Using Video Self-Modeling Via iPads to Increase Academic Responding of an Adolescent with Autism Spectrum Disorder and Intellectual Disability

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Abstract: Recent investigations on effective interventions for students with autism spectrum disorder (ASD) have focused on video modeling (VM) and video self-modeling (VSM) to teach a variety of skills. While a considerable literature base exists on VM/VSM to address the social communication, functional, vocational, and behavioral needs of this student population, studies targeting academic skills are only recently emerging. Using an ABAB reversal design, this study examined the impact of VSM, delivered using a video iPad, on the academic responding of a secondary student with ASD and intellectual disability during science instruction. Results indicated positive treatment effects, with the participant increasing correct, unprompted academic responding during the VSM intervention, decreasing such responses when VSM was withdrawn, and increasing response rate when the intervention was re-introduced. Recommendations for teacher preparation in ASD and future research directions are discussed.

Video modeling (VM) and video self-modeling (VSM) are considered effective, evidence-based strategies for individuals with ASD, and have been used to improve communication, functional, play and social skills and decrease instances of challenging behavior (see Bellini & Akullian, 2007; Delano, 2007; Gelbar, Anderson, McCarthy, & Buggey, 2012 for reviews). Results from a meta-analysis indicate that not only are VM and VSM effective interventions for individuals with ASD, but they also produced similar treatment, maintenance, and generalization effects when implemented in a variety of settings including home, school, and clinics (Bellini, Peters, Benner, & Hopf, 2007). Both VM and VSM provide individuals with ASD a model or demonstration of a targeted behavior performed to mastery (Gelbar et al., 2011). The primary difference between VM and VSM is that in VSM, the child with ASD serves as the video model, whereas in VM, the target behavior is performed by another individual (e.g., typically-developing peer, sibling).

What seems to make VM and VSM so powerful is that these techniques support the needs of learners with ASD while also attending to their strengths. For example, learning from a live model can be a challenge for individuals with ASD because they often have difficulty differentiating important information from the extraneous (Tsatsanis, 2005). VM and VSM eliminate the superfluous information and isolate the target behavior (Bellini et al., 2007). Moreover, individuals with ASD tend to be highly visual learners, and VM and VSM capitalize on this strength by providing a visual model of a target skill (Bellini et al., 2007). Lastly, VSM may serve to promote self-efficacy as it offers the child with ASD demonstrable, visual evidence that he/she can successfully perform the task (Buggey, Hoomes, Sherberger, & Williams, 2011).

Despite evidence documenting the effectiveness of both VM and VSM, some gaps still exist in the literature. For example, some emerging evidence suggests that although VM and VSM are considered effective practices, VSM may have a greater impact for individuals with ASD in some instances (Buggey et al., 2011; Marcus & Wilder, 2009). Yet, there is a
relatively small number of studies using self as model (i.e., using individual children with ASD as participants) (Buggey et al., 2011), and even fewer with students over the age of 12 (Buggey, Toombs, Gardener, & Cervetti, 1999; Delano, 2007) emphasizing the need to further investigate the effect VSM has on students with ASD, particularly adolescents. Moreover, the evidence base of VSM has primarily focused on the communication, social skills, and behavior of children with ASD with limited evidence of the impact of VSM on academic skills or behaviors (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010). It has been recommended that future research explore the role of VM/VSM to improve the skills of individuals with ASD in academic contexts (Delano, 2007).

VSM may be one way to teach learners with ASD how to engage in discussions about academic content. One of the core challenges inherent in ASD is the ability to understand and use nonverbal and verbal communication (ASHA, 2006). Therefore, it is not surprising that an important instructional target for children with ASD is their spontaneous communication across activities and contexts, which includes the ability to maintain conversations with others (ASHA, 2006). These challenges present a problem for students with ASD attempting to engage in classroom instruction given the nature of classroom discourse. Classroom discourse is comprised of reciprocal interactions for the purpose of learning information (Cazden, 2001). Classroom interactions may begin with a teacher initiation followed by a student response, then teacher evaluation of that response. These interactions become increasingly complex because accurate interpretation often involves the comprehension of cues such as gaze, proximity, intonation, and volume, and may include multiple communication partners (Cazden, 2001). Moreover, children with ASD have difficulty attending to multiple forms of stimuli, distinguishing relevant from irrelevant or extraneous information, and shifting attentional focus (Tsatsanis, 2005). As a result, such classroom interactions are inherently difficult for children with ASD (Tager-Flusberg, Paul & Lord, 2005), as they have trouble interpreting both nonverbal cues and conversational discourse (Loveland & Tunali-Kotoski, 2005).

Therefore, the purpose of this study was to teach an adolescent male with ASD and intellectual disability to engage in academic discussions by responding correctly to teacher questions using VSM delivered by an iPad. One of the criticisms of VSM is that it may be more time intensive than VM (Gelbar et al., 2011). The iPad was selected because it can make the task of taking and editing video more efficient, thereby enabling the production of effective self-modeling videos. Moreover, it is small and a non-stigmatizing technology, enabling users to create “in the moment” learning. For many students with ASD who struggle to learn and participate in academic contexts, creative technologies paired with evidence-based approaches such as VSM can serve as potentially powerful interventions to increase academic skills and provide a faster, more accessible route to learning than would be otherwise possible.

Method

Participant

Austin was a 16 year old, 10th grade male with ASD and moderate intellectual disability. In addition, his IEP indicated Other Health Impairment (OHI) for known hearing loss (for which he used hearing aids), and speech and language impairment. Austin received speech and language services to address interpersonal and social communication goals. He also wore glasses for corrective vision.

Austin spent less than 40% of his school day in general education, although he attended elective classes (e.g., graphic design) in the general education program with a unique aide or peer facilitator assigned to him for one-on-one support. Receiving a functional curriculum for reading, writing, and mathematics, Austin’s measured reading level was 2nd grade and he could write simple 4–6 word sentences. Austin’s teacher commented that Austin could respond to basic, concrete questions, but that this only occurred with heavy prompting that would sometimes go on for several minutes, significantly impeding instructional momentum. She also mentioned that he required repeated verbal redirection to focus and participate, particularly when verbal answers were required of him. Observa-
tions suggested that Austin’s voice became halting and high-pitched when he was uncomfortable, particularly when the teacher prompted him to respond to questions. Austin also engaged in some repetitive/stereotypic behaviors including loud vocalizations, scrunching of shoulders and head while squinting his eyes, frequent picking of nose and skin until bleeding occurred, giggling, eye movements, head turning, sighing, and arm raising (unrelated to attempts to respond to questions). Though his verbal initiations during classroom instruction were generally infrequent, observations revealed that Austin would ask questions unrelated to the task at hand (e.g., “Do I have choir?” or “Am I riding the bus today?”). Although his teacher described several areas of concern, she identified her most pressing goal for Austin to be his responding to questions during academic activities. Therefore, increasing Austin’s correct, unprompted response rate to questions posed during classroom instruction was the behavior targeted for intervention.

Setting

This study was conducted in a public high school resource room in the southwest during science instruction. The class consisted of 18 students with a range of disabilities including mild to moderate intellectual disability, ASD, physical, and profound multiple disabilities. During science instruction, the room was divided into two sections to facilitate two groups of instruction based on student language ability. Specifically, the teacher led instruction at the front of the room near the whiteboard and projector with a group considered higher functioning based on their ability to use language (including Austin), while two paraprofessionals led another group of students demonstrating a limited use of functional language. Three student facilitators (i.e., general education students attending the high school) also worked in the classroom, assisting with small group instruction, along with a unique aide assigned to work with Austin.

Science instruction took place after lunch in a block schedule format, 4 days per week. During the intervention period, the teacher was observed using discussion and fill-in-the-blank lecture notes projected on the whiteboard (which students had copies of at their seats to complete) along with videos and internet resources (e.g., Discovery, National Geographic) to deliver instruction on science units related to animal groups, such as reptiles, amphibians, and mammals. Observation and video data revealed that Austin would regularly lose focus when attempting to transition from looking at the content on his worksheet to the content projected at the whiteboard and almost always required prompting and assistance from his aide or teacher to focus his attention and fill in written responses on the worksheets.

Outcome Measure

Prior to the intervention, the teacher was interviewed regarding Austin’s participation in academic settings, and any competing behaviors that impacted his engagement. Austin’s teacher wanted to increase his unprompted correct responding during science instruction. An unprompted correct response was defined as any communication act directly related to the academic content in response to a question that does not follow a prompt. To further define and explain the data, the frequency of prompted, incorrect and no response were recorded. Prompted correct responses were defined as any communication act directly related to the academic content in response to a question following a teacher, paraprofessional, or peer prompt. Incorrect response was defined as any communication act unrelated to the academic content in response to a question, while no response was recorded for failure on the student’s part to provide any response.

Experimental Design and Procedures

A single-subject, ABAB reversal design was used to evaluate the effectiveness of the VSM-iPad intervention in this study. An ABAB design, or reversal design, permits the confirmation of a treatment effect by showing that behavior changes systematically with conditions of No Treatment (baseline) and Treatment (Barlow & Hersen, 1984). Ethical issues may arise when using the ABAB design if a treatment that has been shown to be benefi-
cial is withdrawn during the second baseline stage. Therefore, we decided that if the intervention showed a positive impact, the iPad as well as flip camera would be left with the teacher to enable her to continue and expand the intervention.

Baseline data was collected until Austin’s correct responding was stable or descending and lasted approximately 1.5 weeks over six instructional sessions. Intervention data was collected for approximately 5 weeks over 20 instructional sessions. Following 20 sessions of Phase B, the VSM-iPad intervention was withdrawn to baseline conditions for a total of 8 data points. In the second intervention phase (B), the VSM-iPad intervention was resumed for an additional 6 instructional sessions to ascertain the impact of the intervention a second time.

The lead author collected all data by videotaping each instructional session throughout all phases of the study. Analyzing the video data allowed observers to return to the video for any specific incidents in the data requiring further analysis or exploration. During observations of instruction, the lead author sat several feet away from the participant, set up the camera zoomed in on him, and made efforts to remain unobtrusive by working on her laptop or engaging in other activities that intentionally appeared unrelated to the participant. Frequency of the target behavior (i.e., an unprompted, correct academic response) was coded during 25-minute instructional segments of teacher-led discussion.

Baseline. In each baseline phase (A), Austin was observed for 25-minute instructional sessions in his science classroom setting. Baseline consisted of “business as usual” with classroom staff conducting regular instruction and behavior management routines. Austin’s rate of correct, unprompted responding to questions was recorded for 6 sessions, until his observed academic responding behavior was stable or descending.

Video Self-Modeling (VSM). The VSM conditions (B) were the same as baseline with the addition of VSM. After observing Austin in the classroom, we created the video self-modeling script with the teacher in order to target science content that Austin would be learning in upcoming lessons. Because Austin was unable to respond extemporaneously or correctly to the teacher’s questions, we provided verbal prompts while videotaping. Using a flip camera, we then attempted to capture Austin responding directly to questions posed by his teacher prompted through a script that related to current topics in science instruction (i.e., reptiles). For example, the first ‘question’ the teacher posed was, “Austin, give me an example of a reptile” to which he was verbally prompted to respond, “A snake.” We followed this same process to enable Austin to respond to two additional questions. Next, using iMovie, we edited the video to remove the teacher prompting and highlighted only the desired behavior (i.e., correct, unprompted, academic responses to each of the three teacher questions) in a 1-minute video clip, which included a brief directive on the screen accompanied by the researcher’s voice indicating, “Austin pays attention in class. He always answers the teacher’s questions. Watch Austin answer questions.” Just prior to the start of science class each day, Austin was directed by his teacher to view the 1-minute video clip on the iPad at least 3 times (approximately 3–5 minutes) (Buggey, 2005).

Treatment fidelity. The teacher was administered a form with boxes representing the days of the week. She was asked to check the box on each day Austin observed the video (Bellini et al., 2007). The teacher indicated that the student viewed the video prior to instruction on each day of the intervention, and this was corroborated on the video recordings from each session.

Inter-observer agreement (IOA) of the dependent variable. A second rater who was not informed of the study’s purpose coded 30% of the data across each phase (i.e., baseline, intervention, return to baseline, and re-introduction). Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Agreement occurred when both observers independently recorded the same number of responses by type (i.e., unprompted correct, prompted correct, incorrect, and no response). The IOA for the target variable (unprompted correct response) was 99% while the mean IOA across response types was 94%.
Results

The results per instructional session are shown in Figure 1. Based on visual inspection of the data, although variable, a positive treatment effect is indicated, with a functional relationship demonstrated between the VSM-iPad condition and Austin’s rate of correct unprompted responses to questions, which clearly increased during both intervention phases (B).

The average number of questions posed in each phase ranged from 11 to 22 (BL = 22, VSM 1 = 22, BL 2 = 17, VSM 2 = 11). In addition to correct responses, the number and percent of incorrect, prompted, and non-responses were recorded and are reported in Tables 1 and 2. The data indicates that although correct responding increased, Austin continued to require prompting. However, the number of times that Austin failed to respond decreased during VSM conditions. Increases in correct responding occurred,

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Frequency of Correct, Incorrect, Prompted, and No Responses During All Phases</th>
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<tbody>
<tr>
<td></td>
<td><strong>Baseline 1</strong></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>CR</td>
<td>1</td>
</tr>
<tr>
<td>IR</td>
<td>5</td>
</tr>
<tr>
<td>PR</td>
<td>4</td>
</tr>
<tr>
<td>NR</td>
<td>12</td>
</tr>
</tbody>
</table>

VSM = video self-modeling; Med = median; CR = correct response; PR = prompted response; IR = incorrect response; NR = no response
TABLE 2
Percentage of Correct, Incorrect, Prompted, No, and Spontaneous Responses

<table>
<thead>
<tr>
<th></th>
<th>Baseline 1</th>
<th>VSM 1</th>
<th>Baseline 2</th>
<th>VSM 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR: Correct responding</td>
<td>4%</td>
<td>24%</td>
<td>6%</td>
<td>42%</td>
</tr>
<tr>
<td>IR: Incorrect responding</td>
<td>21%</td>
<td>16%</td>
<td>15%</td>
<td>11%</td>
</tr>
<tr>
<td>PR: Prompted responding</td>
<td>19%</td>
<td>28%</td>
<td>22%</td>
<td>19%</td>
</tr>
<tr>
<td>NR: No response</td>
<td>56%</td>
<td>32%</td>
<td>57%</td>
<td>28%</td>
</tr>
<tr>
<td>SR: Spontaneous Responding</td>
<td>25%</td>
<td>40%</td>
<td>21%</td>
<td>53%</td>
</tr>
</tbody>
</table>

CR: Correct responding; IR: Incorrect responding; PR: Prompted responding; NR: No response, SR: Spontaneous Responding

from 4–6% of questions posted in baseline conditions, to 24 and 42% in VSM conditions. As previously noted, the specific goal of the intervention was to decrease the level of prompting the student required to respond to teacher questions. The percent of incorrect and correct responses were combined to determine the percentage of spontaneous responses. In the video modeling conditions, spontaneous responses increased from 25 and 21% in baseline conditions to 40 and 53% respectively during the VSM conditions. Although prompting was consistently needed in all sessions, the number of times the student failed to respond decreased from nearly half of the questions posed in baseline conditions, to 32 and 28% during VSM phases.

Social validity. Prior to the intervention, the teacher indicated that neither she nor her paraprofessional had familiarity with video modeling as an intervention for students with ASD but she shared that she had some experience incorporating technology as part of instruction (e.g., smartboards). Following completion of the study, the teacher was asked to complete a checklist in which she indicated the extent to which she agreed, somewhat agreed, or disagreed with the following statements (adapted from Bellini et al. 2007). Her responses are indicated adjacent to each question below:

1. The intervention interferes with typical classroom activities. Disagree
2. The intervention is distracting to the child with ASD. Disagree
3. The intervention is distracting to other students in the classroom. Disagree
4. The intervention is easy to implement. Agree
5. I believe the intervention is beneficial for the student with ASD. Agree
6. I notice a difference in the student with ASD’s academic responding. Somewhat agree. The intervention was simple to implement and didn’t take too long. The student responded well, but I feel we would have gotten better results if we could have done it longer and had trained the para who worked with him beforehand.

Discussion
The results suggest that the VSM intervention delivered using the iPad was effective for increasing the frequency of correct, unprompted responding of an adolescent with ASD and intellectual disability in the context of a resource-room, science class setting. Although there was some variability during the VSM condition, increases in correct, spontaneous responding were evident (i.e., increasing from 4 and 6% in baseline to 24 and 42% in VSM conditions). Austin continued to require prompting during science instruction (19–28% of questions posed) across all phases; however, his failure to respond declined (from over 50% of questions asked in baseline conditions to 32 and 28% respectively during VSM). It was expected that as he was learning new content, some prompting would be required. The increase in spontaneous responses suggests that Austin began to engage in classroom discussions more often. There is an emerging literature base that suggests the use of visuals can increase the active engagement of children with ASD (See Carnahan, Musti-Rao, & Bailey, 2009 for an example and review), and VSM may be one additional visual strategy that can encourage academic engagement.

This study makes several important contributions to the current knowledge on effective interventions for students with ASD, and in terms of VSM specifically. First, although the iPod and other personal digital assistant (PDA) devices have recently been used to deliver video modeling interventions (Ghah, Fahrenkrog, Ayres, & Smith, 2010; Mechling, Gast, & Seid, 2009), this study is the first to
utilize an iPad to deliver VSM, which given its larger size, may be more useful for students with significant disabilities and visual impairment, as in the case of Austin. Secondly, this VSM study was conducted with a unique population in that the student was an adolescent, and few studies have targeted this age group specifically (Buggey et al., 1999; Delano, 2007). Thirdly, though this student contended with multiple disabilities (i.e., vision/hearing impairments, intellectual disability, and ASD), the focus of the study was on an academic variable, whereas other video modeling studies have focused on ASD exclusively and have tended to focus on behavioral, social, leisure/play, language, and functional life skills (Bellini, Peters, Benner, & Hopf, 2007; Buggey, 2005; Buggey et al., 1999; Cihak et al., 2010; Mechling et al., 2009; Whitlow & Buggey, 2003). Fourth, responding to the call for video modeling interventions to be evaluated in natural settings (Delano, 2007) this study was conducted in the naturalistic classroom as opposed to a more controlled separate setting or lab setting. In this study, at any given time, there were up to 7 individuals working in the classroom in instructional roles (e.g., teacher, paraprofessionals, student workers, and student teachers), which required a significant amount of coordination and understandably resulted in a healthy noise level and some disruption during academic activities, in addition to the expected activity level of the natural classroom setting in high school. Nonetheless, the intervention was successfully implemented relatively unobtrusively. Moreover, the teacher reported general ease of use, which may encourage future research in settings where children and adolescents typically receive their instruction.

**Implications for Teacher Preparation in ASD**

One of the challenges in this study was the difficulty in analyzing and interpreting some of the data given the nature of teacher questioning, which at times was unclear, with little evidence of scaffolding or use of concrete, visual supports. Therefore, it was sometimes problematic to determine if Austin failed to respond due to lack of understanding of the question and/or failure to jointly attend to the task. This circumstance naturally leads to the more general question of how teachers’ skill level and expertise in teaching students with ASD may mediate the efficacy of VSM for this population of student, particularly in academic contexts. Future research should explore pairing VSM with other strategies that teachers can use to facilitate the academic participation of children with ASD. These may include systematic prompting (time delay or spontaneous prompting depending on individual need), providing a way for children to chorally respond when questions are posed to a group (e.g., thumbs up, visuals), and using the child’s name to gain attention before asking a question.

Furthermore, typical classroom instruction involves a lot of teacher talk, and students with ASD are less likely to demonstrate behaviors associated with engagement in such settings (Carnahan, Basham, & Musti-Rao, 2009; Carnahan et al., 2009). The social, reciprocal nature of classroom instruction may even limit the ability of children with ASD to participate in certain academic activities including group instruction (Carnahan, Musti-Rao, & Bailey, 2009). There is evidence that students with ASD exhibited higher levels of engagement when instruction has been conducted in smaller groups, at a fast pace, and with a lot of teacher direction using short, explicit language (Kamps, Leonard, Dugan, Boland, & Greenwood, 1991). Students with ASD have also demonstrated greater engagement when teachers incorporated a variety of media and materials in their lessons (Kamps et al., 1991).

Although it is highly probable that both general and special educators will encounter students with ASD in their classrooms, consistent with the findings of the National Research Council (2001), most teacher graduates receive minimal to no preparation in evidence-based practices for students with ASD (Morrier, Hess, & Heflin, 2011). The NRC (2001) confirmed that, “personnel preparation remains one of the weakest elements of effective programming for children with autism spectrum disorders and their families” (p. 225). It is therefore not surprising to find that teachers may be lacking in their ability to employ evidence-based, instructional strategies with students with ASD (Hess, Morrier, Heflin, & Ivey, 2008).
Limitations and Future Research

It is important to note the limitations that may affect the overall interpretations of this study, and where future research is needed. As is the case with single subject research, a small sample size was examined, and in this study, due to the constraints of the classroom setting and intensive needs of some of its students, the intervention was explored with only one child. Moreover, the intervention targeted only one skill. With this in mind, conclusions must be situated and interpreted within the context of the study. Future research is needed with larger sample sizes and should include examination of multiple, target academic variables to verify the results more comprehensively and validly. In addition, future research should also address generalization to other contexts throughout the school day, which this study did not address.

Another limitation of this study was the short return to the VSM condition. Given the constraints of the fall semester holiday schedule, the reintroduction of the VSM condition was only permitted for two weeks. As such, the extent to which the positive effects would have continued to be observed and at what rate is unknown. Additionally, this study did not include an attempt to fade the use of VSM, so whether Austin would be able to maintain increases in correct responding without VSM is unclear. Future research should explore to degree to which VSM can be effectively faded. Because of the positive impact observed and the belief that more pronounced effects could be attained with more time in intervention, the teacher agreed to resume the intervention upon return from winter break. Future research should consider that more extended periods of time in intervention may be required depending on students’ intellectual level and other characteristics, and, when conducted in naturalistic settings, may be affected by breaks in the schedule and interruptions to classroom routines (e.g., bell schedules, assemblies, special events). These factors need to be explored to determine which types of students stand to benefit from VSM most and under what conditions.

To conclude, advances in academic interventions for students with ASD are greatly needed and VSM has continued to show promise as an evidence-based practice for this population of students. Future research studies employing VSM via innovative technologies across settings may lead to more definitive guidelines for practice and application for children and youth with ASD.

References


Carnahan, C., Musti-Rao, S., & Bailey, J. (2009). Promoting active engagement in small group learning experiences for students with autism and


