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Using a Forward Chain to Teach Intruder Training to Children with Autism

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EDSBA 56000: Master's Thesis – Behavior Analysis

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Author Note

This thesis is submitted by the first author under the supervision of the faculty advisor to Lindenwood University as partial fulfillment of the requirements for an M.A. degree in Behavior Analysis.

Abstract

Safety drills, such as tornado, fire and intruder drills are mandated in schools across the United States. These drills require prolonged compliance by students and are commonly taught using verbal instructions. However, individuals with autism spectrum disorder (ASD), may struggle with complex routines, attending to verbal stimuli, or complying for long durations. Thus, when children with ASD transition to school these drills may be difficult for them to complete and little to no research has been conducted on this topic. Thus, the current study utilized a concurrent multiple baseline design across participants to examine the use of a forward chain to teach intruder training to two children diagnosed with ASD. The results demonstrated that both participants met mastery criterion for all components of the intruder drill and the results have important implications for the school setting.

Keywords: intruder training, forward chain, safety skills, school, autism spectrum disorder

Using a Forward Chain to Teach Intruder Training to Children with Autism

Schools across the United States require their staff and students to partake in safety drills such as fire, tornado, earthquake, and intruder. These drills typically occur in controlled settings within the school and serve as practice in the event that a live drill is necessary (State of New Jersey Department of Education, n.d.). Currently, federal law does not mandate states to practice a specific drill or to practice a certain number of times within the school year (Education Commission of the States, 2022). Rather, each state and county independently determine and enforce the quota that their respective schools must follow and as of 2022, it was found that 45 states required their schools to conduct safety drills per state regulations (Education Commission of the States, 2022).

Intruder drills are those in which individuals within the school practice emergency and safety strategies in the instance an unwanted and/or dangerous individual enters the premises. The purpose of the drill is to remove all individuals from the intruder's path and to remain safe until authorities arrive. One study found that between 2017-2018, over 4 million students participated in an intruder training drill on school grounds, including those within general education and those with individualized education plans (IEPs; Rich & Cox, 2018). Further, teachers of students who fall under IEPs are typically advised to make modifications to drills as needed so that their students can successfully participate, but no other information or programs have been established to guide effective teaching for these drills to students with learning and/or behavioral disabilities (The National Child Traumatic Stress Network, 2018).

Previous research has examined teaching safety skills to children with and without disabilities. Baruni and Miltenberger (2022) conducted a review of the literature and discussed seven key features that have emerged. The first being the use of in situ training (IST) which takes

place in a natural and applicable setting while manipulating the environment to contain the safety threat being taught. This form of training has been noted as successful because the trial closely resembles that of real life and because the participant is typically unaware that they are taking part in a trial. Another important factor pinpointed was utilizing active learning, like behavioral skills training (BST) and more specifically, repetition and corrective feedback. Giannakakos et al. (2020) also conducted a review of the literature and found that BST in isolation was not as successful compared to using BST and IST in unison. Using data-based decisions to determine the intensity of training was another factor highlighted by Baruni and Miltenberger (2022) with one example being the use of booster training if a participant was struggling to acquire a safety skill using BST.

The fourth factor identified that has emerged in the research was implementing specific strategies, such as multiple exemplar training (MET), to account for generalization. Giannakakos et al. (2020) furthered this idea by stating that general-case programming was also imperative to ensure irrelevant features of the stimuli were not controlling the response. The next feature that emerged in safety skills studies was the need to assess the maintenance of behavior months after it was acquired. Further, although it is imperative to teach specific skills to children it is also important to share the safety procedures with other adults like parents and teachers. The final feature identified in Baruni and Miltenberger (2022) is the need for modifications when teaching those with disabilities.

Miltenberger and Novotny (2022) reviewed past safety skills literature but focused their efforts on studies that taught individuals with developmental disabilities. The studies they analyzed taught specific safety skills for abduction, sexual abuse, gun safety, and poison safety. Similar to Baruni and Miltenberger (2022) and Giannakakos et al. (2020) the authors stated that

using BST and MET produced a higher percentage of success. The use of tangible reinforcers was also found to increase the effectiveness of intervention as opposed to verbal praise alone (Miltenberger & Novotny, 2022). Based on the data collected in the reviewed studies, the authors also deduced that limiting errors and decreasing the latency for correct responding through prompting strategies greatly increases the acquisition of safety skills. The final factor identified by Miltenberger and Novotny was fading the technician's presence from trials. However, teachers are present in the classroom for intruder training to fulfill specific duties and cannot be faded.

Himle et al. (2004) and Maxfield et al. (2019) examined teaching firearm safety using different strategies. Himle et al. (2004) used a multiple baseline design across subjects to teach neurotypical children three separate safety skills including not touching the gun, leaving the area immediately, and telling an adult (Himle et al., 2004). To teach these skills, the experimenters used BST which included instruction, modeling, rehearsal, and feedback. All training trials were conducted in the participant's preschool and generalization trials were conducted in a plethora of settings including the participant's home. Data from this study showed that three of the participants reached mastery criterion with BST alone. The other five participants met criterion with additional IST. Maxfield et al. (2019) taught firearm safety to neurotypical children through both simulation training and IST in their homes. During the simulation training the participant modeled how they would respond if a gun was present using a doll and toy firearm (Maxfield et al., 2019). When conducting IST, a toy gun was placed in the child's home somewhere in which they would naturally encounter it. The participant's response when they encountered the gun was recorded. The results showed a significant increase in overall firearm safety behavior across all four participants. This study shows the overall success of simulation training in teaching new

behaviors. However, a limitation was that each participant received both simulation and IST, thus the experimenters were unable to determine which teaching strategy was responsible for the results obtained. Another limitation in this study and in Himle et al. (2004) is that the participant pools were exclusively neurotypical children. Thus, it is unclear the extent that these results would extend to neurodivergent individuals.

Previous research has also examined teaching street and gun safety. For example, Brown and Gillard (2009) used a within subject reversal design to teach a 15-year-old boy with severe learning disabilities and Down syndrome to safely cross a road utilizing a backward chain in a classroom environment and in vivo. The experiment followed an ABCAD pattern. Phase A was baseline and was conducted on a working street. In Phase B the experimenter used model prompts to teach the behavior in vivo. Phase C was conducted in a classroom and used pictures to teach the desired chain of behavior using a backwards chain. In the last phase, D, generalization trials were conducted in vivo. The results showed that the participant independently completed the chain for crossing the road quicker in the classroom setting when compared to the in vivo setting. The authors also found that the participant generalized the classroom skill to the in vivo setting. This study shows that safety skills can be learned and generalized even when they are taught in controlled settings, like a classroom. A limitation from the Brown and Gillard (2009) study is that the classroom environment taught the chain via picture stimuli. Although this is helpful in learning the chain, picture stimuli are very different from mastering the physical act of each step. Future research should continue to expand on teaching the physical chain of safety skills in controlled settings like classrooms.

Garcia et al. (2016) utilized a nonconcurrent multiple baseline design to teach children with ASD how to evacuate a room and tell an adult when a fire alarm sounded. To teach this, the

response was divided into six separate skills. First, the experimenter modeled the entire behavior, then the participant had to verbally label each step to ensure they were attending to the model, and finally the participant demonstrated the behavior independently. Praise and/or corrective feedback were provided during the second step (labeling) and the third step (modeling). This study showed that both modeling and rehearsal were effective strategies in teaching fire safety to children with ASD (Garcia et al., 2016). Limitations from this study included that all six skills were targeted at once and the experimenters did not notate which step(s) within the behavior chain were most troublesome or how these barriers were overcome.

Only one study has focused on teaching lockdown drills. Dickson and Vargo (2017) implemented a concurrent multiple baseline design across participants in a group design to evaluate the use of BST to teach neurotypical kindergarten students the correct response to a lockdown drill. While the students were engaged in various activities in the classroom, the experimenter announced that a lockdown drill was occurring. During intervention, two separate conditions were implemented. In the first phase, the experimenter implemented BST (i.e., instruction, modeling, rehearsal, and feedback). During the instruction portion, the experimenter used supplemental pictures to aid in the student's comprehension. Additionally, mastery criterion included the participants remaining quiet during the final phase of the behavior chain for 85% or more of the partial interval trials. Only after mastery criteria was met did the participants progress to the second phase of the experiment. In this phase the participants completed the drill without any feedback from the experimenter. Dickson and Vargo found that their participants successfully completed all stages using BST and met mastery criteria for six of the seven stages during the second stage of the study. One limitation that was not addressed included the modifications necessary when individuals with learning disabilities are present in the classroom.

Although previous research is encouraging, there is limited research on the use of these procedures for individuals with ASD, particularly for teaching the steps to an intruder drill. In addition, none of the safety skills taught were centered around the procedures used in school settings, which is where children (both neurotypical and neurodivergent) will spend most of their childhood/adolescence. Thus, the purpose of the current study was to replicate and extend Dickson and Vargo (2017) by incorporating best practices identified above to teach children with ASD how to respond during a school intruder drill.

Method

Participants and Setting

Two male participants were included in this study (referred to as CK and BA hereafter). CK was 5 years and 2 months of age, was diagnosed with ASD and had been receiving applied behavior analysis (ABA) services for 2 years. CK was not attending school, but his parents planned on transitioning CK to his respective school district within the next year. The school district in which it was anticipated that CK would attend implemented intruder drills two times every semester. BA was 4 years and 3 months of age, was diagnosed with ASD and had been receiving ABA services for a year and a half. BA was not attending school at the time of the study and his parents projected a transition to their respective school district within approximately 2 years. Their school district was reported to conduct intruder drills once per semester.

The study was conducted at a clinic in which ABA services were provided to early learners diagnosed with ASD. At the time of the study, the clinic had five individual classrooms along with one motor room/indoor recess area and one outdoor recess area. Each classroom held approximately five clients and five technicians. Trials were conducted within a 30 min period in

which the classroom was vacant. CK and BA attended separate classrooms within the clinic and during baseline and intervention phases, the experimenter conducted trials within each client's respective classroom. Trials during the generalization condition were conducted in novel rooms in the clinic (excluding the outdoor play area).

Neither CK nor BA had any exposure to emergency drills (e.g., fire, intruder, tornado, etc.) before the study. Prerequisite skills required to be considered for this study included independently following three-step instructions for five different directions (e.g., "Stand up, walk to the sink, and put cup in sink") as evidenced by the "Verbal Behavior Milestones Assessment and Placement Program" (VB-MAPP; Sundberg, 2008; see Table 1) and independently traveling distances up to 3 m after being given a gestural cue. In addition, maladaptive behaviors could not include self-injurious behavior (SIB).

All parents whose children met this criterion within the clinic were emailed a recruitment script that outlined the individual steps of the procedure, the voluntary nature of the experiment, and the risks and benefits. Two parents responded to the email expressing interest in their child participating. The experimenter and the owner of the clinic met individually with each participant's parent(s) to discuss the experiment and answer all questions. At the end of the meeting, the experimenter gave the legal guardians the parental consent on behalf of a minor form. Both parent(s) returned the consent forms within 24 hr. Neither participant was offered any form of compensation for their participation and the experimenter informed the parent(s) that participation could be terminated at any time without penalty. To obtain assent before each session, the experimenter evaluated the behavior of the participant. For instance, if the participant sought physical interaction with the experimenter or sat at the table independently the experimenter considered this assent. If the participant demonstrated behaviors such as elopement

or tantrum, the experimenter delayed or terminated the session. Lindenwood University's institutional review board (IRB) approved all procedures before data collection began and data collection was completed during regularly scheduled treatment hours.

Materials

Materials included a table, two chairs, a bag or container, and access to an enclosed room (i.e., four walls and a door that closed). Other materials included various stimuli within the room used to determine highly preferred items (see preference assessment portion of general procedure) and data collection forms.

Dependent Variable and Response Definitions

The primary dependent variable was the percentage of independence for following an intruder drill. Mastery was achieved when the participant completed all six steps of the forward chain independently and with 100% accuracy after being given the verbal discriminative stimulus across three consecutive trials. Data collection was completed for each trial by annotating on paper the step of the chain, and if the participant completed each step correctly (+), incorrectly (-), or required a prompt (see Appendix A). A full physical (FP) prompt required the experimenter to use hand-over-hand contact with the participant throughout the entire targeted behavior. Partial physical (PP) prompting required minimal physical contact to aid the participant in completing the step. An example of partial physical prompting used was the experimenter tapping a participant on the back to prompt them to start walking. Modeling (M) consisted of the experimenter completing (modeling) the intended behavior in front of the participant and then instructing the participant to imitate the action. A verbal prompt (VP) consisted of the experimenter providing a verbal repetition of the current step (e.g., "Stand up",

"Sit down", "Walk"). A gestural (G) prompt consisted of the experimenter using a point cue to assist the participant in completing the step.

A correct response during the first step of the forward chain consisted of the participant independently standing up from their chair after being given the verbal discriminative stimulus. An incorrect response consisted of the participant engaging in any behavior other than standing up (e.g., remaining seated, lying on the ground, standing up and running to the toys). During the second step of the forward chain, a response was considered correct when the participant walked from the place in which the instruction was given to the area the experimenter gestured toward (within an arm's reach). A response was notated as incorrect if the participant remained in their current area. A correct response during step three of the forward chain was defined as the participant lowering their body to their hands and knees (into a crawling position). An incorrect response during this step occurred when the participant engaged in anything other than moving into the crawling position described above (e.g., laying on the ground, sitting on the ground, no response).

During step four within the forward chain a response was considered correct when the participant crawled from outside of the table on all fours (knees and hands) to under the table (with entire body under the table). An incorrect response included the participant engaging in any other behavior (e.g., rolling under the table or walking away) or if their entire body was not underneath the table. Correct responses during step five required participants to transition from the crawling position to the sitting position under the table. The response was considered correct if the participant sat on their buttocks with their extremities underneath the table. For instance, the participant could sit crisscross applesauce, sit on their buttocks with their legs extended but still under the table, or with their knees tucked to their chest. Incorrect responses included any

behavior other than the participant sitting on their buttocks or if any extremities were visible from under the table. A correct response during step six of the forward chain consisted of the participant remaining quiet (not talking or making noise with the provided stimuli) and remaining in the seated position until the duration of the step was concluded. An incorrect response occurred if the participant made noise that could be heard from 1.5 m away or if their body became visible and/or if they left the seated position. Throughout the entire chain, the response was considered incorrect if the participant did not respond within 20 s during each step.

Procedure

Pre-experimental Conditions

Preference Assessment. A free operant preference assessment was conducted at the start of each session (Cooper et al., 2020). Each assessment lasted for approximately 5 min in which the participant had access to all items in the room. The stimuli within the room were identical to the stimuli the participants typically had access to daily. The classroom was set up as it normally was during a school day in which tables and chairs were present with multiple different shelving units that held clear containers of toys. Each container held similar toys (cars, building blocks, play food, etc.) and all stimuli were easily accessible to the participants without adult assistance. The duration spent engaging with each item was documented (see Appendix B). To begin the preference assessment, the experimenter delivered an instruction or statement similar to, “Let’s play” or “What do you want to play with?” The experimenter played alongside the participant if the participant requested. The item(s) the participant interacted with for the longest duration were used as the reinforcer when the participant emitted the correct response for the targeted step of the chain during the intervention phase and the reinforcer was given immediately after the correct response during each step of the chain.

A multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) preference assessment was conducted at the onset of the study to determine three toys that would be available exclusively during the sixth step of the chain. The MSWO preference assessment was conducted in the participant's classroom at their assigned desk. The experimenter and participant were sat facing one another. At the start of the assessment the experimenter presented five total stimuli (i.e., small car, playdough, Pop It fidget, small dinosaur, liquid motion bubbler, and three Legos that came as a pack). These stimuli were chosen because they were quiet, did not light up, and were hand sized. These requirements were set in place for safety reasons in the instance an intruder was present. Given that both participants were familiar with all five stimuli, the preference assessment began without allowing the participants to interact with the toys in a general setting. To begin the preference assessment the experimenter placed all five toys in a line in front of the participant and then stated the instruction to, "Pick the one you want to play with" or "Choose one." After a choice was made, the participant was allowed to engage with the item for 30 s. After that time had elapsed the toy was removed from the environment completely. The process was then repeated with the four remaining stimuli and so on until all stimuli had been selected. If at any time a participant tried to choose multiple toys at once this action was blocked and then redirected by the experimenter stating that they must choose one. If the participant did not make a selection the demand was restated. If a selection was not made twice in a row the assessment was stopped. Each selection was documented (see Appendix C). The top three selections were put into a black drawstring bag and later presented during the sixth step of the chain for the participant to engage in while remaining quiet under the desk.

General Procedure

All sessions within the experiment persisted for either 30 min or 15 total trials, whichever occurred first. One session was conducted per day and sessions were conducted two to three times per week. A forward chain was followed in every trial of baseline, intervention, and generalization. Neither school districts the participants were anticipated to attend publicly shared their personalized intruder drills as a safety precaution. Thus, the forward chain was modeled after the national suggestions for a lockdown/intruder drill (National Association of School Psychologists, 2013; School Safety Solution, 2022; U.S. Department of Homeland Security, 2022).

At the onset of each trial the experimenter stated the verbal discriminative stimulus (i.e., "We are now in lockdown") accompanied with a gestural cue to the designated area. The gestural cue consisted of the experimenter pointing to the intended area (within 3 m of the participant). Examples of areas cued to were underneath the participant's desk, under a classmate's desk, or under a sturdy object that would provide the participant safety in the event of an intruder. A forward chain was followed in every trial (see Table 2). After the participant stood up and began the chain, the experimenter stood up, walked to the door of the classroom, locked it, turned off the lights, and then sat back down in their original chair. This was completed so that the setting modeled a school intruder drill in which the teacher is responsible for these steps.

Experimental Conditions

Baseline. A trial within baseline began when both the experimenter and participant were seated at a table and the verbal discriminative stimulus was stated along with the gestural cue of where the experimenter wanted the participant to hide. After the discriminative stimulus and gestural cue were given, the experimenter took data on the percentage of steps the participant completed independently. When the participant incorrectly completed a step, the trial was

terminated. No reinforcement, prompts, or feedback was given during the baseline condition. To create or continue momentum, the experimenter then placed demands for mastered one-step gross motor imitation targets and provided reinforcement.

Intervention. In intervention, a trial began when both the experimenter and participant were seated at a table. Like baseline, the experimenter stated the discriminative stimulus while using a gestural cue to point to the designated area. At the start of intervention, the participant was only required to complete the first step of the chain. The experimenter implemented least-to-most prompting (i.e., gestural, verbal, modeling, partial physical, and full physical) at a 0 s delay. If the participant completed the step of the chain independently the experimenter granted the participant 5 min of access to their preferred item chosen during the free operant preference assessment. If they required prompting the participant was not given access to their preferred item but were allowed to play with other stimuli within the classroom for a shorter duration (approximately 2-4 min). Each step of the chain was considered mastered when the participant completed the step independently and with 100% accuracy across three consecutive trials. Once mastery was reached for a step in the chain, the participant was required to complete the mastered step and the subsequent step in which they received least-to-most prompting on the subsequent step only. This process was repeated until the participant completed the entire chain independently for three consecutive trials with 100% accuracy.

During the final step of the chain, the experimenter gave the participant a bag of predetermined stimuli. The participant only had access to this bag during the sixth step of the chain. These were available for the participant to interact with during the 5 min duration of remaining quiet and underneath the table during the final step within the forward chain. This bag was offered during the final step of the chain based on how school districts complete their

intruder training drills. The purpose of offering these stimuli was to help occupy the participants while they were required to remain seated and silent. If at any point the participant began to play with the stimuli in an inappropriate or unsafe manner, like throwing or mouthing the toy, the experimenter immediately removed the stimuli from the environment and terminated the trial.

The final step, which lasted for 5 min, was separated into 10 s partial intervals. Within each interval the experimenter noted if the participant made any noise that was louder than an individual rubbing their hands on a piece of paper (Dickson & Vargo, 2017). To reach mastery criteria in this step the participant had to be silent for 80% of the intervals. If the participant was silent it was annotated as a (+) and if they made audible noise within the interval, it was marked as (-) on the data sheet (see Appendix D).

After mastery criterion was reached, the experimenter began to fade reinforcement from a fixed-ratio 1 (FR 1) schedule. To do this, the experimenter implemented an FR 3 schedule of reinforcement. During trials in which the participants did not receive reinforcement in the form of their preferred item, the experimenter delivered verbal praise. This phase of intervention was considered mastered when the participant completed the chain independently and with 100% accuracy for three consecutive trials. Next, all reinforcement with preferred items (identified during the free operant preference assessment) were removed, but verbal praise was still given. This final stage of intervention was mastered when the participant completed the chain independently and with 100% accuracy for three consecutive trials.

Generalization. Trials within generalization mirrored intervention trials apart from where the trial began and current activities within the room. Additionally, no reinforcement or prompting was provided during generalization trials. Generalization trials took place in different classrooms with unique setups and while the participant was playing or while others were present

in the room. Generalization was considered mastered when the participant completed five consecutive trials (all in novel areas) independently and with 100% accuracy.

Experimental Design

A concurrent multiple baseline design across participants was used in this experiment for several reasons. Running the participant's sessions concurrently minimized threats of maturation and history effects and minimized threats to validity. A multiple baseline design was also necessary because the behavior taught was irreversible.

Interobserver Agreement and Treatment Integrity

Interobserver agreement (IOA) data were collected for 80% of all trials within the experiment. A secondary observer collected data by viewing the clinic's security system which saved and collected video footage in every room of the clinic. IOA was calculated by comparing the primary experimenter's data to that collected by the secondary observer. The calculation was completed by dividing the number of agreements by the total number of agreements and disagreements and then multiplying by 100. IOA averaged 94% (range, 91%-100%).

Treatment integrity (TI) data were calculated in 80% of both intervention and generalization trials. TI was used to compare if the primary experimenter taught each step within the task analysis correctly and if the experimenter used the correct prompting hierarchy. TI data were collected in the same manner as IOA data. To calculate TI, the number of correctly performed trials were divided by the number of both correct and incorrectly performed trials and multiplied by 100. Treatment integrity averaged 98% (range, 95%-100%).

Social Validity

Social validity data were collected after the experiment was concluded. To collect data a survey was sent to both participant's parents via email the day of their child's last trial (see Figure 1).

Results

Figure 2 shows the number of mastered steps within the forward chain across participants. During baseline, neither participant completed any step of the chain independently. Following intervention, both BA and CK reached mastery criterion and demonstrated correct responding during schedule thinning and generalization. BA reached mastery criterion within six sessions. Following the sixth session, the experimenter began thinning the schedule of reinforcement in which a variable ratio of three (VR 3) was implemented and during the next session, the experimenter removed reinforcement entirely. Correct responding maintained during this time. Generalization trials were conducted in four different classrooms within the center all under novel desks. Within these trials, a variety of other peers and technicians entered the room causing varying magnitudes of distractions. In addition, the experimenter sporadically and periodically completed other tasks that involved traveling throughout the classroom and, in some instances, moving out of sight from the participant. None of these distractions caused BA to elope from the area or engage with another individual. During partial interval recordings (conducted during the 5 min duration of the sixth step of the chain) BA averaged 93.5% successful intervals (not making a sound louder than paper rubbing together) with scores ranging from 87% to 100% (see Figure 3).

CK met mastery criterion within seven sessions. Similar to BA, after CK mastered the chain, reinforcement was thinned to a VR 3 schedule and then was completely removed. Generalization trials were conducted in four novel classrooms and under novel desks.

Throughout the intervention and generalization phases, distractions appeared within the classroom (e.g., peer grabbing toys on top of desk). In generalization, the experimenter purposefully completed tasks that involved traveling within and out of sight of the participant. During the last step of the chain, CK averaged 83% successful intervals (range, 47%-93%).

Both participant's parents returned the social validity survey within one week. BA's and CK's parents both scored questions one, two, five, and six of the survey as a five. Question three averaged a score of four (range from three to five). Question four averaged a score of four and a half (range from four to five).

Discussion

Schools across the United States require that staff and students partake in a variety of safety drills including intruder drills. However, little guidance is given to teachers of students with disabilities and individuals with ASD may struggle with learning these skills. The purpose of the current study was to replicate and extend Dickson and Vargo (2017) by teaching two participants with ASD an intruder drill using a forward chain. The results showed that both participants met mastery criterion for the forward chain, including the sixth step in the chain in which participants were required to remain quiet and hidden. Further, both participants maintained correct responding during reinforcement thinning and generalization.

Although the current results are encouraging, there were several limitations. First, at the onset of the study, the experimenter made minor changes to the fifth step of the chain, due to varying desk sizes in the intervention setting. Rather than requiring the participants to sit under the table uncomfortably, the experimenter modified the step so that participants could lay down if no part of their body was visible outside of the table. Researchers in the future may need to make similar modifications depending on the supplies available.

Second, although the experimenter thinned the schedule of reinforcement for the items used as reinforcers for completing the first through fifth steps of the chain, the experimenter did not remove the items identified during the MSWO that were used during the sixth step of the chain. Research in the future should manipulate this variable to remove all reinforcement, even during the sixth step of the chain. Next, no maintenance trials were conducted. Thus, it is unclear if the current results would maintain over time and future research should measure this. Similarly, the time spent underneath the table was targeted at 5 min. However, intruder drills typically range from 30 min to 2 hr (NASP, 2021). Future research should allot more time both within sessions to increase the duration of the sixth step and between sessions to test how the skill maintains over time, possibly even over an entire school year.

Given the nature of the experiment, calculated modifications were made to ensure that no added stress was placed on the participants during the study. Rather than having an alarm sound, the experimenter stated the beginning of the drill. Another modification was not using loud sounds, like fake gun shots, to resemble what may occur during an active lockdown. Finally, each participant was taught individually, and the sessions were completed in an empty classroom. While these modifications were necessary, they also did not create an authentic atmosphere. Each participant's skills will need to be further generalized to be independent in a school. Future research should aim to create more realistic trials, while continuing to ensure the participant's well-being.

Despite limitations, the current results are promising for increasing safety skills among the ASD population. Safety skills are essential for all children to learn so that they can minimize risks while navigating their day-to-day life. The current results demonstrate that children with ASD can independently complete an intruder drill and remain quiet and hidden for a short period

of time. Given the increasing number of school shootings these findings seem especially important and warrant further research.

References

Baruni, R, R., & Miltenberger, R, G. (2022). Teaching safety skills to children: A discussion of critical features and practice recommendations. *Behavior Analysis in Practice*, *15*(3), 938-950. https://doi.org/10.1007/s40617-021-00667-4

Brown, F, J., & Gillard D. (2009). Learning road safety skills in the classroom. *British Journal of Learning Disabilities*, *37*(3), 228-231. https://doi.org/10.1111/j.1468-3156.2009.00557.x

Cooper, J, O., Heron, T, E., & Heward, W, L. (2020). *Applied behavior analysis* (3rd ed.). Pearson Education.

DeLeon, I, G., & Iwata, B, A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis*, *29*(4), 519-533. https://doi.org/10.1901/jaba.1996.29-519

Dickson, M, J., & Vargo, K, K. (2017). Training kindergarten student lockdown drill procedures using behavioral skills training. *Journal of Applied Behavior Analysis*, *50*(2), 407-412. https://doi.org/10.1002/jaba.369

Education Commission of the States. (2022, October 5). *50-state comparison: K-12 school safety*. https://www.ecs.org/50-state-comparison-k-12-school-safety-2022/

Garcia, D., Dukes, C., Brady, M. P., Scott, J., & Wilson, C. L. (2016). Using modeling and rehearsal to teach fire safety to children with autism. *Journal of Applied Behavior Analysis*, *49*(3), 699-704. https://doi.org/10.1002/jaba.331

Giannakakos, A, R., Vladescu, J, C., Kisamore, A, N., Reeve, K, F., & Fienup, D, M. (2020). A review of the literature on safety response training. *Journal of Behavioral Education*, *29*, 64-121. https://doi.org/10.1007/s10864-019-09347-4

Himle, M, B., Miltenberger, R, G., Flessner, C., & Gatheridge, B. (2004). Teaching safety skills to children to prevent gun play. *Journal of Applied Behavior Analysis, 37*(1), 1-9. https://doi.org/10.1901/jaba.2004.37-1

Maxfield, T. C., Miltenberger, R, G., & Novotny, M, A. (2019). Evaluating small-scale simulation for training firearm safety skills. *Journal of Applied Behavior Analysis, 52*(2), 491-498. https://doi.org/10.1002/jaba.535

Miltenberger, R, G., & Novotny, M, A. (2022). Teaching safety skills to individuals with developmental disabilities. *Advances in Neurodevelopmental Disorders*, *6*(3), 270-279. https://doi.org/10.1007/s41252-022-00248-8

National Association of School Psychologists. (2013). *Conducting crisis exercises and drills: Guidelines for schools*. https://www.nasponline.org/resources-and-publications/resources-and-podcasts/school-safety-and-crisis/systems-level-prevention/conducting-crisis-exercises-and-drills#:~:text=These%20drills%20involve%20practicing%20a%20single%20specific%20emergency,30%20minutes%20to%202%20hours%20%28Freeman%20%26Taylor%2C%202011%29

Rich, S., & Cox, J. W. (2018, December 26). *What if someone was shooting?* The Washington Post. https://www.washingtonpost.com/graphics/2018/local/school-lockdowns-in-america/?noredirect=on&utm_term=.74090b2560bf

School Safety Solution (2022, May 6). *Practice lockdown drill guide*. https://www.schoolsafetysolution.com/practice-lockdown-drill-guide/#:~:text=The%20steps%20are%20fairly%20straightforward%20and%20designed%20to,the%20shooter%2C%20hopefully%20encouraging%20them%20to%20move%20

onhttps://www.schoolsafetysolution.com/practice-lockdown-drill-guide/#:~:text=The%20steps%20are%20fairly%20straightforward%20and%20designed%20to,the%20shooter%2C%20hopefully%20encouraging%20them%20to%20move%20on

State of New Jersey Department of Education. (n.d.). School *security drill guide*. https://nj.gov/education/security/drill/Guide.pdf#:~:text=DEFINITONS%20School%20Security%20Drill%3A%20An%20exercise%2C%20other%20than,is%20similar%20in%20duration%20to%20a%20fire%20drill.

The National Child Traumatic Stress Network. (2018). *Creating school active shooter/intruder drills*. https://www.nctsn.org/sites/default/files/ resources/fact-sheet/creating_school_active_shooter_intruder_drills.pdf

U.S. Department of Homeland Security. (2022, April 28). *Emergency response plan*. Ready. https://www.ready.gov/business/implementation/emergencyhttps://www.ready.gov/business/implementation/emergency

Table 1

Participant VB-MAPP Scores

Domain	Score	
	CK	BA
Mand	11	7.5
Tact	12.5	9.5
Listener	13.5	11.5
VP/MTS	15	13
Play	12.5	12.5
Social	11	8
Imitation	10	9.5
Echoic	10	9.5
Vocal	5	4
LRFFC	12	13
IV	9	8
Group	12.5	11.5
Linguistic	10	8.5
Reading	15	11
Writing	14.5	N/A
Math	15	N/A

Table 2

Task Analysis for Forward Chain

Step	Description	Additional Notes
Step 1	Participant stands up.	
Step 2	Participant follows the experimenter's gestural cue by walking from the original place of origin in which the instruction was given to designated wall and/or area the cue was directed towards.	The designated area will change based on location
Step 3	Participant gets on their hands and knees.	
Step 4	Participant crawls under the table.	
Step 5	Participant sits under the table.	
Step 6	Participant remains silent under the table until the experimenter dismisses the drill.	Duration will vary but will not exceed 5 min. During this step of the chain the experimenter will give the participant the predetermined bag of stimuli.

Figure 1

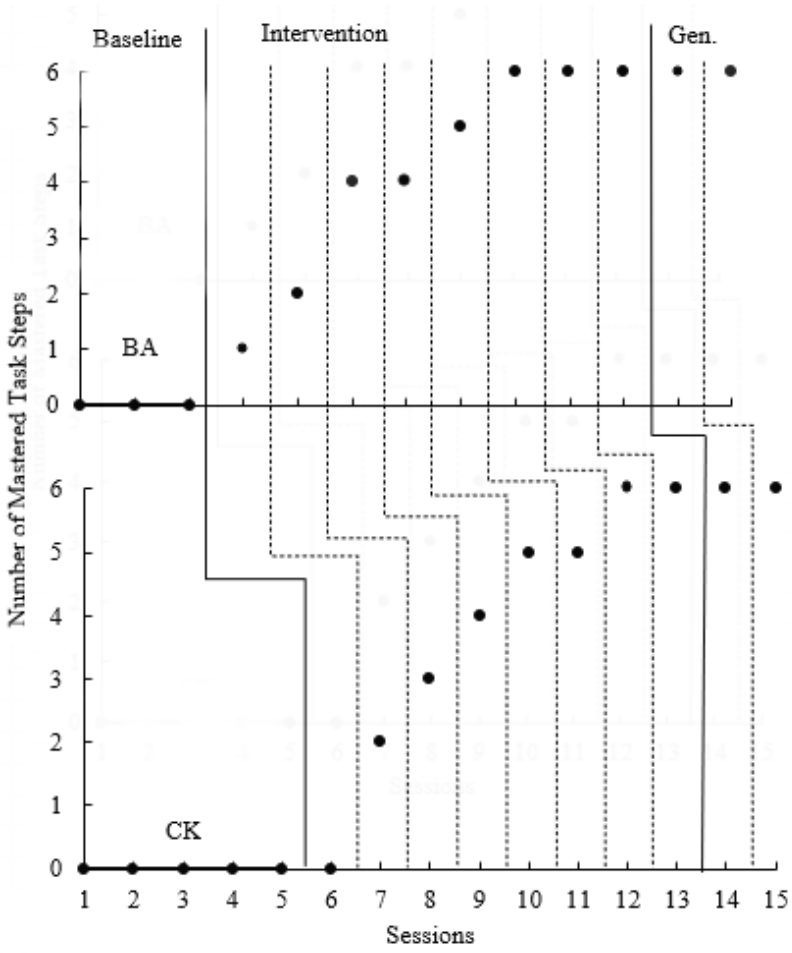
Social Validity Survey

Social Validity Assessment
1= Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree (circle most accurate rating below)

Questions:	Rating:				
Learning safety drills is important for child safety.	1	2	3	4	5
It is important for my child to learn intruder training.	1	2	3	4	5
I had reservations and/or concerns about my child's ability to complete safety drills in a school setting	1	2	3	4	5
Learning intruder training better prepared my child to transition to school.	1	2	3	4	5
Learning intruder training did not put added stress on my child.	1	2	3	4	5
I found the way the experimenter taught the drill acceptable.	1	2	3	4	5

Figure 2

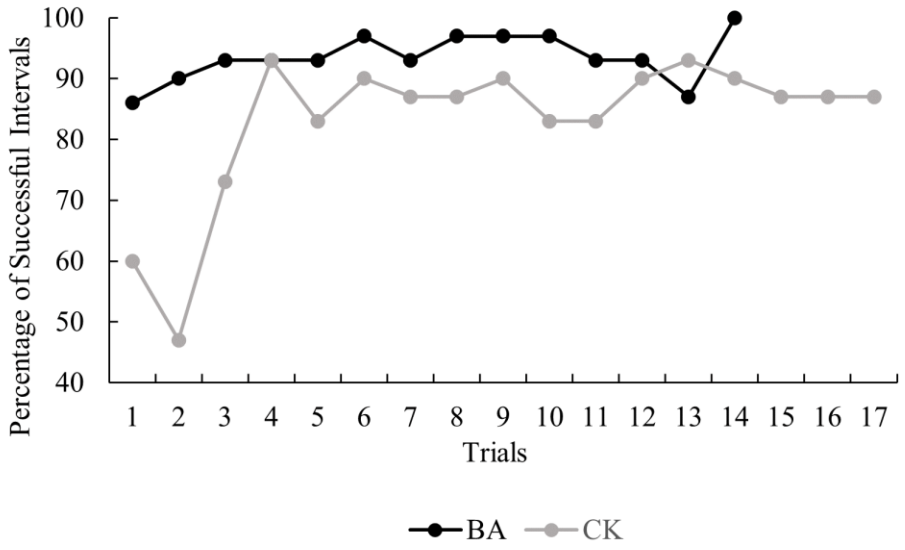
Number of Mastered Steps Across Participants



Note: Gen. = generalization. Solid phase change lines represent the transition between baseline, intervention, and generalization. Dotted lines represent the transition between sessions. Schedule thinning (VR 3) occurred in session 10 for BA and 13 for CK. Reinforcement was removed entirely in session 11 for BA and 14 for CK.

Figure 3

Percentage of Successful Intervals During Step Six Across Participants



Appendix A

Intervention Data Sheet

Participant Initials: **Step Within Chain**

Trials:	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
T1						
T2						
T3						
T4						
T5						
T6						
T7						
T8						
T9						
T10						
T11						
T12						
T13						
T14						
T15						

Prompt Acronyms:
I= Independent
G= Gestural
V= Verbal
M= Modeling
P= Partial Physical
F= Full Physical
NA= Not Attempted

Appendix B

Free Operant Preference Assessment Data Sheet

Participant Initials:		
	Toy Category:	Duration of Engagement:
Toy 1:		
Toy 2:		
Toy 3:		
Toy 4:		
Toy 5:		
Toy 6:		
Toy 7:		
Toy 8:		
Toy 9:		
Toy 10:		

Appendix C

Multiple Stimulus Without Replacement Preference Assessment

Paricipants Initials:

Stimuli Available				
Small Car	Small Dinosaur	Pop It fidget	Liquid Motion Bubbler	Legos

Trials:	**Item Chosen**	**Notes**
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Trial 5		

Appendix D

Sixth Step 10 s Partial Interval Data Sheet

Participant Initials: Session #	Time	Interval Period	Score (+/-)
		1s-10s	
		11s-20s	
		21s-30s	
		31s-40s	
		41s-50s	
	Minute 1	51s-60s	
		1s-10s	
		11s-20s	
		21s-30s	
		31s-40s	
		41s-50s	
	Minute 2	51s-60s	
		1s-10s	
		11s-20s	
		21s-30s	
		31s-40s	
		41s-50s	
	Minute 3	51s-60s	
		1s-10s	
		11s-20s	
		21s-30s	
		31s-40s	
		41s-50s	
	Minute 4	51s-60s	
		1s-10s	
		11s-20s	
		21s-30s	
		31s-40s	
		41s-50s	
	Minute 5	51s-60s	