’s hand to prompt a correct performance. Then a 5-s delay prompts resulted in an immediate increase of expected behavior, and with a 10-s delay, the participant reached 100% accuracy. During the second baseline phase, the participant’s performance decreased, but an improvement was observed when the 10-s delay procedure was reintroduced. During the follow-up sessions, the expected behavior remained. van der Meer et al. (2011) used the iPod Touch® with Proloquo2Go™ software to teach three individuals with developmental disabilities to use functional language. The study used a multiple-baseline across participants design, which included baseline, acquisition training, post-training, and follow-up phases. During the acquisition training, the researcher used physical prompting to guide the participants’ hands to touch the correct icon and activate the speech output. A 0-s delay was implemented in the first three trials and a 10-s delay was implemented in the remaining trials. Two participants proceeded to the post-training phase after achieving the acquisition criterion; however, the third participant failed to reach the acquisition criterion within 40 training sessions. In the post-training phase, no prompting was provided and access to preferred stimuli was contingent on correct responses. With physical prompting and differential reinforcement procedures, two of the three participants learned how to apply the iPad-based SGD to make requests. Achmadi et al. (2012) evaluated a program of teaching two adults with ASD to operate an iPod-based SGD and request preferred stimuli. The program was evaluated using a multiple-baseline across participants design. The intervention procedures involved least-to-most prompting, differential reinforcement, and backward chaining. Via these teaching procedures, both participants successfully learned to operate the iPod-based SGD more independently to request their preferred stimuli. Regarding behavioral interventions, the findings of the above-mentioned studies all suggested positive outcomes. However, most empirical studies implemented their SGDs using in vivo behavioral interventions that require heavy personnel investment, such as prompting, differential reinforcement, time delay, and modeling, which requires time commitment, trained personnel, and expertise. Moreover, insufficient application and evidence was accumulated for culturally linguistically diverse learners and for those from non-Western countries whose predominant language is not English.

**Video Modeling**

As an EBP for people with ASD, VM can be used to provide instruction on many skills for individuals with different diagnoses (Baker, Lang, & O’Reilly, 2009; Wang & Koyama,
VM has some potential advantages over other strategies; for example, VM requires less expertise, simplifies instruction standardization, minimizes effort to implement, maximizes the consistency and replication within a study, and is cost-effective (Gena, Couloura, & Kymissis, 2005; Rayner, Denholm, & Sigafoos, 2009; Sigafoos, O'Reilly, & De La Cruz, 2007). In addition, the rationale of using VM supports the characteristics of learners with ASD to practice observational learning as a less intrusive strategy, and the results are more sustainable than physical prompting (Biederman, Pairhall, Raven, & Davey, 1998; Corbett & Abdullah, 2005). VM is mostly delivered one-on-one and has been less applied as a SGD intervention. Two recent SGD VM studies used an iPod® or iPad® to deliver instructions (Cihak, Fahrenkrog, Ayres & Smith, 2010; Kagohara, Sigafoos, Achmadi, O'Reilly, & Lancioni, 2012). Cihak et al. (2010) used an A-B-A-B withdrawal design to evaluate the efficacy of iPod-based VM for assisting four students (ages 6 to 8) with ASD in transitioning at school. During the baseline phase, assistance was provided if participants performed inappropriate behaviors and were unable to transition independently. During the VM intervention phase, least-to-most prompting was implemented when the participants failed to respond correctly, even after watching videos several times. The study returned to the baseline once the participants achieved accurate responses (100%) at three consecutive sessions. When the participants’ performance decreased, the VM phase was reinstated. The participants reached the criterion in two VM intervention phases within 9 to 15 sessions and 4 to 10 sessions, respectively. The high level of performance was maintained at the follow-up probes occurring 9 weeks after the second intervention. Even though the findings suggest that VM delivered on an iPod® with prompting was effective for promoting successful transitioning at school, the effectiveness of independent transitions using solely VM procedures without prompts cannot be concluded. In other research, Kagohara et al. (2012) employed an iPad® to show a video to teach two children with Asperger’s syndrome and hyperactivity disorders how to check the spellings of words in their classrooms using a delayed multiple-baseline-across-participants design. During the baseline phase, with only verbal praise, neither participant correctly typed the words or checked the spellings. However, during the VM intervention, the participants demonstrated an increase in correct responses and gradually reached 100% success. Even though VM was not provided, their performance was retained in the follow-up sessions. The results illustrated the effectiveness of iPad-based VM in teaching students to type and check the spellings of words. While these studies aimed to evaluate the effectiveness of VM in improving academic or transitioning skills, SGD VM has been less utilized in the domain of communication.

Three-tier VM Intervention Model

Recently, the three-tier VM intervention model (3TVM), which is an application of the response-to-intervention framework, has been conceptualized to address the corresponding level of resources, support, and intervention delivery type an individual requires to yield the best learning outcomes and to promote the dissemination of VM (Wang & Koyama, 2014). In this sense, the educational decision of utilizing 3TVM is made based the learner’s responses to the intervention rather than on the disability type, placement setting, or other man-made categories. Specifically, for learners with ASD and other developmental disabilities of their individual heterogeneity and different needs of the ecological factors, a one-fits-all service is inadequate. 3TVM consists of three tiers, which provide an alternative choice menu when the primary selected intervention type fails to sufficiently meet the learner’s needs. Moreover, despite the intervention fidelity issue and the learner’s response to the intervention, there are often times ecological validity, such as the resources and support of practitioners and families who are responsible for the effectiveness of the intervention. According to Wang and Koyama (2014), resources and support include the cost, time, equipment, and the skills of the personnel to produce VM videos, administer the intervention, and provide additional evidence-based instructions and assessment when necessary. It also includes duration, travel time and scheduling conflict for both practitioners and families to a designated time and place for intervention.
For example, it might be difficult for (1) rural residents to travel to a group intervention held at a community center, (2) double-income families to schedule sessions on worktimes, and (3) low social and economic status families to prioritize their time and expenses to attend intervention sessions (Lundahl, Risser, & Lovejoy, 2006). The tiers of 3TVM represent a different delivery type that corresponds to the different levels of resources and support involved. Therefore, 3TVM not only provides an alternate intervention choice, but also considers the resources and support needs of practitioners and families.

The three tiers of the 3TVM are classified by the levels of resources and support, primarily determined using generic or individualized VM. Some studies indicated the need to produce the individualized VM videos or not may differentiate the practitioners’ acceptability and usability of VM (Rosenberg, Schwartz, & Davis, 2010; Wang, 2016b). Table 1 provides a reference framework for determining the specific tier based on Wang and Koyama (2014). Primary tier intervention comprises the lowest level of resources and support, which uses already available generic VM for all learners. Learners can receive instruction via video anywhere and at any time with any implementer, including the learner, as long as the video can be played and viewed. The tertiary tier intervention uses the most intensive resources and support by producing and utilizing individualized VM videos and all other necessary practices on a one-on-one basis at a designated time and place by a qualified well-trained professional personnel and team until the learners respond individually to the intervention. The resources and support involved in the secondary-tier intervention fall between the primary and tertiary tier interventions. Therefore, for those who do not respond to the Primary tier intervention, the secondary-tier intervention provides a group setting in which trained personnel can implement generic or individualized VM if necessary.

Each tier of the implementation could be applied separately or on a continuum. Rosenberg et al. (2010) used a generic commercialized video for teaching three children with ASD to wash their hands; for a better outcome, the authors developed three individualized VM videos, which accomplished an effect with high social validity. To date, this has been the only clear study that utilized the 3TVM on a continuum. However, the generic VM video used in their study was not developed using evidence-based rationale. For separate use of each tier, most VM studies in the literature either support the tertiary tier or lack information to identify the tier of the 3TVM (Wang & Koyama, 2014). Nevertheless, evidence exists of utilizing primary-tier generic VM to teach children with ASD how to wash their hands (Rosenberg et al., 2010; Wang, 2016a) and take turns with the involvement of their parents (Wang, 2017). Evidence of the secondary-tier group-based VM, both individualized and generic VM, is unidentified or lacking. Therefore, the purpose of this study is to (1) apply secondary-tier generic SGD VM to non-English speaking children, i.e., learners in Taiwan, with AAC needs and (b) teach children with ASD/developmental disabilities in common group settings, their school classrooms, to independently express needs for snacks using an iPad® without further prompting.

Method

Participants

This study recruited three primary participants ages 9 to 12 years old with diagnoses of ASD or a developmental disability from three different self-contained classes at a public elementary school. The diagnoses were made independently by the primary participants’ pediatricians based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994) per the procedure in Taiwan. Each class consisted of four or five peer classmates who were also recruited for the group intervention. The inclusive criteria of the primary participants were (a) no prior training or experience with SGDs; (b) an expressive language age equivalence score from the Vineland Adaptive Behavior Scales, Second Edition (Vineland-II; Sparrow, Cicchetti, & Balla, 2005), less than 2.5 years; (c) an ability to attend to any video for at least 66 seconds, which was the identical length of the intervention video and recognize graphic symbols; and (d) prerequisite skills of matching and imitation (Wang & Koyama, 2014). Students were excluded if their physical impair-
<table>
<thead>
<tr>
<th>Primary Tier</th>
<th>Secondary Tier</th>
<th>Tertiary Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic VM</td>
<td>Generic or individualized VM</td>
<td>Individualized VM</td>
</tr>
<tr>
<td>Already available video</td>
<td>Available or self-developed video</td>
<td>Self-developed video</td>
</tr>
<tr>
<td>Standardized fixed procedure with no other</td>
<td>Some flexible procedure with group-based additional</td>
<td>Individualized flexible procedure with as many</td>
</tr>
<tr>
<td>additional instructions</td>
<td>instructions</td>
<td>other additional instructions as necessary</td>
</tr>
<tr>
<td>Anywhere</td>
<td>Designated group setting</td>
<td>until the learner masters target skill</td>
</tr>
<tr>
<td>Anytime</td>
<td>Designated group common time</td>
<td>Most effective and convenient place for the learner and family</td>
</tr>
<tr>
<td>Any implementer with no training besides playing</td>
<td>An implementer with or without a team with some</td>
<td>Most effective and convenient time for the learner and family</td>
</tr>
<tr>
<td>video</td>
<td>training</td>
<td></td>
</tr>
<tr>
<td>Any learner/everyone</td>
<td>A group of learners</td>
<td>Qualified, very well trained professional(s) and</td>
</tr>
<tr>
<td>Self-Implementation</td>
<td>Some trained implementer implementation</td>
<td>team with VM rational and video technology</td>
</tr>
<tr>
<td>Equipment: A player and screen</td>
<td>Group equipment necessary, more than just a player</td>
<td>skills</td>
</tr>
<tr>
<td></td>
<td>and screen; less than equipment for just one specific learner</td>
<td></td>
</tr>
<tr>
<td>Lowest service fee (could be as low as equivalent</td>
<td>Medium service fee</td>
<td>Specific learner with special needs</td>
</tr>
<tr>
<td>to the cost of the video)</td>
<td></td>
<td>Professional-implementation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A player and screen and everything else needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>until learner masters target skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highest service fee (cost and skills required for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>producing the video, travel, place rental fee,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>personnel, equipment, additional training of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>personnel or learner etc.)</td>
</tr>
</tbody>
</table>
ment significantly prevented the operation of an iPad®. In accordance with these criteria, the teachers nominated the three participants. After all the parents and students gave their consent to participate in this study, the researcher confirmed the primary participants’ ability to attend to videos and their prerequisite skills.

Each participant was qualified for special education services according to the law of special education and verification of the Committee Responsible for Identification and Placement of Gifted and Disabled Students in Taiwan. The participants were placed in the self-contained classes based on their intellectual and cognitive impairment; however, in this study, no formal IQ testing occurred to confirm the primary participants’ severity of intellectual and cognitive impairment. Each class received instruction from two qualified special education teachers. The teachers developed their instructional content based on the Grade 1–9 Curriculum Guidelines for individualized instruction. The three primary participants all had very limited verbal skills, and two of them qualified for low-income family status.

Larry and his five classmates. Larry was an 11-year-old male with ASD whose expressive communication skills placed on the subscales of the Vineland-II (Sparrow et al., 2005) age equivalencies of 2 years and 2 months. Larry came from a low-income family and qualified for complimentary lunch at school. According to his individual education plan (IEP), he could imitate a single word or an easy phrase, and his oral vocabulary was less than four words. He rarely spoke, and sometimes he would touch others’ arms to express his needs. When his intention was not noticed, he exhibited challenging behaviors, such as crying and screaming. When he saw food that he wanted, he usually just grabbed it without making a request. Among Larry’s classmates, one had moderate Down syndrome, two had moderate intellectual disability, and two had severe physical disability in addition to intellectual disability. Peer interaction was frequent and active in this class. The two special education teachers often provided communication instructions during snack time, such as verbal imitation and receptive communication confirmation.

Shane and his five classmates. Shane was a 12-year-old male with ASD and other comorbidities. His age equivalencies were 2 years and 4 months for expressive communication, according to Vineland-II (Sparrow et al., 2005). Among the three primary participants, Shane had fewer challenging behaviors and better self-control when his preferred food was present. Shane’s teacher reported that he had good performance in cognition (e.g., following instructions and daily routines) and a stronger intention to communicate and make verbal requests than did other students, though these were mostly unintelligible. Shane had two classmates with moderate to severe Down syndrome, one with moderate intellectual disability, and two with moderate to severe multiple disabilities (physical disability in addition to intellectual disability). Among the three classes, this class generally had lower functioning skills and lower peer interaction. The communication instructions at snack time were only provided to the higher functioning students. The other two students with multiple disabilities were spoon-fed by a classroom aide.

Sam and his four classmates. Sam was a 9-year-old with moderate intellectual disability whose spoken vocabulary was less than 10 words. Sam received age equivalencies of 2 years on the expressive domain of the Vineland-II. He usually communicated with people by pointing or using two- to three-word phrases prompted by the teachers. Without prompts, he would merely respond with a nod or shake of the head. His strength in learning was that he was a good imitator when visual supports were provided. At snack time, he would point at the snack and touch his mouth to express his request for snacks. He also qualified for complimentary lunch at school due to a low-income family status. Sam had three classmates with moderate to severe ASD and one with intellectual disability. Among the three classes, the students in this class exhibited the most challenging behaviors such as screaming, crying, aggression, impulsion and self-injury. The teachers spent more time responding to these challenging behaviors than implementing communication demands during snack time.

Except for their limited communication, the three primary participants all had very different performances in social interaction.
and development. Larry was characterized by social interaction difficulties, communication challenges, a tendency to engage in repetitive behaviors, and some challenging behaviors (i.e., screaming, crying). Compared with Larry, the other participant with ASD, Shane, had better social skills for interacting with people and had a stronger intention to communicate, though his words mostly were unintelligible. However, Shane’s social interaction was still less active than that of Sam. Additionally, while Shane had very few challenging behaviors, better cognition, and was more independent in daily routines, Sam was the most active at interacting with people, but he lacked the ability to communicate. In terms of cognition, Sam could comply with teachers’ instructions but could hardly deal with the daily routines without prompts.

Settings

Snack time was scheduled during the last class session of each day in their homeroom classrooms as a natural setting for requesting snacks, and it was usually paired with communication instructions. The students were seated in a U-shaped arrangement, and one of the teachers sat in front of them. This study was conducted in the classrooms, and the VM video was displayed on the projector screen, which was located at the front of each classroom. The projector was connected to a computer leaning against the wall. After the video was played, the iPad® with VoiceSymbol software was placed in an upright orientation on the table within reach of the participant. The iPad® was always turned on and opened to the correct screen page.

Materials

Snacks. The researcher interviewed the teachers and asked them to list the participants’ preferred snacks. Based on the teachers’ reports, the researcher prepared three of the participants’ preferred snack items (e.g., crackers, cookies, potato chips) and presented them during the study. During each session, the researcher presented a different snack and avoided picking the same snack item from the previous session.

iPad® with VoiceSymbol. The primary participants were instructed to request snack items using an iPad® with VoiceSymbol software (Unlimiter, 2014). Existing literature has frequently used the application Proloquo2GO™ to create symbols that facilitate the communication of English-speaking children with developmental disabilities. VoiceSymbol is another software which is similar to Proloquo2GO™, and the devices configured with VoiceSymbol also function as SGDs. However, VoiceSymbol is designed for Mandarin Chinese users who have difficulties communicating and have symbol-supported needs. VoiceSymbol works on a computer and on the iPad®.

The interface in this study was configured to present a single page with graphic symbols of “I want,” “snacks,” and a blank row for construction (see Figure 1). The graphic symbols were from the VoiceSymbol package. The synthetic speech output was activated when the symbols were selected.

Group-based generic VM video production. A group-based generic VM video developed by the researcher presented a model of a request for snack items using an iPad® with VoiceSymbol software. The video, which lasted 66 seconds, included the following frequently used video components from existing literature (Wang & Koyama, 2014): (a) a prerequisite of matching and imitation skills; (b) reinforcers of verbal praise and the requested snack item provided to the student models on the video and the learners after demonstrating the target skill; (c) two exemplars of a group of three students, and one of them requesting a snack item from a teacher; (d) subtitles of the steps; (e) scripted content; (f) and a task analysis of the three steps: “I want,” “snack,” and “(enter for sentence configuration and voice output).”

The video was produced as a secondary-tier group-based combination of peer and point-of-view VM and was made prior to the study to ensure generic VM. All of the video models—two female teachers, five male students, and one female student—were recruited from the general education classes; thus, they were not familiar to or recognized by the participants. The participants were also not familiar with the video setting. The scene started with a shot of a class snack time involving one teacher and...
three students from a third-person perspective, i.e., the peer VM. The teacher asks, “What do you want?” when the snack item is presented. One of the students serving as the video model performs a three-step-request. The video zooms in for a closer view of the touching symbols, as if being manipulated by the person watching the video on the iPad, i.e., point-of-view modeling.

**Experimental Design and Procedure**

**Design and measurement.** A multiple-base-line-across-participants-probe design was employed in this study, and it included baseline, intervention, and follow-up phases (Kennedy, 2005). The experimental control was demonstrated with repeated observation probes in a staggered manner so that the intervention phases of each tier entered only when the baseline of the previous tier showed a stable trend of performance.

The independent variable was the VM intervention, and the dependent variable was the number of correct steps and sequence order for requesting snacks on the iPad during each session. Specifically, a correct response involved the participant touching the symbols “I want” and “snacks,” followed by the blank row to activate the synthetic speech output within five seconds after stimuli were presented. Only the primary participants’ data were recorded and used for decision-making in changing phases.

**Procedure**

**Baseline.** In each baseline session, the researcher presented the stimuli—the snack items—on the table and asked, “What do you want?” If the participant answered appropriately within five seconds, using either verbal words or the correct three-step request on the iPad, the researcher gave the participant the snack item. If no response occurred within five seconds, the researcher repeated the same question and presented the stimuli again. The participants did not receive the snack item if they failed to respond or for giving an incorrect response. When the participants tried to grab the snacks without making any response, they were blocked. Each session probe ended when the participants gave a correct response, an incorrect response, or no response. Every participant received the same opportunity to respond. The baseline ended when participants responded with a consistent pattern.

**Intervention.** During the intervention phase, the VM instruction was presented on the projector screen for each class. Before the video clip was played, the researcher would remind the participants to focus on the video clip. After watching the video clip, the researcher again presented the stimuli on the table and asked, “What do you want?” and the procedure continued in the same manner as the baseline. During the intervention, there was no prompt to promote or correct the partici-
pants’ performances. The intervention phase was terminated when the participant performed the three steps in the correct sequence order in three successive sessions.

**Follow-up.** Each class received two follow-up sessions at 1 and 2 weeks after the intervention phase. In this phase, the procedures were identical to the baseline. The social validity questionnaires were distributed after this phase.

**Data Analysis**

The data were analyzed by visual inspection, which included trend, variability, and level, both within and across participants (Gast & Ledford, 2014).

**Inter-Observer Agreement**

To assess the reliability of the data collection, i.e., the inter-observer agreement (IOA), the primary data collector (i.e., the researcher) and an independent observer collected at least 30% of the sessions for each phase for each primary participant. The independent observer was the researcher’s colleague who had a master’s degree in special education. The IOA was calculated using the formula: agreements of all responses / (agreements + disagreements of all responses) * 100%. IOA for Larry ranged from 84%–100%, with a mean of 90%. The IOA for Shane was 97%–100%, with a mean of 99%, and the IOA for Sam was 86%–100%, with a mean of 95%.

**Fidelity of Implementation**

The researcher and the other independent observer assessed whether the procedures of the interventions were correctly implemented to ensure treatment fidelity. The procedures were assessed in at least 30% of the sessions respectively in the baseline, intervention, and follow-up phases using a procedure checklist, which comprised 12 statements such as, “The participant and peers are seated in a U-shaped arrangement, and the researcher sits in front of them,” “An iPad® is placed in an upright orientation on the desk,” and “An iPad® is always turned on and opened to the correct screen page.” The statements provided the steps of the procedure for the researcher to follow while conducting the research. The researcher completely followed the protocol with 100% accuracy. The other independent observer marked it 97% correct for Larry, and 100% correct for Shane and Sam.

**Social Validity**

The intervention effectiveness is only valid when people of significance to the participants consider it effective and acceptable (Horner et al., 2005). Therefore, in this study, two types of social validity data were gathered. The first type of social validity data was collected by interviewing the participants’ speech language pathologists before the study. From the experiences of working with the participants, the speech language pathologists considered that using an iPad® as an SGD would have the potential to facilitate their communication. According to the definition of quality social validity (Reichow, Volumar, & Cicchetti, 2008), SGD is a socially important dependent variable. The second type of social validity data was collected from the teachers using an anonymous questionnaire based on the social validity definition posited by Reichow, Volumar, and Cicchetti (2008). The questionnaire included seven items, to which the teachers had to respond on a 4-item Likert scale (1=false, 2=somewhat false, 3=somewhat true, and 4=true), and an open-ended question associated with their experiences with results of the iPad®-based SGD VM. To ensure anonymity, the questionnaires were sealed and collected by a colleague who was not involved in this study. The results of the questionnaire demonstrated that all the teachers answered 4 (true) to each question, thus indicating that the teachers considered the intervention appropriate and important for the participants, easy to implement, and something they would like to use in the future.

**Results**

Figure 2 shows the frequency at which Larry, Shane, and Sam touched the symbols during the baseline, intervention, and follow-up phases. Based on a visual inspection, experimental control was demonstrated and the functional relationship between the second-
ary-tier group-based VM and communicative behavior was firmly formed. None of the participants performed the responses in the correct order during the baseline phase; the trend and level of data were clear, and the variability was stable. After the intervention, a certain delay effect was evident, which, according to existing VM literature, is normal. After three consecutive sessions stably reached criteria, which was three steps in the correct order, the intervention phase ended and all participants maintained their performance for at least 2 weeks. The results were obtained with high social validity.

In the baseline session, Larry kept touching the symbols randomly, with a frequency ranging from 6 to 13, and his level of correct responses was zero and stable. He tried to grab...
the snacks the moment he saw them. However, after watching the video, Larry began to perform the correct response; he reached the criteria at three successive sessions and maintained the correct responses at the follow-up.

Shane did not touch the iPad at all during the baseline session, and during the first session of the intervention, his attempt was not successful. However, he quickly performed the target behavior successfully and met the criteria, and his incorrect responses diminished simultaneously. The trend, variability, and level of the data on graph confirm the effect of the intervention. At the follow-up, Shane maintained the correct responses.

Similar to Larry, Sam touched the symbols incorrectly and randomly in the baseline session, with a frequency ranging from 4 to 6. Sam grabbed the snack during the baseline session and failed to perform the target behavior in the correct order, yielding a stable trend and level. As the video intervention was introduced, he started to respond correctly in session 15, and he soon followed a stable trend and level of success. The behavior of grabbing snacks was not observed when he learned to request them with the iPad.

Discussion

The secondary-tier VM intervention successfully increased the non-English-speaking participants’ communication during snack time, and their performances remained correct at follow-up in a group setting. This outcome suggests that VM leads to greater independence in learning and success in using an iPad as an SGD to communicate. The findings of this study are consistent with the results of previous research, which used an iPad as an SGD and found that this method enabled individuals with developmental disabilities to successfully request stimuli (Achmadi et al., 2012; Kagohara et al., 2010; King et al., 2014; van der Meer et al., 2011). This study was conducted using VM, which is less intrusive and laborious than the instructions of in vivo behavior strategies, such as prompting, used in previous studies (e.g., Paterson & Arco, 2007). This study suggests that VM is a feasible strategy for teaching individuals with developmental disabilities to use an iPad for requesting stimuli, and it also supports the general finding that VM is an effective tool for instructional purposes (Baker et al., 2009; Cihak et al., 2010; Kagohara et al., 2012; Wang & Koyama, 2014).

Besides the successful learning of using an iPad as an SGD to make requests, the outcome also showed that, as the participants’ communication improved, the incorrect random selection of symbols decreased without further prompting or error correction procedure. Anecdotal evidence showed that the intervention also reduced the inappropriate communication behavior, such as grabbing snacks, of two participants. Through the intervention, the participants learned to use the iPad to replace grabbing to obtain snacks eventually. This positive outcome echoes the findings of Anderson et al.’s (2007) study, which showed improved communication and positive changes in behavior. Anecdotal reports in this study also suggest that the primary participants’ peers exhibited improved communication. During the baseline sessions, the peers were inactive to request snacks verbally. However, while the participants developed the expected behavior, their peers also spontaneously performed behaviors such as imitating synthetic speech output. Thus, this study seems to increase peer verbal requests along with using the device. However, specific behaviors were not measured and the effects of the intervention on peers are unclear.

Group-based instruction can encourage kinship, alternate or adjust the environment to provide more opportunities to interact and respond, and facilitate contingent group intervention (Wang & Koyama, 2014). This study addressed the secondary tier of the three-tier VM intervention model, which is limited in existing literature, where fewer resources and less support are invested than in the third-tier individualized VM. This study was a secondary-tier intervention of 3TVM because the authors used a generic VM (ideally in the future, an already available video) on an iPad to teach learners in a designated place and time in a group with additional instructions if necessary. While containing the effectiveness of individualized VM, it may be a more feasible instructional strategy for teachers to utilize in class. However, there are certainly many students with disabilities who
quire individualized VM that would still need to proceed to a third-tier VM intervention.

Future research is encouraged to replicate the study with other children who have culturally and linguistically diverse backgrounds and whose predominant language is not English, since most SGDs are designed for an English-speaking population. Another future direction to consider is to extend the target behavior or explore other settings. For example, requesting a snack can be made more specific, such as “I want a snack” or “I want a pretzel.”

Third, future studies might wish to measure the intervention effect on peer behaviors and group contingency. Fourth, it is obvious of needs to conduct more secondary-tier interventions and to explore the variety among secondary-tier interventions, such as using individualized videos in group settings; homogenous or different levels of heterogeneous grouping; and implementation with additional group instructions.

In closing, the results of this study support the effectiveness of using VM and the iPad® to teach children with developmental disabilities and ASD to request snacks. These findings are important because they not only increase the communication and social interactions in cost-effective instruction to teach students with developmental disabilities, but they also contribute to the AAC, VM, and EBP literature. Moreover, this study enhanced the 3TVM model by accumulating evidence of the secondary-tier intervention for a better dissemination of EBPs.

References


King, A. M., Thomeczek, M., Voreis, G., & Scott, V. (2014). iPad® use in children and young adults...


