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ORIGINAL ARTICLE

Using Video Modeling to Increase Face-Covering Behavior for Individuals with Down Syndrome in the School Setting

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Abstract

The COVID-19 pandemic has altered the school environment for millions of students worldwide, which has resulted in the need to learn new behaviors, such as wearing face coverings. Teaching students with Down syndrome (DS) new COVID-19 prevention behaviors is essential. Individuals with DS are more likely to contract COVID-19, be hospitalized, and are ten times more likely to die from the disease than individuals without DS (Clift, Coupland, Keogh, Hemingway, & Hippisley-Cox, 2020; Malle et al., 2021). With the need to return students to in-person learning, educators have to quickly identify empirically based teaching tools to teach DS students to wear face coverings. Video modeling (VM) may be one tool that could efficiently teach students with DS to wear face coverings (Park et al., 2019). An intervention package, including VM, was evaluated within a non-concurrent multiple baseline across participants for increasing the time in which 3 participants with DS wore a face covering in the classroom. Results demonstrated that VM alone was an effective antecedent strategy to increase the duration of wearing a face covering for two students. The third participant required behavior specific praise targeting wearing a face covering in addition to VM.

Keywords Down syndrome · COVID-19 · Safety · Prevention · Video modeling

The COVID-19 pandemic made it more challenging for educators and related service professionals to provide students with disabilities the education they are entitled to have (Brandenburg et al., 2020; Jackson & Bowdon, 2020). According to the Individuals with Disabilities Education Act (IDEA—1997), individuals with

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disabilities — who represent 14% of students in the USA — must be granted the right to (a) appropriate identification; (b) the development and continuous review of individualized educational plans (IEPs); (c) instructional accommodations; (d) least restrictive environment; and (e) access to related services (e.g., speech and language services, occupational therapy, physical therapy). Within a pandemic context, this included preparing those students to follow measures that will prevent its spread.

As schools reopened for in-person instruction, it was essential to follow safety guidelines that help mitigate the spread of COVID-19. Guidelines to reduce the spread of COVID-19 included wearing a face covering, practicing physical distancing, frequent cleaning and disinfecting, accessible hand hygiene supplies and opportunities for use, room ventilation, and visual signaling (Centers for Disease Control and Prevention [CDC], 2020a).

Wearing a face covering was indispensable because of its efficacy in reducing transmission rates. Wearing a face covering blocks contact with respiratory droplets, and because of that, it might reduce up to 75% of the risk of transmission of COVID-19 (CDC, 2020b; Endo, 2020; Ha, 2020). Wearing a face covering is a must even for individuals who do not show symptoms; at least 35% of the sick individuals never become symptomatic (Oran & Topol, 2020).

As the pandemic has continued, we have learned that some individuals are at greater risk of more significant complications and death when they contract the virus. Recent research suggests that individuals with Down syndrome (DS) are more likely to contract COVID-19, be hospitalized, and are ten times more likely to die from it than individuals without DS (Clift et al., 2020; Malle et al., 2021). These risk factors make it imperative that mitigation guidelines are followed when students with DS return to in-person learning.

Unfortunately, some students with disabilities lack the independent skills of handwashing, wearing a face covering, and/or physical distancing. Brandenburg et al. (2020) recommended that prior to returning to in-person classrooms, parents practice these essential skills with their children and, when necessary, program systems to reinforce appropriate behaviors. Additionally, they recommended extra safety precautions for adults in the classroom when the student is unable to engage in these preventive behaviors, when the student may grab at face coverings worn by others, or when students are afraid of others wearing the face covering (Brandenburg et al., 2020).

When students are not performing skills, educators develop plans to teach and reinforce the skills. The approach to teach the behaviors mentioned earlier, designed to mitigate the spread of COVID-19, should be no different. One cost-effective teaching strategy that might achieve this goal is video modeling (VM). VM is a method in which a student is instructed to perform that same task after being shown a video of a model performing the steps of a task (Alberto et al., 2005). Evidence suggests that VM may lead to faster acquisition of tasks than in vivo modeling (Charlop-Christy et al., 2000). As pointed by Thelen et al. (1979), there are several benefits when using VM: The availability of filmed and videotaped media provides the opportunity to capture naturalistic modeling sequences that would be difficult to create in clinic settings. And of course, the therapist has greater control over the composition of the modeling scene because the film or videotape can be reconstructed until the most desirable scene is produced. These media also allow the convenient use of multiple models, repeated observations of the same model, reuse of the films or videotapes with other persons, and self-administered treatment sessions.

VM is a viable intervention to implement in schools (National Autism Center, 2015). VM is easily incorporated in a school setting because it does not require someone with extensive training to implement it, and it is not significantly disruptive to a daily routine (Wilson, 2013). VM requires time for the single production of videos that can then be lasting and used across students across different years, making costs dramatically reduced (Bagaiolo et al., 2017). Because VM can be administered without close physical contact, it becomes a method to deliver services while observing the school's COVID-19 prevention policies. The instruction could be easily provided during remote instruction. These advantages may make it more preferable by educators during these times.

Recent reviews have shown VM applications to teach academic, social, and readiness skills to a variety of individuals. Boon et al. (2020) demonstrated moderate to large effect sizes in using VM to improve mathematics, reading, and social behavior skills in students with learning disabilities. Seok et al. (2018) demonstrated VM efficacy when applied to students with emotional behavior disorders to teach appropriate behaviors (e.g., compliance with instructions, on-task behavior, and social skills).

A systematic literature review by Park et al. (2019) analyzed studies between 2004 and 2016 that used different types of video-based instruction (VBI) for individuals with intellectual disabilities. Of the 32 studies found, seven of them used VM alone or in conjunction with additional strategies. VM was used to teach fine and gross motor skills (Mechling & Swindle, 2012), fire safety skills (Mechling et al., 2009), social safety skills (Spivey & Mechling, 2016), use of automatic teller machine (ATM–Scott et al., 2013), job skills (Mechling & Ortega-Hurndon, 2007), and daily living skills (Mechling, Ayres, Purrazzella, & Purrazzella, 2014; Mechling, Ayres, Bryant, & Foster, 2014). A total of 25 individuals (22 diagnosed with intellectual disabilities and 3 with autism spectrum disorders) participated in those studies. Five studies demonstrated significant effects, and two demonstrated medium effects.

Another review conducted by Jess and Dozier (2020) reviewed antecedent and consequence strategies for increasing handwashing in young children as a means of preventing COVID-19 spread. VM with individualized feedback was identified as widely effective to increase the duration and effectiveness of handwashing. Additional applications of VM to disease preventative behaviors in individuals with intellectual disabilities should be evaluated given the success of VM and its ease of application during COVID-19. We sought to evaluate the effectiveness of VM to another disease prevention behavior, wearing a face covering. The longer the students wear a face covering, the more effective it becomes, so increasing the duration of engagement in the appropriate behavior becomes as essential as establishing this skill. Also, when individuals with disabilities can adopt prevention strategies for extended periods, opportunities to participate in community activities increase. Considering the high risk for individuals with DS when contracting COVID-19, and since no studies have been found to teach or increase individuals' time of engagement in other disease prevention behaviors, this study evaluated the use of VM to increase face-covering behavior time for three students with DS in their school classroom. We hypothesized that VM would be an effective strategy to increase the duration of face covering for the participants without any additional procedures.

Method

Participants and Setting

Three male students diagnosed with DS participated in this study. All participants were students at schools located in an urban city in the state of Nebraska. Both school districts had specific COVID-19 policies that included mitigation strategies of physical distancing, handwashing, wearing a face-covering, and surface cleaning protocols. Accommodations were made when students could not wear a face covering (e.g., adults wore face shields, installed plexiglass on the student's desk) to mitigate spread. Most students and staff were in the school building, but the district did have remote learning options.

Recruitment of participants occurred by individual referral from special education teachers to the University's school–based applied behavior analysis consultation team. All three students were referred for primary concerns about not wearing a face covering. Individuals who were not referred to the team by their special education teachers with primary concerns of not wearing a face covering were excluded from this study. Brody and Jaxon were 13-year-old, 8th-grade students who attended a public middle-school special-education program. Their classroom consisted of a lead special education teacher, three paraprofessionals, and 17 students. Miles was an 11-year-old, 6th-grade student who attended a parochial elementary school. His classroom consisted of one special education teacher, one paraprofessional, and five other students. All students qualified for special education services under other health impairment and were served on individual education plans that included more than 50% of their school day in a special education classroom. Students participated in general education environments with general education peers for music, art, physical education, and lunch. Face coverings that were available to be worn by students included surgical masks, cloth/fabric masks, face shields, or neck gaiters.

All sessions were conducted in students' special education classrooms by the consultant team (i.e., authors) and lasted 15 min. The duration of the sessions allowed the consultants to standardize data across sessions while additional clinical duties were carried out. During sessions, classroom instruction continued without additional intervention or interruption. All sessions were implemented in the special education classroom.

Video-Making Process

Essential characteristics for the video-making process were considered based on Barboza et al. (2019) to establish proper stimulus control (i.e., instructions, visual demonstrations, highlights, and instructional subtitles). The instructional video was created by following a set of steps that comprised (a) pre-production (i.e., scriptwriting); (b) production (i.e., audio and video recording and graphical making); and (c) post-production (i.e., audio and video editing). Audios were recorded with a smartphone and edited with *Audacity® 2.4.2*. After signed consent was provided by one of the actors' parents, video exemplars were recorded with a smartphone and edited with *Davinci Resolve 15*. Then, a web-based tool, *PowToon©* (www.powtoon.com), was used to insert graphics along with the edited video exemplars and voiceover content. Figure 1 shows a flowchart of the video-making process. The full video used for this study can be accessed at: https://www.youtube.com/watch?v=YE71Lsj9DLU

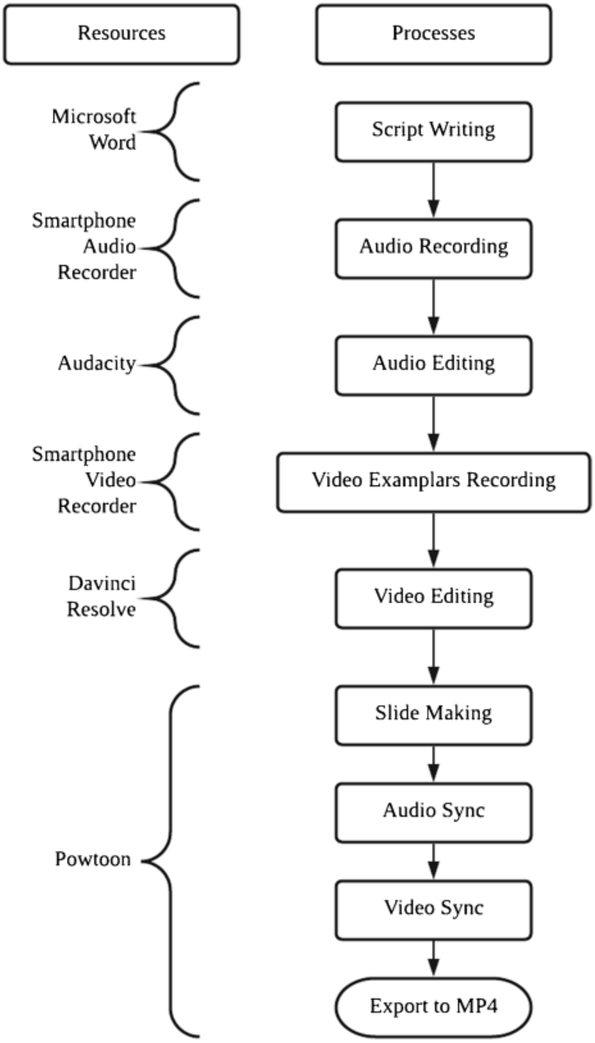

Fig. 1 Video-making process flowchart, including resources and processes

Specifically, the video script started with the rationale for wearing a face covering and then going through the entire face-covering process. The video script was then used as the base for the voiceover recordings. After voice recordings were made, one video exemplar was recorded where a 9-year-old typically developing child was shown performing the entire task. The background was devoid of context clues (e.g., classroom, home, clinic) to increase the potential for universal application. For situations where a child would need to speak (e.g., "Help me put the mask, please"), the actor's voice was kept in the video editing process. Then, the voiceover recordings and the videos were imported at *PowToon*©, where slides and graphics were added, and finally, the video was exported to an mp4 format.

Approximately 5 h were necessary for the video-making process. The video content included the task analysis of proper face-covering behavior, the rationale for wearing a face covering, and encouragement to continue to wear a face covering.

Experimental Design

A non-concurrent multiple-baseline across participants design (Watson & Workman, 1981) was used to assess the efficacy of VM on the duration of wearing a face covering. FCB was defined as the participant wearing a face covering (e.g., surgical mask, cloth mask, or face shield) that covers the mouth and nostrils for more than five consecutive seconds.

Data Collection and Interobserver Agreement

The duration of the participant's engagement in face-covering behavior (now referred to as FCB) was calculated during each 15-min session. Visual inspection was used to assess for significant differences in data trend, variability, and level across baseline and intervention phases, across participants. A whole-session method for interobserver agreement ([IOA]; Repp et al., 1976) was used. Additional observers were trained by reviewing operational definitions of FCB and data collection methods. The training was conducted using behavior skills training, including reviewing operational definitions, reviewing procedures, observation of implementation, and procedural feedback (Dib & Sturmey, 2012). IOA was collected on FCB duration for 26% of all sessions (i.e., 24% of sessions for Jaxon; 29% of sessions for Brody; 27% of sessions for Miles).

IOA was calculated by dividing the total duration of appropriate FCB observed by the primary observer and by the reliability observer. The quotient was then multiplied by 100 to obtain a percentage of agreement. IOA of the frequency and average duration of appropriate FCB was calculated by dividing the primary observer's frequency count by the reliability observer's count, then multiplied by 100 to obtain a percentage of agreement. The mean IOA for the duration of appropriate FCB was approximately 99% across all participants.

Procedures

The current study included four phases: a prerequisite assessment, baseline, video modeling, and video modeling with behavior-specific praise.

Prerequisite Assessment

Before the study, the consultants evaluated each participant's ability to wear the face covering independently and in a proper manner. The consultants directed students to put on a mask and evaluated their skills using a checklist of proper FCB. The 5-step checklist (Table 1) included picking up the face covering, placing the face covering up to the face, putting the ear loops over the ears when applicable, covering the mouth and nose, and asking for help if needed.

Baseline

Following the prerequisite assessment, the consultants collected data on the duration of appropriate FCB. To begin a baseline session, the consultant directed the participant by saying "put on your mask, please." The consultants provided no specific consequences related to the dependent variable (i.e., time wearing the face covering). However, if the participants had failed any of the previous phase's (i.e., prerequisite assessment) steps during the current step, they would be redirected to a video model while receiving behavior-specific praise as feedback for accuracy of FCB only. The consultants observed and recorded the cumulative duration of appropriate FCB. The consultants collected duration data using a lap-timer to track the duration of appropriate FCB and recorded the results on a data sheet. The session ended after 15 min had passed (the terminal goal).

Video Modeling Instruction

VM sessions included the participant watching a 112-s video. A consultant used a laptop computer before group instruction or independent work tasks to present the video to participants. At the beginning of the VM session, the consultant stated to the participant, "we are going to watch a video," and the participant watched the

Table 1 Task analysis of appropriate face-covering behavior. COVID-19 prevention behaviors screening tool. (Y = Yes; N = No; N/A = Not applicable). Directions: Observe the student doing each of the tasks to determine whether they can perform each step. Mark "yes" or "no" as the student tries. Provide instruction for the steps missing and re-test

Task	Steps	Check/Dates
Wearing a mask	Picks up the mask	
	Puts the mask on the face using both hands	
	Puts the ear loops over the ears	
	Covers mouth and nose	
	Asks for help to put the mask (if needed)	
Components completed correctly		

video with the consultant. There were no directions from the consultants that the participants wear the face covering before or while watching the VM. No data on whether a face covering was worn during the video was taken. Although the mandate to wear a face covering was in place, there were no specific consequences when students with disabilities and/or challenging behaviors were not following the mandate. At the end of the video, the consultant thanked the participant for watching and stated, "Remember to wear your mask (gaiter, face shield)." Participants were free to choose from the different types of face coverings provided to them by the school or their caregivers (e.g., surgical mask, cloth mask, gaiter). Once a specific type of face covering was chosen by the participant, it was used for the 15-min session. The consultant then observed and collected data across the 15-min session noting the duration that the student wore the face covering and the frequency in which they removed the face covering. No other programmed consequences for appropriate or inappropriate FCB were given to the participant. The session ended after the 15-min criterion was reached.

Video Modeling with Behavior Specific Praise

When VM alone was ineffective for increasing the FCB duration, programmed reinforcement was added by providing behavior-specific praise (BSP) on a variable-momentary schedule (Brophy, 1981). BSP was defined as the consultant providing the participant with a praise statement that labeled the FCB. For example, the consultant may have stated, "Jaxon, great job wearing your mask over your nose and mouth!" The schedule was determined by calculating the average duration of appropriate FCB during baseline. VM with BSP phase was only needed for Jaxon, and his baseline indicated that he could wear the face covering for 30 s.

During the VM with BSP phase, the consultant began the session by providing the participant with the video to watch. Following the conclusion of the video, the consultant would state, "Remember to wear your mask. I will check in with you later." The consultant walked away from the participant. The consultant wore a MotivAider™ to signal when to provide behavior-specific praise for appropriate FCB. The MotivAider™ was set to the designated schedule and vibrated to signal the consultant to observe the participant. If the participant was engaged in the appropriate FCB, the consultant walked to the participant and provided the participant with behavior-specific praise. If the participant engaged in inappropriate FCB, the consultant did not provide a consequence (i.e., behavior-specific praise nor any programmed attention).

Maintenance

Following the video modeling phase, maintenance tests were conducted for Brody and Miles. No instructions were provided, and no differential consequences were provided for either appropriate or inappropriate FCB.

Results

Figure 2 shows the duration of FCB for Brody, Jaxon, and Miles across baseline, treatment (VM alone or VM with BSP), and maintenance (for Brody and Miles).

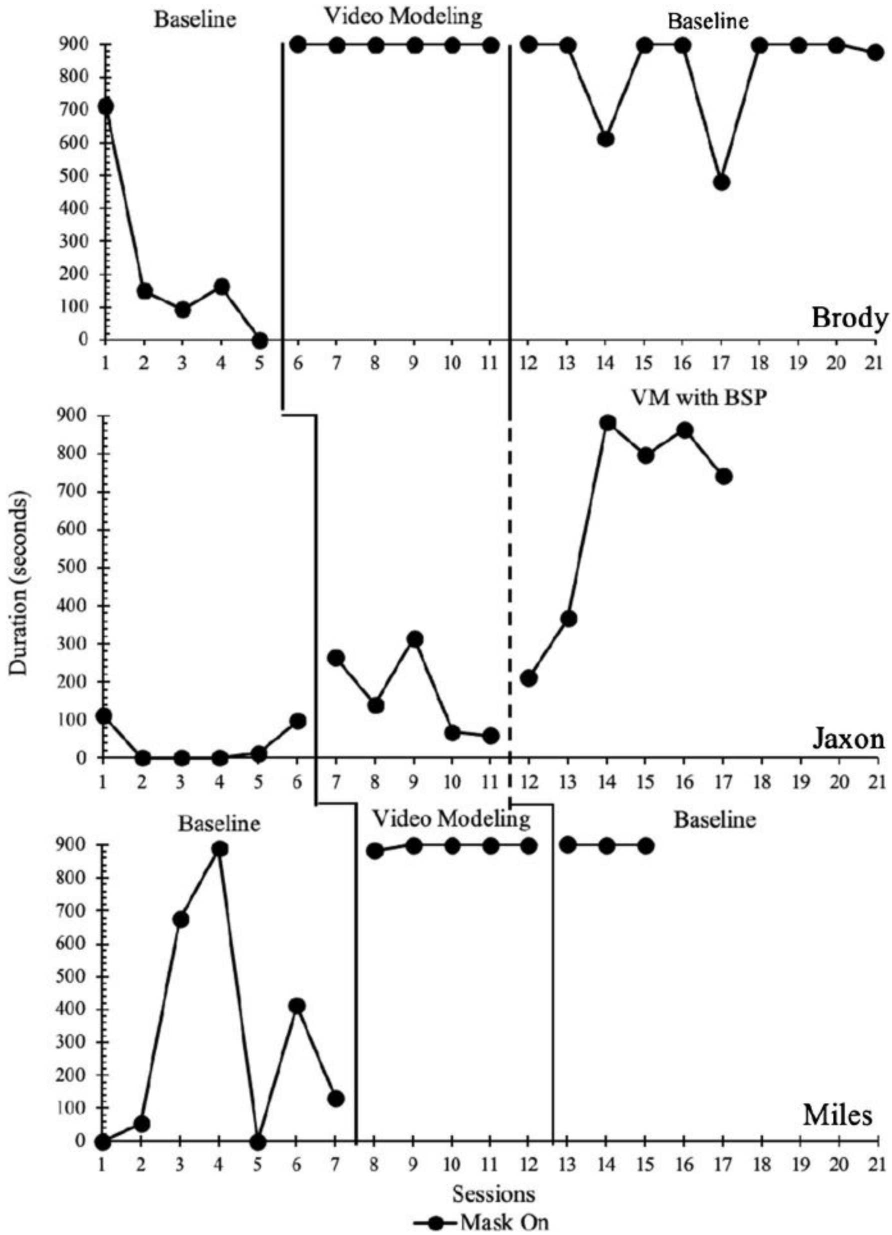

Fig. 2 Duration, in seconds, of face-covering behavior for Brody, Jaxon, and Miles

Data were analyzed by the intervention team, looking at variability, level, and trend of data across the different participants.

Brody

Brody independently completed all steps of the prerequisite checklist for wearing a face covering. During the baseline phase, Brody was observed to engage in appropriate FCB for an average of 223 s across 5 observations. After initially wearing a face covering for 700 s, Brody's appropriate FCB quickly decreased across sessions. However, appropriate FCB immediately increased following exposure to VM, in which Brody's appropriate FCB averaged 900 s across six consecutive sessions. During the maintenance phase in which the experimenters implemented the same conditions described during baseline, Brody maintained high levels of appropriate FCB across the remaining ten sessions. During maintenance, Brody wore a face covering an average of 827 s. The intervention results on Brody's FCB suggested that VM alone increased and maintained the duration of appropriate FCB.

Jaxon

Jaxon completed all steps of the prerequisite checklist for wearing a face covering independently. During the baseline phase, Jaxon was observed to engage in appropriate FCB for an average of approximately 25 s across 6 sessions. Following baseline, Jaxon was exposed to VM in Session 7. Although there was a slight increase in the appropriate FCB with an average duration of 169 s across five sessions (range: 59 s to 262 s), the appropriate FCB duration quickly decreased. Thus, VM with BSP was introduced.

Classroom observations and interviews with the special education teacher suggested that Jaxon preferred adult attention in the form of verbal praise with or without physical touch (e.g., fist bump, pat on the back). The experimenters used BSP with physical touch as a consequence of wearing the face covering. During the VM with BSP phase (sessions 12 to 17), the duration of appropriate FCB immediately increased to 210 s and increased across 5 additional sessions (range: 210 to 883 s). The results of the VM with BSP would suggest that this treatment package could likely be effective in increasing the duration of appropriate FCB.

Miles

Miles independently completed all steps of the prerequisite checklist for wearing a face covering independently. During baseline sessions, Miles initially engaged in low durations of FCB during the first and second sessions (0 s and 53 s, respectively). During sessions three and four, appropriate FCB increased up to 889 s. However, over time, appropriate FCB decreased across seven sessions, with an average duration of 308 s. Following baseline sessions, Miles was exposed to VM, which immediately increased the duration of appropriate FCB to 883 s and maintained at 900 s across four consecutive sessions. During three maintenance sessions in which

VM was removed and no additional programmed consequences were provided for appropriate FCB, Miles maintained 900 s of appropriate FCB. Results suggested that VM alone was sufficient in increasing and maintaining appropriate FCB duration for Miles.

Social Validity

The consultants collected data on the acceptability, perceived effectiveness, and feasibility of the teaching procedures. Each special education teacher was asked (a) if the treatment met the need of the referral; (b) if the treatment was effective in increasing appropriate FCB; and (c) if the staff could continue to implement the treatment. Both teachers responded favorably by stating that the treatment was acceptable, effective, and could easily be implemented in the classroom.

Discussion

The current study aimed to evaluate whether VM was an effective strategy for increasing the duration of wearing a face covering for individuals with DS. Despite demonstrating the skills to appropriately wear a face covering as evidenced by their score on the prerequisite checklist, none of the participants wore the face covering in the baseline for the terminal goal of 900 s. Two participants increased the duration of wearing a face covering with VM alone, while one participant required BSP to increase his duration of wearing a face covering.

This study represents an important addition for the literature about the use of VM to increase health safety. Since other individuals (e.g., autism spectrum disorders, adults with intellectual and developmental disabilities) are at a high risk of contracting and dying from COVID-19, future studies could evaluate the effectiveness of VM to increase FCB with other demographics of individuals, extending its external validity. Future studies could also investigate potential uses of VM for additional health safety behaviors (e.g., physical distancing) and analyze video components that might reduce the need for additional feedback.

Theories of rule-governed behavior may explain the improvement in wearing a face covering observed with VM for Brody and Miles. Rule-governed behavior occurs following contact with descriptions of contingencies and not necessarily following direct or prior contact with the contingencies stated within the rule (Skinner, 1969; Tarbox et al., 2011). Nikopoulos (2007) suggested responses to video models might be an example of rule-governed behavior with the video functioning as a discriminative stimulus that increases the probability of participants demonstrating the expected behavior (e.g., wearing a face covering) without necessarily contacting the specific contingencies related to it. Based on the teacher's report, Brody and Miles have a history of compliance with expectations. So, it is possible that the video provided a context that increased the reinforcing value of following the rule of wearing a mask for them. Another limitation of this study relates to the type of face covering shown in the video models (i.e., face mask). Therefore, the degree of generalization of this tool to other types of face coverings is unclear. Future studies could include exemplars of different face coverings to ensure generalization across different stimuli.

Jaxon did not demonstrate rule-governed responding when using VM. Jaxon's special education teacher reported to the consultant team that he does not consistently follow classroom expectations unless given specific feedback in the form of praise. Thus, it is not surprising that he required praise in our study. His response was similar to participants in Jess and Dozier (2020), who found feedback to be essential to increase handwashing duration and effectiveness when using VM. A limitation of our study is that we did not evaluate whether VM was needed for Jaxon, as he may have simply responded to a behavior intervention plan without additional instruction.

There may be other contributing factors that led to the differential response between the three participants. Unfortunately, the current study did not evaluate or review participants' performance on prerequisite skills that have been demonstrated to increase the efficacy of VM (MacDonald et al., 2015; Park et al., 2019). High performances on delayed matching-to-sample tasks, delayed imitation tasks, and attending to videos are considered essential prerequisite skills for learning through VM (MacDonald et al., 2015; Park et al., 2019). It is possible that Jaxon lacked some of these skills for the VM alone to be effective. We recommend that future studies assess both prerequisite skills and acquisition barriers that may affect the efficacy of VM as a stand-alone treatment versus VM with reinforcement versus reinforcement plan without VM.

While the procedures described in the current study increased appropriate FCB for all three participants, there were no additional opportunities to continue observation and usage of the VM or VM with BSP due to the participants leaving for an extended break from school. For Jaxon, there appeared to be a slightly decreasing trend within the VM with BSP phase. It is plausible that attention was beginning to lose its reinforcing value. Had the consultant team had more time, evaluating other reinforcement classes for a more potent reinforcer may have been more effective in maintaining longer durations of appropriate FCB. Future studies could extend the current study by assessing the efficacy of various classes of reinforcers (e.g., tangibles). Evaluation or assessment of reinforcement classes through preference or reinforcer assessments has been demonstrated to promote learning (Piazza et al., 2011).

Nonetheless, the current study results are consistent with previous studies that have demonstrated the efficacy of VM to teach safety and hygiene skills for individuals with special needs, such as DS (Corbett, 2003; National Autism Center, 2015; Thelen et al., 1979). Specifically, the current study provides school-based practitioners with procedures that teach behaviors that may help prevent the contraction of COVID-19, which has an increased health risk for individuals with DS (Jess & Dozier, 2020). This study also confirms what is outlined by Wilson (2013) regarding the practical use of VM for school settings, validating the potential for dissemination of this tool. Therefore, the data presented in this study show that VM can be a promising tool to increase FCB for individuals with DS, assisting educators and healthcare professionals worldwide to prevent and mitigate the effects of the COVID-19 pandemic while ensuring a safer return to in person instruction.

Acknowledgements The video made for this study is available at https://www.youtube.com/watch?v=YE71Lsj9DLU. We would like to thank the educators with whom we worked for trusting us to partner with them to help to increase protections for all of their students during this pandemic.

Data Availability The author confirms that all data generated or analyzed during this study are included in this published article.

Declarations

Ethics Approval This article was written from a procedure conducted within a consultation system. No specific ethical committee approval was necessary to provide the service outlined in this article.

Consent to Participate All parents consented to the consultants to conduct the procedures outlined here.

Competing Interests The authors declare no competing interests.

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