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Using Behavior Skills Training and a Group Contingency to Promote Mask-Wearing in an Early Childhood Special Education Classroom

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ABSTRACT

Coronavirus (COVID-19) and the resulting pandemic had widespread implications on the safety of the job tasks teachers are charged with each day. The Center for Disease Control (CDC, 2020) recommends people age 2 years and older should wear masks in public settings; however, for children with disabilities, wearing a mask may be difficult and as such, is not required. Special education teachers and students in particular are at high risk for exposure and contracting COVID-19. Therefore, behavior-analytic strategies that can teach and reinforce appropriate mask-wearing should be evaluated. Given the environment of schools at the time of the study, mask-wearing was a critical skill that children had to learn, and quickly. In this study, students ages 3 to 5-years-old with developmental delays were taught how to properly wear a mask using behavior skills training (BST) until all students were able to put on a mask, or ask for help in doing so, independently. Then, a group contingency was utilized to reinforce the wearing of masks throughout the day in the classroom. Using a changing criterion design, BST and a group contingency was effective in increasing mask wearing for students in the classroom.

KEYWORDS group contingency, mask-wearing, school, early education

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*I*n 2020, the world was significantly impacted by an infectious respiratory disease known as COVID-19. This produced a global pandemic that caused significant health issues for millions of people, with hundreds of thousands resulting in death (Center for Disease Control and Prevention [CDC], 2022). In March and April of 2020, the United States, and many

other countries, entered a lockdown in order to reduce the transmission of COVID-19 (CDC, n.d.) which required schools, universities, and companies to transition to online environments. In order to provide the greater society a means to interact while mitigating the transmission of COVID-19, the recommendation from the CDC was to remain physically distanced from one another and to wear facial coverings when in public (CDC, 2020). This recommendation was particularly important for those in education, medicine, and businesses as these environments require constant interaction with each other. Specifically, school-aged children were required to wear a mask for approximately seven hours per day which posed a challenge for younger children and those with disabilities.

Currently, there is a limited amount of research on increasing mask wearing with either of these two populations. Halbur al. (2021) used an intervention package consisting of graduated exposure, prompts, reinforcement, and escape extinction to increase tolerance of wearing a mask for autistic children ages 4-10 years. The participants in the study were served either in person at an outpatient clinic providing applied behavior analysis (ABA) services or over telehealth, and sessions were conducted individually. While the intervention package was successful at increasing tolerance of wearing a mask, the time in which children wore a mask was only up to five minutes. However, most children are in large groups (i.e., school settings) for up to seven or eight hours a day. Furthermore, the intervention package used would be more difficult for teachers to implement in the classroom due to the various components required for each child. Lillie et al. (2021) also addressed mask wearing in autistic children. They used differential reinforcement of other behavior (DRO) without escape extinction for six participants between the ages of 4-14 years old. Like Halbur et al., the participants were served at an ABA clinic with sessions occurring individually for each participant. This approach increased compliance of wearing a mask with participants being able to tolerate wearing the mask for up to 30 min. In comparison to Halbur et al., Lillie et al. used an approach that would be easier for teachers to implement and increased compliance for a longer amount of time; however, teachers and school staff may have difficulty being able to conduct intervention sessions with students individually due to staffing ratios. Therefore, an approach to teaching and reinforcing this skill for the whole class may be the most ideal option.

Teaching health and safety skills to children with and without disabilities has been a focus for research and practice. One method to teach these skills is behavior skills training (BST). BST consists of four components: instruction, modeling, rehearsal, and feedback (Miltenberger, 2015). This method can be individualized to meet the specific needs of the trainer or learner (e.g., using video models rather than in-vivo models), and is particularly helpful for skills in which the learner has no previous experience and requires hands on learning (Kirkpatrick et al., 2019). BST has been used to teach children gun safety skills (Lee et al., 2019), abduction prevention safety to autistic children (Ledbetter-Cho et al., 2016), fire safety to adolescents (Houvouras & Harvey, 2014), and poisonous substance safety to autistic children (Morosohk & Miltenberger, 2022), to name a few. BST is typically used to provide initial training and "booster training," as needed, should the trainer notice a decrease in performance (Kirkpatrick et al., 2019). Additionally, having a system of reinforcement ensures that the learner maintains their performance over time.

Group contingencies are a type of reinforcement procedure in which reinforcement is contingent on the performance of the whole group, a small number of individuals within a group, or an individual (Cooper et al., 2020). This reinforcement procedure is particularly successful when the target behavior is applicable to multiple people within the group such as on-task behavior in a classroom (Chow & Gilmour, 2016). They have been used successfully with preschool,

elementary, and secondary classrooms (Maggin et al., 2012; Pokorski et al., 2017), as well as with students with and without disabilities (Chow & Gilmour, 2016). For example, in Pasqua et al. (2021), the researchers evaluated an interdependent group contingency, with a 'mystery student' component to promote appropriate behaviors and decrease disruptive behaviors in a preschool classroom. Specifically, the teachers began each session by selecting two random students in the classroom (i.e., the mystery students). They did not inform the class which students were selected, but rather indicated that all students should engage in the expected behaviors (e.g., on-task) in case they were the mystery student. During the session, the teacher assistants collected data using interval recording on whether the 'mystery students' were engaging in the expected behavior. At the end of the session, if the 'mystery students' were engaged in the target behavior for at least 60% of the session, the whole class could receive reinforcement. Given that on-task behavior was expected of all students, data could be collected on any 'mystery student' with the consequence applying to the entire group.

Due to the importance of mask wearing during the COVID-19 pandemic and the numerous responsibilities of teachers, it is important to identify an effective yet feasible intervention package for teachers to use. Therefore, the purpose of the current study was to evaluate the effect of using BST and an interdependent group contingency to teach appropriate mask wearing to students in an early childhood special education classroom. Specifically, the research question was: to what extent can the use of BST and an interdependent group contingency increase mask wearing for young students with disabilities in the classroom?

Method

Participants and Settings

This study was conducted in an Early Childhood Special Education (ECSE) classroom in a public elementary school in the southern United States serving primarily low-income students from minority backgrounds (77.5% Hispanic). Participants included seven students, a total of two females and five males, with ages ranging between three and five years old. All students were currently receiving special education services in a self-contained classroom for part of, or the entire school day. Their demographics are provided in Table 1. All students in the classroom were eligible to participate in the study, and caregivers were informed of the study procedures during the informed consent process. All caregivers agreed to have their child participate which included consent for video recording for data collection purposes only. Additionally, approval was granted from the university's institutional review board (IRB #21-014).

The lead teacher implemented the intervention, while a paraprofessional collected reliability data for the primary dependent variables. In addition, the paraprofessional agreed to participate in the intervention procedures if the lead teacher's absence would require them to do so. The paraprofessional filled in for the lead teacher on less than 10 occasions. The lead teacher was a fifth-year special education teacher who had been teaching in an Early Childhood Special Education setting for 2 years and was a Registered Behavior Technician® under the supervision of a Board Certified Behavior Analyst- Doctoral® (BCBA-D®). The supervising BCBA-D observed baseline and intervention sessions remotely, via Zoom®, and collected reliability and treatment integrity data.

All sessions were carried out in a preschool program for children with disabilities (PPCD) classroom in a local public elementary school. At the time of the current study, a mask mandate

was in order; however, students with special needs were excluded from this requirement according to Center for Disease Control guidelines for children and youth with special healthcare needs (CDC, 2021). Students in the district the study was conducted returned to in-person learning in a staggered manner between September and November of 2020. The study was conducted over the course of 5 months between December of 2020 and April of 2021, once all students had returned to school. All sessions took place in the classroom and lasted approximately 1 hr from 8:30 AM to 9:30 AM.

Table 1. Participant Demographics

Participant	Race	Gender, Age (years)	Special Education Eligibility
Participant 1	White	Male, 3	Orthopedic Impairment, Speech Impairment
Participant 2	Black, Hispanic	Male, 3	Autism, Speech Impairment
Participant 3	Black, Hispanic	Male, 4	Autism, Speech Impairment
Participant 4	Hispanic	Male, 4	Autism, Speech Impairment
Participant 5	Hispanic	Female, 5	Speech Impairment, Orthopedic Impairment
Participant 6	Hispanic	Female, 4	Noncategorical Early Childhood – Suspicion of Autism
Participant 7	White	Male, 5	Autism, Speech Impairment

Dependent Variable and Measurement

The primary dependent variable in the current study was the percentage of students wearing their mask. Data on mask wearing were collected using momentary time sampling, with data collected at the end of each 30-min interval. Data were collected by counting the number of students wearing their mask, dividing by the total number of students in the classroom, and multiplying by 100 to obtain a percentage. Data were collected in 30-min intervals as this was determined by staff to be feasible while also maintaining other classroom duties (i.e., ensuring continuing instructional opportunities for students, toileting, supervision, etc.). Specifically, data were collected for a total of three 30-min intervals per day, at 9:00, 9:30, and 10:00, which coincided with the end of scheduled activities in the classroom.

Interobserver Agreement and Treatment Integrity

Reliability data were collected by having a secondary observer collect data on the primary dependent variable. These data were collected either by the paraprofessional or the supervising BCBA-D. All sessions were video-recorded for later data analysis and treatment integrity purposes. Reliability data were collected for at least of 25% of sessions within each condition. Specifically, reliability data were collected for 40% of baseline sessions, 29% of BST sessions, and 40.4% of group contingency condition sessions. Total count interobserver agreement (IOA) was calculated by taking the frequency of students wearing a mask collected by the lead teacher and the secondary observer, dividing the smaller number by the larger number, and multiplying by 100. The resulting IOA across baseline, BST, and intervention sessions was 96.3% (range, 87%–100%).

Treatment integrity was collected for on average 25% of baseline, BST, and intervention sessions. Specifically, the supervising BCBA-D observed the lead teacher's implementation of the procedures 1 day per week over the course of the study. Treatment integrity scores averaged 100% across baseline, BST, and intervention sessions.

Materials and General Study Procedures

Various materials were used throughout this study including visuals to promote and model correct mask-wearing, reinforcers that students could earn if they met the group contingency requirement, a laptop computer equipped with a camera, microphone, and Zoom® for remote supervision, data collection, and video recording purposes, as well as a datasheet and pen for in-person data collection in the classroom and a whiteboard and dry erase marker to track and display points accrued at each data collection interval. The visuals were posted in two places in the classroom that were frequently visited by students including the restroom area and external sink where students washed their hands. Preferred tangibles and activities that were used as consequences (i.e., reinforcers) for the group contingency included kinetic sand ™, play-doh, 15-min dance party, slime, stickers, and scooter boards. These are referred to as reinforcers throughout the manuscript, but consequences were only presumably reinforcing until they increased the target behavior (i.e., mask wearing), which confirmed their function as a reinforcer.

A changing criterion design was used to measure students' performance under increasingly challenging conditions. That is, as student performance improved (i.e., mask-wearing increased), the criterion to attain the reinforcer became more difficult. Conditions included baseline, BST, and the group contingency condition. After baseline, BST was implemented to teach all students how to properly put on and wear a mask or ask for help from the teacher. Then, once all students were able to put on their mask independently or request help to do so, the group contingency condition began.

Baseline

Baseline consisted of greeting students as they arrived in class each morning, ensuring they had a mask in their possession, without any further instruction. Data were collected at the end of each 30-min interval to record how many students were wearing their mask. Overall, only one student was reliably wearing their mask during baseline, suggesting the need to intervene.

Behavior skills training

After baseline responding was stable, the lead teacher conducted BST to teach the students how to properly put on and wear a mask. It should be noted that some students, even with direct teaching, still required help to put on their mask. As such, they were also provided with the option to ask the teacher for help to put their mask on initially, and throughout the day, as needed. BST was implemented during the morning message on the circle-time carpet. The teacher began by providing the initial instruction to the students, "Okay everyone, today we are doing to learn/ practice how to put on our mask." Then, the teacher modeled and provided opportunities for choral responding regarding why it was important to wear a mask at school. For example, the first day, the lead teacher said, "Masks are important to keep everyone safe!" Then, instructed students to repeat after her with choral responding (i.e., "Masks are important to keep everyone [safe]." Then, the lead teacher provided additional opportunities for active responding regarding mask-wearing by asking questions such as, "Do your teachers wear a mask?", "How many masks can you count?", "Does your bus driver wear a mask?", etc.

Then, the lead teacher began with instruction and modeling of how to properly put on and wear a mask. Instructions included use of verbal instruction and modeling while following the task analysis developed by the lead teacher and BCBA-D supervisor. The lead teacher prompted all students to try to put on their mask and offered help as needed. Praise and a sticker were provided for any attempts to put on the mask, successfully putting their mask on, or any other appropriate mask behavior (i.e., asking for help to put on). Additionally, if new students joined the class later in the day, individual or small group BST sessions were conducted again using the same procedures (also included in BST data collection). Data were collected for how many students were able to put their mask on or ask for help independently each BST session until the classroom achieved 100% of students. No other prompts or instructions were delivered for the remainder of the day.

Group contingency

Once all students were able to independently put on their mask or ask for assistance to put their mask on, the group contingency condition began. The denominator for each group contingency requirement was the total number of students in the classroom each day ("S"). In the first criterion phase, the total number of students in the classroom served as the initial goal. For example, if five students were in attendance that day, the total number of stars required to earn the reinforcer at the end of the day was five. Given there were three data collection intervals, the maximum stars possible to earn was 15.

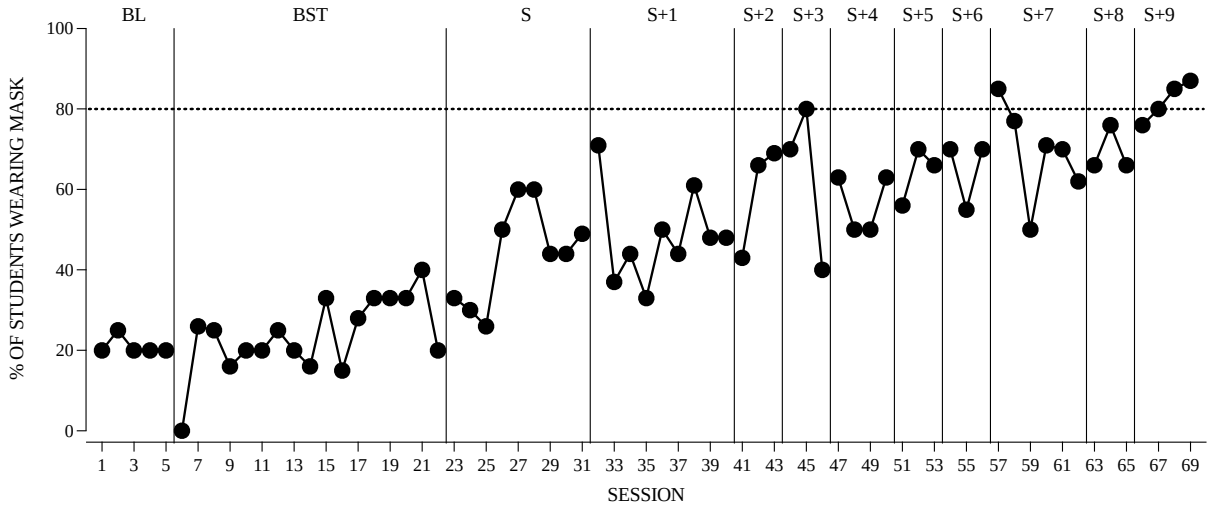
For the first day of the group contingency, the lead teacher described the rules of the game and had students vote on the reinforcer to earn at the end of the day contingent on meeting their goal. She introduced the conditioned reinforcer (stars drawn on the board) by drawing blank boxes equaling the criteria for the current group contingency. That is if five students were in attendance, she drew five blank boxes on the board and said, "Okay, today we need to earn five stars to get [chosen reinforcer]." At the end of each 30-min interval, the lead teacher announced, "Okay, let's see who is wearing their mask" and drew a star for each student wearing their mask while simultaneously counting the number of students wearing their mask. Similar to the BST condition, students wearing their mask also earned a sticker at each data collection interval.

During subsequent phases, each criterion was increased by one star when students met the previous goal 3 days in a row (i.e., S, S +1, S + 2, and so forth). For example, if there were five students in the classroom on Monday, Tuesday, and Wednesday and they earned at least five stars each day (i.e., met their goal), then on Thursday, the criterion increased by one star (5 students + 1 star= 6 stars total). Mastery criteria for each phase was set to meeting the predetermined goal across three consecutive days. Termination criteria for the entire study was at least 80% or more of students wearing their mask across three consecutive sessions. This termination criterion was selected because two students in the class had physical disabilities that precluded them from mask-wearing (i.e., it was not safe for them to wear masks due to their disability).

Results

Within-group outcomes were analyzed to determine the extent to which BST and an interdependent group contingency occasioned correct mask-wearing throughout the school day. The percentage of students wearing a mask during each condition is presented in Figure 1. During baseline, only 17.5% of students were consistently wearing masks, therefore intervention was warranted. During BST, an average of 25% of students consistently wore masks across sessions, indicating a need for additional intervention components. During the first phase of group contingency, mastery criteria was three consecutive sessions of students earning the same number of stars as students in the classroom (i.e., 'S'). During the second phase of the group contingency, the mastery for criteria was the number of students (S) + 1 star (i.e., S+1). During this phase, mastery criteria needed to be met across two full weeks to allow for treatment integrity data to be collected on the teacher and paraprofessionals within the classroom. In following phases, mastery criteria were set at 3 consecutive days with the students meeting the set contingency (i.e., S + 7, etc.). As contingency requirements increased, mask-wearing also increased, with students meeting the group contingency mastery criteria each phase. In the final phase, S+9, students met mastery criteria in four sessions with an average of 82% of students wearing their mask in the final session.

Figure 2. Percentage of Students Wearing Mask



Note. S = number of students in attendance that day

Discussion

The purpose of the current study was to evaluate the use of BST and an interdependent group contingency to reinforce mask wearing in a classroom for young children with disabilities. The teacher provided students with BST on appropriate mask wearing; however, this was not sufficient alone and an interdependent group contingency was introduced. Students were able to meet the criterion for each phase in 3-4 sessions. This indicated that the combination of BST and group contingency were successful at increasing the number of students able to wear their mask throughout the school day. This result was significant given that the time in which the study was conducted, mask wearing was highly encouraged, particularly for those unable to be vaccinated (i.e., young children and those with disabilities).

This study adds to the literature base on mask wearing for people with disabilities and our results are similar to those of other studies that use behavior analytic interventions to increase compliance with wearing a mask for children with developmental disabilities (Frank-Crawford et al., 2021; Halbur et al., 2021; Lillie et al., 2021). However, we feel that our study's focus on a classroom rather than individual therapy sessions adds to the research base and demonstrates an aspect of social validity. For example, both Halbur et al. (2021) and Lillie et al. (2021) worked with participants individually with terminal criteria of approximately 5–30-min sessions with wearing a mask. Alternatively, our study procedures taught and reinforced mask compliance to multiple participants (i.e., seven students) with various developmental and physical disabilities for at least one-hour sessions in a natural environment where mask wearing may be of importance. In addition, the teacher reported that students would wear the mask throughout the day outside of the research sessions (i.e., in the afternoon class period and when attending other classrooms for special classes, i.e., Art, Music, and P.E.). This study was conducted during the height of the COVID-19 pandemic when children, especially young children, were ineligible for vaccination. Therefore, many school districts across the country put mask mandates in place to protect the health of their students. Our study demonstrates that this intervention package can be successful for increasing compliance with mask wearing for a group of children and thus mitigating the risk for contracting COVID-19.

Another notable difference and important distinction between our study and previous research is that our study specifically targets younger participants. While the current literature has a sample of varying ages, most of the participants are in the adolescent to adult age range (Frank-Crawford et al., 2021). This finding is not surprising given that at the time most studies were conducted (i.e., 2020), schools across the country were utilizing virtual learning for some or all of their students, particularly elementary schools. Our study targets a gap in the literature to understand how we can help younger children (3-5 years of age) increase mask wearing, a socially valid health-related behavior. Finally, our study focused on implementation and intervention components that have proven to be successful and feasible for teachers to implement in classrooms (Andzik & Schaefer, 2020; Page et al., 2021). The teacher and the paraprofessional in the current study were able to implement the intervention protocol with consistent high fidelity (i.e., 100%). The previous research regarding mask wearing has included intervention packages with components that may be difficult for teachers or natural change agents with limited training to implement consistently and with high fidelity due to the nature of their procedures. For example, in Halbur et al. (2021), the intervention package used included escape extinction, meaning the researchers prevented the participants from being able to remove the mask. While extinction is an evidence-based practice (Hume et al., 2021), it can be difficult for teachers to implement and may

be difficult to ensure proper fidelity outside of research sessions. For example, the requirement that the teacher not allow the student to contact reinforcement (i.e., remove the mask) throughout the day may not be feasible given the daily activities and ratio to adult and children in the classroom at any given time (Burt & Pennington, 2017). Moreover, if the child is not required to wear their mask in other settings, complete tolerance may be harder to achieve using escape extinction in the research setting. The current study used reinforcement-based procedures that were successful in increasing mask compliance in and outside the school/ research setting.

Implications for Practice

Our findings from the current study indicate that the combined use of BST and an interdependent group contingency can increase mask wearing in young children with disabilities in the classroom. Group contingencies have proven to be successful in classrooms, including preschool classrooms and use with students with disabilities. Interdependent group contingencies seem to be used most often with elementary and preschool students as it provides the learners the opportunity to see cause and effect of their behavior on contacting reinforcement, and potentially builds opportunities for community-building by working together to reach a goal (Maggin et al., 2012; Pokorski et al., 2017). Teachers should be considerate of what serves as reinforcement for their students by conducting a preference assessment with the class prior to developing the contingency, which should, ideally be done in collaboration with the students. While the name 'behavior skills training' may not be familiar to most teachers, they are familiar with the components of BST as some of these are used in a similar manner in explicit instruction (e.g., modeling or think-aloud of the skill, provide opportunities for practice, provide feedback on the learner's performance; Hughes et al., 2017). Because BST is adaptable to meet the needs of the learners, teachers will want to consider all elements ahead of time and how they will be delivered. For some learners, group BST will suffice; however, it may be necessary to provide additional "booster" sessions with individual learners who have difficulty learning the skill (Kirkpatrick et al., 2021). The intervention package used in this study could also be useful for other areas of need in a preschool classroom such as engaging in appropriate behavior during whole group instruction (e.g., circle time), transitions, and cleaning up centers.

Limitations and Future Research

This study has a few limitations that are worth noting and could be addressed through future research. The teacher in our study had previous training in ABA. While this enhanced the teacher's competence with providing the intervention and collecting data, we recognize that many teachers do not have this same background and may hinder applicability of our results to other classrooms. However, other studies have demonstrated that with training (e.g., BST), teachers are able to implement evidence-based practices with their students in the classroom (Kirkpatrick et al., 2019). Therefore, future research should evaluate the use of this intervention package with a novice teacher who receives specific training during the study. Second, we utilized a 30-min momentary time sampling data collection procedure to ensure that staff could collect data with high fidelity while also completing their other classroom duties. However, collecting data every 30 minutes does not capture the target behavior throughout the entire session and may over or underestimate student's actual performance. As such, future research may consider having more stringent data collection procedures (e.g., 30-s intervals) to be more sensitive to behavior throughout the session.

Finally, our study does not include either maintenance or generalization data. Our study concluded toward the end of the school year which limited our ability to continue to collect data. Future research should plan for opportunities to collect both pieces of data to understand the extent to which the intervention produces long-term effects and whether the intervention can be applied to other areas of need in the classroom (e.g., transitions, cleaning up).

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