Teaching Dog Safety Skills to Children via Remote Technology

By

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Abstract

Behavior analysts have been effective in teaching various safety skills (e.g., Dancho et al., 2008; Himle et al., 2004; Miltenberger et al., 2009); however, few studies have evaluated dog safety skills. Over 4.5 million people are bitten by dogs each year and more than half are children (American Humane, 2019). Additionally, children often engage in behaviors that may increase the likelihood of dog bites and injuries (Patronek et al., 2013). Therefore, it is important to develop effective dog safety skills trainings. In Study 1, we conducted a survey to identify the prevalence of dog bites, common behavior of children around known and unknown dogs, and the importance of teaching dog safety skills to children as reported by their caregivers. Results of the survey suggest that children are more likely to sustain bites and injuries from known dogs, engage in behaviors that increase the likelihood of bites and injuries, and caregivers find dog safety skills important. In Study 2, we evaluated the effects of computerized behavioral skills training in teaching three children to engage in safe behavior in the presence of unknown, off-leash dog videos. Computerized behavioral skills training was effective for all three participants, and generalization occurred for two of the three participants to novel videos of unknown, off-leash dog videos.

Keywords: computerized behavioral skills training, dog safety skills training

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Over 4.5 million people are bitten by dogs each year and more than half are children (American Humane, 2019). Of those bitten, 1 in 5 bites will require medical attention (American Veterinary Medical Association, 2019), and at least half of the bites are sustained by children between the ages of 5 and 9, with males at a slightly higher risk for bites than females. Injuries related to dog bites are the third most common cause for a child receiving emergency medical services (Patronek et al., 2013). Additionally, dog attacks were responsible for approximately 208 deaths in a 13-year span for children less than 9 years old (Holmquist & Elixhauser, 2010). Children are likely at a greater risk than adults for dog related injuries due to risky behaviors in which they engage around dogs including running, quick darting movements, yelling, grabbing, hitting, and maintaining eye contact with dogs (Patronek et al., 2013). In addition, children are often in contact with both known and unknown dogs. There are currently 78 million dogs in the United States, 63.4 million of which are in households (American Pet Products Association, 2020). Because children often interact with known dogs in the home and unknown dogs in the community, it is important to teach dog safety skills to reduce the number and severity of dog related injuries. Therefore, it is important to identify effective training procedures to teach dog safety skills (Best Friends Animal Society, 2019).

Behavior analysts have been successful in teaching various safety skills such as personal safety (e.g., Wurtele & Sarno Owens, 1997), firearm safety (e.g., Himle et al., 2004; Miltenberger et al., 2009), fire escape safety (e.g., Bigelow et al., 1993), abduction prevention safety (e.g., Gunby et al., 2010), and poison safety (e.g., Dancho et al., 2008) with various populations (e.g., neurotypical children, children with autism spectrum disorder [ASD],

adolescents with moderate intellectual disabilities). For example, Gunby et al. (2010) taught three children with ASD to say "no," immediately leave the area, and report the event to a familiar adult when presented with safety abduction lures. Similarly, Winterling et al. (1992) taught high school students with moderate intellectual disabilities to safely respond to broken materials (e.g., glass) in which safety responses varied based on the location of broken materials. Although behavior analysts have been successful in teaching these safety skills, there has been little to no research on teaching dog safety skills. Therefore, it is likely that the procedures that have been successful in teaching these other safety skills (e.g., behavioral skills training [BST], in-situ training [IST]), may also be effective in teaching dog safety skills.

BST involves the use of instructions, modeling, rehearsal, and feedback to teach a target skill (e.g., Himle et al., 2004). For example, Ledbetter-Cho et al. (2016) used BST to teach four boys between the ages of 9 and 12 with ASD to engage in abduction prevention skills (i.e., saying no to leaving with a stranger, moving away from the stranger, and notifying a familiar adult) using a concurrent multiple baseline design across participants. During baseline, the experimenter presented four different lures (i.e., simple requests, appeals to authority, assistance request, and incentives). If the participant began to leave with the stranger (i.e., a confederate), the confederate would interrupt the response to prevent any possible reinforcement of leaving with the stranger. During BST, the experimenters conducted individual training by providing an explanation of why strangers are unsafe and what to do when a stranger approaches (i.e., instructions), playing a 30-s video model of an adult engaging in the correct response when approached by a stranger (i.e., modeling), and practicing the skill in locations used during baseline (i.e., rehearsal). The experimenters provided praise for correct responses and corrective feedback for incorrect responses (i.e., feedback). BST sessions lasted 5 to 8 min and continued

until the participant emitted the correct behaviors independently for each lure type. Post-training, generalization, and maintenance were assessed following BST. The results suggest that all participants engaged in unsafe behavior prior to BST; however, BST was effective in teaching abduction-prevention skills for three of the four participants and skills maintained during follow-up sessions for two of the three participants for which maintenance was evaluated. These data suggest that BST is effective in teaching abduction prevention skills to some individuals.

Similarly, Rossi and colleagues (2017) evaluated BST on the effectiveness of teaching safety skills in response to dangerous stimuli (i.e., firearms, liquid poisons, and fire-starting agents) to three, 5- to 6-year-old children with ASD using a nonconcurrent multiple baseline design across participants. During baseline, the experimenter baited the environment such that a dangerous stimulus was present and left the participant alone for up to 2 min. If the participant touched the dangerous stimulus, then the experimenter interrupted the response and removed the dangerous item from the participant. The experimenters implemented BST (i.e., instructions, modeling, rehearsal, and feedback) for each training exemplar until the participant independently engaged in the correct safety responses for two consecutive role plays. Following BST, post-training and maintenance data were collected. The results of the study indicated that BST was effective in teaching all three children to respond to dangerous stimuli. Additionally, responding generalized to untrained stimuli and settings and maintained at 2- and 4-weeks post-training.

Although BST has been demonstrated to be effective in teaching safety skills, there is research to suggest that safety skills do not generalize or maintain after training with BST alone (e.g., Dancho et al., 2008; Himle et al. 2004; Miltenberger et al., 2004, Miltenberger et al.,

2009). A second procedure that is often implemented following BST or in conjunction with BST to enhance generalization and maintenance is IST. When the participant does not perform the safety skill correctly during an in-situ opportunity (e.g., lures or probes), the experimenter will interrupt the participant's responses, deliver feedback, and provide an opportunity to rehearse the skill. The implementation of IST allows exposure to the same conditions and variables that are present within the natural environment such that the stimuli in the natural environment acquire stimulus control rather than training stimuli. For example, Dancho et al. (2008) evaluated the effects of group BST for teaching poison safety skills with 15 preschool children using simulated pill and cleaning supplies as poison. Following training, three participants did not engage in appropriate safety skills and consumed the simulated poison, suggesting group BST was ineffective for those three participants. IST (in the form of feedback) and response interruption were implemented in which the experimenter would immediately deliver feedback contingent on a participant's attempt to open the simulated pills or cleaning supplies and reset the simulated pills or cleaning supplies such that there was no opportunity for the participant to consume the simulated poisons. If the simulated pills or cleaning supplies were not opened, the experimenter delivered descriptive praise. IST and response interruption were effective in teaching poison safety skills to all three participants. Additionally, responding maintained following the removal of praise for all three participants. These data suggest that BST may not be effective for safety skills acquisition for all participants, thus necessitating the addition of more intensive training during in-situ opportunities.

Similarly, Himle et al. (2004) evaluated the effects of BST and simulated IST for teaching firearm safety skills to eight children using a multiple baseline design across participants. The firearm safety skill involved (a) not touching the firearm, (b) leaving the

immediate area of the firearm, and (c) telling an appropriate adult about the presence of the firearm within 10 s of leaving the room. Following baseline, at least two, 30-min BST sessions were conducted. If the participant did not meet performance criteria, up to three booster BST sessions were conducted. Three of the eight participants acquired firearm safety skills following BST. For the five participants who did not acquire firearm safety skills following BST and BST booster sessions, IST was implemented in which the experimenter would enter the room, identify the firearm, and conduct a training session (i.e., modeling, rehearsal, and feedback) contingent on the participant not immediately reporting the firearm. All five participants acquired the firearm safety skills following IST. Additionally, six children with whom generalization was evaluated generalized the firearm safety skills to the home. These data are similar to Dancho et al. (2008) in that some individuals acquire safety skills with BST alone; however, others may require IST.

In addition to in-vivo BST and IST, computer-based trainings have been used to teach safety skills (e.g., Self et al., 2007; Vanselow & Hanley, 2014). In a set of three studies, Vanselow and Hanley (2014) evaluated computerized BST (CBST) to teach children various safety skills (i.e., abduction prevention, poison, and fire safety skills). CBST was implemented using a computer game format in which instructions, modeling, rehearsal, and feedback were embedded within the computer game. During Study 1, CBST was used to teach abduction prevention skills. If participants needed additional training, IST was implemented. Abduction prevention skills were acquired by one participant following CBST, nine participants following CBST and IST, and one participant following CBST and IST with additional consequences (i.e., stickers and games for correct responding). During Study 2, CBST was used to teach poison and fire safety skills. IST was also implemented for fire safety

skills to determine whether responding would generalize to poison safety skills associated with CBST only. Two participants acquired poison and fire safety skills following CBST alone, four participants acquired poison safety skills following a single session of IST for fire safety skills, and five participants acquired poison safety skills following mastery of fire safety skills with IST. Study 3 replicated the procedures of Studies 1 and 2; however, it included all three safety skills. Results were similar in that CBST was effective for one participant and IST was necessary for acquisition of safety skills for the other three participants. Additionally, safety skills did not generalize to abduction prevention skills, necessitating IST for abduction prevention skills. These data suggest that CBST may be effective for acquisition of safety skills for some participants; however, IST was often necessary to promote acquisition and generalization for some safety skills.

Given remote technology advances (e.g., video conferencing software), COVID-19, and restrictions placed on face-to-face research, it may be important to identify effective online training methods for teaching safety skills. Thus, teaching remotely using BST may be an important next step in the safety skills literature. Additionally, given the dearth of dog safety skills literature, it may also be important to identify effective training methods for teaching dog safety skills. Therefore, the purpose of this study was to replicate and extend previous behavior-analytic research on safety skills to children's interactions with off-leash, unknown dogs. First, we conducted a survey to gather information related to (a) the prevalence of dog bites, (b) the behavior in which children engage around known and unknown dogs, and (c) the importance of dog safety skills to caregivers. Second, we evaluated the effects of CBST on teaching "be a tree" in response to short video clips of unknown, off-leash dogs. Given that children often engage in behaviors that increase the likelihood of dog related injuries (e.g., sudden movements,

loud noises, eye contact), “be a tree” was developed to decrease these behaviors around unknown, off-leash dogs. That is, in the presence of an unknown, off-leash dog, a child should stop moving, cross their hands in front of them, look at their feet, and wait until the dog leaves or help arrives (e.g., Best Friends Animal Society, 2019; Orr, 2012). Finally, we evaluated generalization of CBST to novel videos of unknown, off-leash dogs.

Study 1 – Survey of Prevalence

The purpose of Study 1 was to identify the prevalence of dog bites, common behavior of children around both known and unknown dogs, and the importance of teaching dog safety skills to children as identified by caregivers of children with and without intellectual and developmental disabilities (IDD).

Method

Participants

Caregivers and legal guardians with a child, 0 to 18 years old, participated in Study 1. Participants accessed the survey via a link in an advertisement posted to Facebook (Appendix A). We received 281 responses. Of those responses, 130 were incomplete, 31 for children older than 18, four for siblings (i.e., eight separate children within four responses), and 116 were completed in entirety for children 0-18 years old. Therefore, we included the 116 responses for individual children 0-18 years old, as well as the eight responses completed for siblings in data analysis such that 124 responses were analyzed.

Survey Instrument and Procedure

We developed a survey in Qualtrics to identify the prevalence of dog bites, common behavior of children around known and unknown dogs, and the importance of teaching dog safety skills to children with and without IDD as reported by caregivers (Appendix A). The

survey included 22 questions on (a) demographics (e.g., age, diagnoses, pets within the home), (b) bite and injury incidents, (c) child responses to unknown dogs in the community, (d) child responses to known dogs, (e) importance of dog safety skills training, (f) whether the caregiver would be interested in receiving materials related to dog safety skills, and (g) whether the caregiver would be interested in having their child participate in an online study related to dog safety skills. There were two additional questions if a respondent indicated that their child had been bitten or injured by a dog previously which addressed the (a) frequency of dog bites or injuries and (b) circumstances under which the bite or injury occurred.

The survey was posted to Facebook on June 8, 2020. The survey was opened on June 8, 2020 and closed on July 5, 2020. The last response we received was on July 3, 2020. The survey was open for 27 days.

Results

Table 1 depicts the demographics of children. Of the 124 children, 61 were female (49.2%), and 63 were male (50.8%). Sixty-six children were 0-4 years old (53.2%), 35 were 5-9 years old (28.2%), 15 were 10-14 years old (12.1%), and eight were 15-18 years old (6.5%). Seven caregivers reported their child had an IDD (e.g., ASD, Fragile X Syndrome; 5.6%), and 117 reported no disability (94.4%). Of the 124 children, 110 had a pet (e.g., dogs, cats, rats, fish) in the home (88.7%), 100 had at least one dog in the home (80.6%), and 14 had no pets in the home (11.3%). When assessing the frequency in which children encountered dogs in the community, 14 caregivers indicated rarely (11.3%), 36 indicated sometimes (29.0%), 58 indicated frequently (46.8%), and 16 indicated always (12.9%). Five children (4.0%) had previously participated in dog safety training including education through a volunteer shelter in

which a caregiver reported training their child on the same procedures on which volunteers are trained, and 119 children had not (96.0%). No formal dog safety skills trainings were reported.

Table 2 depicts the data on known and unknown dog bites and injuries by gender, age, and disability. Overall, 13 children were reported to have been bitten by a dog (10.5%). Of the bites sustained, 92.3% were by known dogs and 7.7% were by unknown dogs. Eight females were reported to be bitten by a dog (13.1%). Of the bites sustained, 87.5% were by known dogs and 12.5% were by unknown dogs. Five males were reported to be bitten by a dog (7.9%). Of the bites sustained, 100% were by known dogs. Five children between the ages of 0 to 4 were reported to be bitten by a dog (7.6%). Of the bites sustained, 100% were by known dogs. Three children between the ages of 5 to 9 were reported to be bitten by a dog (8.6%). Of the bites sustained, 100% were by known dogs. Three children between the ages of 10 and 14 were reported to be bitten by a dog (20.0%). Of the bites sustained, 66.7% were by known dogs and 33.3% were by unknown dogs. Two children between the ages of 15 and 18 were reported to be bitten by a dog (25%). Of the bites sustained, 100% were by known dogs. Two children with IDD were reported to be bitten by a dog (28.6%). Of the bites sustained, 100% were by known dogs. Twelve children with no reported disability were reported to be bitten by a dog (10.3%). Of the bites sustained, 91.7% were by known dogs and 8.3% by unknown dogs.

Overall, 48 children were reported to have been injured by a dog (38.7%). Of the injuries sustained, 87.5% were by known dogs, 4.2% were by unknown dogs, and 8.3% were from both. Twenty-one females were reported to be injured by a dog (34.4%). Of the injuries sustained, 80.9% were by known dogs, 4.8% were by unknown dogs, and 14.3% were from both. Twenty-seven males were reported to be injured by a dog (42.9%). Of the injuries sustained, 92.6% were by known dogs, 3.7% were by unknown dogs, and 3.7% were

by both. Twenty children between the ages of 0 to 4 were reported to be injured by a dog (30.3%). Of the injuries sustained, 90% were by known dogs, 5% were by unknown dogs, and 5% were by both. Twenty-two children between the ages of 5 to 9 were reported to be injured by a dog (62.9%). Of the injuries sustained, 90.9% were by known dogs and 9.1% were by both known and unknown dogs. Four children between the ages of 10 to 14 were reported to be injured by a dog (26.7%). Of the injuries sustained, 50% were by known dogs, 25% were by unknown dogs, and 25% were by both. Two children between the ages of 15 to 18 were reported to be injured by a dog (25%). Of the injuries sustained, 100% were by known dogs. Three children with IDD were reported to be injured by a dog (42.9%). Of the injuries sustained, 66.7% were by known dogs and 33.3% were by both known and unknown dogs. Forty-five children with no reported disability were reported to be injured by a dog (38.5%). Of the injuries sustained, 88.9% were by known dogs, 4.4% were by unknown dogs, and 6.7% were by both known and unknown dogs.

Table 3 depicts the behaviors in which children are most likely to engage around known dogs by age. Regardless of age, more than half of the children pet known dogs on the head (79.8%), put their face near known dogs' faces (62.9%), and approach known dogs from any direction (59.7%). Children between the ages of 0 and 4 were reported to also make loud noises (51.5%), run towards known dogs (40.9%), engage with known dogs when they are chewing on a toy or stick (39.4%), engage with known dogs when they are sleeping (33.3%), take items from known dogs (31.8%), place hands in or near known dogs' mouths (30.3%), pull the known dogs' ears, tails, or leashes (24.2%), engage with known dogs when they are eating (16.7%), run away from known dogs (15.2%), yell at known dogs (13.6%), tease known dogs (7.6%), scare known dogs (6.0%), and attempt to hurt known dogs (3.0%). Caregivers also reported their child

engaged in giving dogs treats, holding out their hand to allow dog to smell their hand, trying to get the dog to chase them, sitting on the dog, and chasing the dog. Children between the ages of 5 and 9 were reported to also take items from known dogs (52.3%), make loud noises (51.4%), engage with known dogs when they are chewing on a toy or stick (51.4%), engage with known dogs when they are sleeping (48.6%), put their hands in or near known dogs' mouths (37.1%), engage with known dogs when they are eating (31.4%), pulls on known dogs' ears, tails, or leashes (25.7%), run away from known dogs (22.9%), yell at known dogs (22.9%), tease known dogs (20.0%), scare known dogs (11.4%), and attempt to hurt known dogs (5.7%). Caregivers also reported their child engaged in sitting on known dogs and treating known dogs like their doll. Children between the ages of 10 and 14 were also reported to make loud noises (30%), run towards known dogs (20%), engage with known dogs when they are chewing on a toy or stick (20%), put their hands in or near known dogs' mouths (6.7%), engage with known dogs when they are sleeping (6.7%), engage with known dogs while they are eating (6.7%), run away from known dogs (6.7%), and take items away from known dogs (6.7%). Caregivers also reported their child engaged in hugging the dog or not interacting with the dog. Children between the ages of 15 and 18 were reported to also run towards the dog (50.0%), engage with a known dog when they are chewing on a toy or stick (50.0%), take items away from known dogs (37.5%), put their hands in or near known dogs' mouths (37.5%), make loud noises (25%), engage with known dogs while they are sleeping (25%), engage with known dogs while they are eating (25%), tease known dogs (25%), and pull on known dogs' ears, tails, or leashes (12.5%). Caregivers also reported their child engaged in walking slowly up to owner and dog, asking the owner if they can pet the dog, and petting the dog on the back.

Table 3 also depicts the behaviors in which children are most likely to engage around unknown dogs by age. Children between the ages of 0 and 4 were reported to pet unknown dogs on the head (27.3%), make loud noises (18.2%), approach unknown dogs from any direction (15.2%), run towards unknown dogs (13.6%), run away from unknown dogs (12.1%), put their face near known dogs' faces (7.6%), pul on unknown dogs' ears, tails, or leashes (1.5%), engage with unknown dogs while they are sleeping (1.5%), engage with unknown dogs while they are chewing on a toy or stick (1.5%), yell at unknown dogs (1.5%), and take items away from unknown dogs (1.5%). Caregivers also reported their child engaged in giving light body pets to unknown dogs, yelling hello, asking permission to pet unknown dogs, staying with parent, asking to be picked up if unknown dog approaches too quickly, crying, putting out hand for unknown dog to smell and then petting the unknown dog, reaching for unknown dog, and waving at unknown dogs. Nine caregivers noted they prevented their child from interacting with unknown dogs. Children between the ages of 5 and 9 were reported to pet unknown dogs on the head (51.4%), put their face near unknown dogs' faces (31.4%), approach unknown dogs from any direction (31.4%), run away from unknown dogs (30%), run towards unknown dogs (17.1%), engage with unknown dogs while they are chewing on toys or sticks (11.4%), make loud noises (8.6%), put hands in or near unknown dogs' mouths (8.6%), yell at unknown dogs (5.7%), take items away from unknown dogs (5.7%), engage with unknown dogs while they are eating (2.9%), engage with unknown dogs when they are sleeping (2.9%), and scare unknown dogs (2.9%). Caregivers also reported their child engaged in asking the owner of their parents for permission to pet the unknown dog and then approaching and petting the unknown dog, letting the dog sniff their hand before touching, observing unknown dogs from a distance, and petting the unknown dog on the body. One caregiver noted their child was unable to discriminate

important dog behaviors such as when the dog does not want to interact. Children between the ages of 10 and 14 were reported to pet unknown dogs on the head (26.7%), run away from unknown dogs (13.3%), approach unknown dogs from any direction (13.3%), run towards unknown dogs (6.7%), make loud noises (6.7%), put their hands in or near unknown dogs' mouths (6.7%), and put their face near unknown dogs' faces (6.7%). Caregivers also reported their child engaged in ignoring or disengaging with unknown dogs and asking permission prior to petting an unknown dog. Children between the ages of 15 and 18 were reported to pet unknown dogs on the head (25%) and approach unknown dogs from any direction (12.5%). Caregivers also reported their child asking permission prior to approaching an unknown dog, speaking with unknown dogs, and walking away slowly from unknown dog if no owner was present.

Table 4 depicts the behaviors in which children with and without IDD are most likely to engage around known dogs. Regardless of reported disability, more than half of the children pet known dogs on the head (79.8%), puts face near known dogs' faces (71.4%), and approach known dogs from any direction (59.7%). Children with IDD were also reported to make loud noises (71.4%), run towards known dogs (57.1%), engage with known dogs while sleeping (42.9%), pull on known dogs' ears, tails, or leashes (42.9%), engage with known dogs while they are chewing toys or sticks (42.9%), tease known dogs (28.6%), run away from known dogs (28.6%), taking items away from known dogs (28.6%), engage with known dogs while they are eating (28.6%), place hands in or near dogs' mouths (28.6%), yell at known dogs (14.3%), scare known dogs (14.3%), and attempt to hurt known dogs (14.3%). Caregivers also reported their child sitting on the dog. Children with no reported disabilities were reported to make loud noises (44.4%), engage with known dogs while they are chewing on toys or sticks (41.0%), run towards

known dogs (38.5%), take items away from known dogs (35.9%), engage with known dogs while they are sleeping (33.3%), put hands in or near known dogs' mouths (29.9%), engage with known dogs while they are eating (19.7%), pull on known dogs' ears, tails, or leashes (19.7%), run away from known dogs (14.5%), yell at known dogs (13.7%), tease known dogs (10.3%), scare known dogs (6%), and attempt to hurt known dogs (2.6%). Caregivers also reported their child giving dogs treats, holding out their hand to allow dog to smell their hand, trying to get the dog to chase them, chasing the dog, approaching the dog so they can see the child, petting the dog on the back, staying away from the known dog, allowing the dog to lick them, bringing the dog their toys, and sitting where the dog is laying down.

Table 4 also depicts the behaviors in which children with and without IDD are most likely to engage around unknown dogs. Children with IDD were reported to run towards unknown dogs (57.1%), approach unknown dogs from any direction (57.1.%), pet unknown dogs on the head (57.1%), make loud noises (42.9%), run away from unknown dogs (28.6%), engage with unknown dogs while eating (14.3%), scare unknown dogs (14.3%), put their face near unknown dogs' faces (14.3%), and take items away from unknown dogs (14.3%). Caregivers also reported their child asking permission before petting the unknown dog. Children with no reported disability were reported to pet unknown dogs on the head (32.5%), approach unknown dogs from any direction (17.1%), run away from unknown dogs (12.8%), make loud noises (11.1%), run towards unknown dogs (10.3%), put their face near unknown dogs' faces (8.5%), engage with unknown dogs while they are chewing on toys or sticks (4.3%), put their hands in or near unknown dogs' mouths (3.4%), yell at unknown dogs (2.6%), take items away from unknown dogs (1.7%), engage with unknown dogs while they are sleeping (1.7%), and pull on unknown dogs' ears, tails, or leashes (0.9%). Caregivers also reported behavior for children

without disabilities around unknown dogs to engage in asking permission, petting the dogs body, allows the dog to lick and smell if adult who knows the dog is present, ignores the dog, kneels while looking away and offers hand, allows to sniff hand before touching, cries, if unknown dog gets too close child will asked to be picked up, and does not pick up on queues when dog is trying to avoid child's attention.

Table 5 depicts the importance of dog safety skills as reported by caregivers. Of the 124 caregivers, 47.6% reported they were not worried, 43.5% reported they were somewhat worried, 5.6% reported they were worried, and 3.2% reported they were very worried about their child being bitten by a dog. Similarly, 46.8% reported they were not worried, 41.1% reported they were somewhat worried, 5.6% reported they were worried, 1.6% reported they were very worried about their child being injured by a dog. Six caregivers (4.8%) did not respond to this question. Finally, 0.8% of caregivers rated dog safety skills training as not important, 7.3% as somewhat important, 28.2% as important, and 63.7% as very important.

Discussion

The purpose of Study 1 was to identify the prevalence of dog bites, common behavior of children around both known and unknown dogs, and the importance of teaching dog safety skills to children as identified by caregivers of children with and without IDD. Regardless of gender, age, or disability, our data support that children are more likely to sustain bites and injuries from known dogs rather than unknown dogs and engage in behaviors that increase the likelihood of bites (e.g., approaching dogs, making loud noises, running away). Additionally, caregivers are not worried about dog bites or injuries, but they find dog safety skills training important.

In general, our data suggest that dog bites were more likely to occur with known dogs across all demographics regardless of gender, age, or diagnosis, which aligns with previous numbers reported regarding dog bites (e.g., Holmquist & Elixhauser, 2010; Patronek et al., 2013). Although males were previously reported to be at greater risk than females (Patronek et al., 2013), our data support that females are just as likely as males to be bitten by dogs. In addition, previous statistics have suggested that children 5 to 9 years old are at the greatest risk for dog bites noting that lack of supervision may attribute to unsafe behaviors such as hugging or kissing the dog or engaging with a dog when they are eating or sleeping (Patronek et al., 2013; For Kids' Sake, 2020). Our data suggest that all children, regardless of age were at a similar, if not greater, risk of being bitten by a dog. However, these data should be interpreted with caution. First, the size of our sample for 10- to 18-year-old children may not be sufficient to compare to 0- to 9-year-old children. Second, several bites reported for older children occurred when they were younger. For example, one 16-year-old male was bitten on the face by a known dog resulting in an emergency room visit; however, the bite occurred when he was 9 years old. Similarly, an 18-year-old female was bitten by a household pet when she was 18 months old. Therefore, it is possible that the way in which we analyzed our data do not accurately represent bite risks of age groups. Third, statistics reported on dog bites are often obtained from medical records, which may mask the frequency at which bites are occurring that do not require medical attention (e.g., American Humane, 2019; American Veterinary Medical Association, 2019; Holmquist & Elixhauser, 2010; Patronek et al., 2013). Because of this, our definition of a dog bite was if the skin was broken due to contact with a dog's mouth, which may have influenced the results we obtained from our survey and increased the number of bites reported across demographics as some bites may not have necessitated medical attention. Finally, our dog bite

data also suggest that children with IDD sustained more bites than children with no reported diagnosis; however, these data should also be interpreted with caution as the majority of children (94.4%) had no reported diagnosis. Therefore, it will be important to gather more data for children with IDD to make better comparisons between children with and without IDD.

In addition to bites, we also evaluated the prevalence of dog related injuries from known and unknown dogs, as the bulk of previously reported statistics only report on bites and deaths (e.g., American Humane, 2019; American Veterinary Medical Association, 2019; Holmquist & Elixhauser, 2010; Patronek et al., 2013), preventing determination of dog related injuries. The majority of dog related injuries were sustained by known dogs across all demographics regardless of gender, age, or diagnosis. Several children were reported to be injured by unknown dogs, as well as both known and unknown dogs, suggesting that injuries may be more likely than bites to be sustained by unknown dogs. There was a similar percentage of dog injuries between males and females, ages, and reported disabilities. However, these data should also be interpreted with caution given the limited number of responses for older children and children with IDD.

Caregivers reported that children often engaged in behaviors that may increase the likelihood of dog related injuries such as approaching dogs, placing their face near the dog's face, making loud noises, running towards dogs, and engaging with dogs while they eat, sleep, or chew on items. These behaviors parallel those reported by Orr (2012) and may increase the likelihood of dog bites and injuries. Based on the data obtained it appears that there are some differences in child behavior between known and unknown dogs, as well as older and younger children that may affect the likelihood of dog bites and injuries. Although children engaged in similar behaviors around known and unknown dogs, children were much less likely to approach unknown dogs and interact with them in the same way in which they would interact with a

known dog. For example, 62.9% and 8.9% of children were reported to place their face near known and unknown dogs' faces, respectively. Similarly, 20.2% and .1% of children were reported to engage with known and unknown dogs when they were eating, respectively. These data suggest that less children engage in behaviors around unknown dogs that would increase their likelihood of bites or injuries, which may be the reason why children are less likely to be bitten or injured by unknown dogs. Similar differences between younger children (0 to 9 years old) and older children (10 to 18 years old) were observed. That is, younger children were reported to engage in more behaviors that may increase their risk of bites and injuries (e.g., running away from dogs, pulling dogs' tails, ears, or leashes) than older children. In addition, several caregivers reported that their child would ask permission prior to petting an unknown dog. It may be important to teach children to ask permission; however, it may be equally important to teach children whether to approach an unknown dog given the dog's behavior. That is, although permission is given to interact with a dog, the dog may engage in behaviors that signal they do not want to interact. Child responding should be based on behaviors from the dog rather than behaviors from adults to decrease the likelihood of bites and injuries. Therefore, teaching discrimination of dog behavior and appropriate interactions with dogs in the presence of an owner would be important to examine in future research.

Finally, five respondents indicated that their child had received some form of dog safety training. Two caregivers reported dog obedience training, one reported they were a volunteer at an animal shelter and taught their child the skills they learned, one reported a family member with experience in military dog training trained dog safety skills to their family, and one reported that they teach their children to be respectful to dogs and never approach new dogs. However, no formal dog safety training was reported that specifically targeted children and dog safety skills.

Interestingly, many caregivers were not worried about their child being bitten or injured by a dog; however, they felt that learning dog safety skills was important. These combined findings suggest that caregivers value dog safety skills. In addition to caregiver importance and the lack of formal dog safety skills training reported, there is a clear need for dog safety skills based on children's reported behavior around known and unknown dogs. Therefore, it may be important to develop effective training procedures for teaching dog safety skills to reduce the likelihood of bites or injuries.

Study 2 – CBST

The purpose of Study 2 was to teach participants to engage in safe behavior (i.e., "be a tree") when presented with videos of unknown, off-leash dogs using CBST.

Method

Participants

We recruited three participants for this study through the survey conducted in Study 1. We reviewed survey responses and identified 19 caregivers who had a 5- to 9-year-old child and indicated their child (a) was interested in dogs (e.g., talking about dogs, running up to dogs in the community, petting known and unknown dogs), (b) had a history of inappropriate interactions with unknown dogs (e.g., running at unknown dogs, approaching an unknown dog from behind, hopping on an unknown), and (c) indicated they were interested in having their child participate in a dog safety skills study. The first author reached out to caregivers to further determine whether they would be interested in having their child participate in a study on dog safety skills. If the caregiver indicated interest, then the first author conducted a pre-interview (Appendix B) with the caregiver to identify whether their child could (a) follow multi-step instructions, (b) emit two- to three-word phrases through vocal-verbal behavior, PECS, or an

AAC device, (c) answer WH- questions, and (d) identify common safe and unsafe situations (e.g., fire, poisons, strangers, and crossing the street). Following the pre-assessment, the first author conducted a safety pre-assessment with the child in which pictures of five safe (e.g., riding a bike with a helmet, wearing a seatbelt, and walking across the street with an adult) and five unsafe situations (e.g., firearms, fire, child playing with knives, kid riding a bike without a helmet, and car accident) were presented (Appendix C). Children who did not meet the inclusion criteria, engaged in frequent problem behavior (e.g., aggression, self-injurious behavior, elopement), or those with a dog phobia were excluded from the study.

Based on the inclusion and exclusion criteria, we identified three participants, one male and two females, to participate in Study 1. The participants ranged in age from 6 to 7 years with no reported disabilities. Ethan was a 6-year-old male whose caregiver reported he was interested in dogs and engaged in unsafe behaviors around unknown dogs (e.g., approaching unknown dogs and putting his face in the dog's face). Ethan followed multi-step instructions, emitted two- to three-word phrases using vocal-verbal behavior, answered WH- questions, and received a 100% on the safe and unsafe assessment. Ethan's caregiver reported low levels of noncompliance associated with occupational therapy.

Natalia was a 7-year-old female whose caregiver reported she was interested in dogs and engaged in unsafe behaviors around unknown dogs (e.g., running away from unknown dogs). Her caregiver noted that Natalia did not know what to do around unknown dogs. Natalia followed multi-step instructions, emitted two- to three-word phrases using vocal-verbal behavior, answered WH- questions, and received a 100% on the safe and unsafe assessment. Natalia's caregiver reported no problem behavior.

Rachel was a 6-year-old female whose caregiver reported she was interested in dogs and engaged in unsafe behaviors around unknown dogs (e.g., attempting to pet unknown dogs). Her caregiver reported they were unsure what she would do around an unknown dog if they were not in close proximity. Rachel followed multi-step instructions, emitted two- to three-word phrases using vocal-verbal behavior, answered WH- questions, and received a 100% on the safe and unsafe assessment. Rachel's caregiver reported low levels of noncompliance associated with "not getting her way."

Setting and Materials

All sessions were conducted virtually using Zoom. A unique password was required for participants and the experimenter to access all sessions. Both the experimenter and participant were seated at computers in their respective homes with minimal distractions. All sessions were recorded and saved to a Health Insurance Portability and Accountability Act (HIPAA)-compliant network. Due to the nature of remote sessions, all participants needed a personal computer or other form of technology with embedded webcam and microphone capabilities (e.g., iPad, iPhone, tablet), as well as the ability to connect to internet. During each session, the experimenter used PowerPoint to conduct sessions. Depending on the session, the PowerPoint contained one to three, 10- to 30-s video clips of an unknown, off-leash. A total of nine videos were presented to the participant. Three videos were presented to the participant during baseline and following CBST, three during CBST, and three during generalization. Dog behavior varied across videos such as running towards the camera and barking at other individuals in the videos. Settings and seasons (e.g., winter) also varied. Following each session, the experimenter provided the participant with 5 min of preferred online activities (identified via parent interview, see below).

Response Measurement and Interobserver Agreement

Trained data collectors collected data using paper and pencil. During each probe, data collectors scored a correct or incorrect response for four different participant behaviors. Data collectors also recorded problem behavior and crying. *Participant stops* was defined as the participant ceasing movement and audible communication within 5 s of video presentation. That is, the participant stood still by not moving more than 1 inch and did not engage in any audible communication. *Folds hands* was defined as the participant interlocking hands or fingers at their front midline. *Looks at feet* was defined as the participant orienting their head to a neutral downward position towards feet in which their chin touched or was near one's chest. *Stands still until help arrives or dog leaves* was defined as the participant not moving more than 1 inch and not engaging in any audible communication following the initial stop until the experimenter stated, “Dog is gone!” or “Help has arrived!” Following each probe, we calculated percent correct by dividing the correct behaviors by the number of correct and incorrect behaviors and multiplying by 100.

A second, independent data collector collected reliability data for at least 30% of probes across all participants. We calculated IOA for a probe by dividing the number of behaviors with agreements by the total number correct and incorrect behaviors and multiplying by 100. An agreement was scored when both data collectors recorded the same behavior as correct or incorrect. For example, if both data collectors recorded participant stops as correct, folds hands as incorrect, and looks at feet as correct but one data collector recorded correct while the other recorded incorrect for stands still until help arrives or dog leaves, three agreements would be scored such that an IOA percentage of 75% was obtained on the probe. IOA was calculated for 63.6% of probes for Ethan, 33.3% of probes for Natalia, and 40% of probes for Rachel. For

Ethan, mean agreement was 100%. For Natalia, mean agreement was 100%. For Rachel, mean agreement was 95.8% (range, 75%-100%).

Procedure

Identification of Preferred Items

Prior to the start of all sessions, the experimenter conducted a modified Reinforcement Assessment for Individuals with Severe Disabilities (RAISD; Fisher et al., 1996) with the caregivers. We modified the RAISD (Appendix D) to capture items that could be presented in an online format (e.g., videos, games, and music videos). Specifically, we modified questions 1, 2, 8, 9, and 10 to include items or activities that could be delivered in an online format. For example, question 1 was modified to "Some individuals really enjoy watching TV shows, YouTube videos, music videos, movies, etc. What are the things you think _____ likes to watch on the computer?" Items identified by parents were offered to the participant at the end of the session for 5 min.

Ethan's caregiver identified Scooby Doo, Star Wars Kids™, PBS® online games, Myth Busters Jr., reckless racers, YouTube©, NASA kids club, and online dirt bike games. Natalia's caregiver identified YouTube© videos (e.g., cheer squad, Frozen®, JoJo Siwa), tic-tac-toe, switch zoo, and PBS® online games. Rachel's caregiver identified online sketch pad, YouTube© (e.g., Disney ® songs and movie clips, Jessie, Disney), and live feeds of animal exhibits at the zoo.

General Procedures

Probes were conducted prior to and following CBST to evaluate the effects of CBST on teaching dog safety skills and generalization of those skills to novel unknown, off-leash dog videos. During each probe, one video of an unknown, off-leash dog was presented. The

experimenter started a probe by stating, “Show me what you would do if you saw this dog” and then presented the video of an unknown, off-leash dog. Following a variable amount of time (i.e., between 5 and 10 s), the experimenter stated, “The dog has left” or “Help has arrived.” Throughout all probes, the experimenter delivered praise following probes in which the participant performed “be a tree” (i.e., stopping, folding hands, looking at feet, and waiting until dog leaves or help arrives) correctly. The experimenter delivered differential consequences for incorrect, prompted, and no responses depending on the condition. At the end of each session, the experimenter allowed 5-min access to high-preferred items identified via the modified RAISD.

Baseline. During baseline probes, the experimenter delivered praise for “be a tree.” For incorrect or no responses, the experimenter delivered no programmed consequences.

CBST. The experimenter conducted two CBST sessions to teach dog safety skills when a participant was approached by an unknown, off-leash dog. That is, the experimenter trained participants to “be a tree” (Orr, 2012) in which the participants stopped, folded hands, looked at feet, and stood still until help arrived or the dog left in response to videos of unknown, off-leash dogs. First, the experimenter delivered instructions on what to do if the participant encountered an unknown, off-leash dog (i.e., “be a tree”) by describing scenarios and behaviors that should occur when the participant sees an unknown, off-leash dog. Second, the experimenter played a video model of the correct behavior sequence of “be a tree” in response to an unknown, off-leash dog. Third, the experimenter played novel videos of unknown, off-leash dogs and allowed the participant to rehearse the skills. Following each rehearsal, the experimenter delivered descriptive praise for correct responses and corrective feedback for incorrect responses. For example, if the participant stopped, folded their hands, and looked at their feet but forgot to wait

until help arrived or the dog left, the experimenter then used descriptive praise for the correct behavior, (e.g., “Great job standing still and folding your hands and looking down! That was perfect.”) and corrective feedback for not waiting until help arrived or the dog left (e.g., “Remember you need to wait until help has arrived or the dog has left to move. Let’s try again.”). Rehearsal continued until the participant performed the skill correctly on three consecutive probes in the absence of feedback.

Generalization Probes. Following mastery of “be a tree,” we conducted generalization probes. Generalization probes were similar to baseline; however, three novel videos depicting unknown, off-leash dogs were used.

Social Validity

We developed two social validity questionnaires based on the recommendations outlined by Fawcett (1991). Caregivers and participants completed separate questionnaires following the conclusion of the study to assess acceptability of the training methods. The caregiver social validity questionnaire contained items addressing (a) the acceptability of the safety skills training, (b) the length of time of the study, and (c) observed behavioral changes around known and unknown dogs (Appendix E). The participant social validity questionnaire contained items addressing (a) the acceptability of the training methods, and (b) strategies employed to wait for the dog to leave or help to arrive (Appendix F).

Results

The results from Study 2 are depicted in Figure 1. Probes are scaled to the x-ais, and percentage correct is scaled to the y-axis. Ethan’s data are depicted in the top panel, Natalia’s in the middle panel, and Rachel’s in the bottom panel. Closed circles denote baseline and post-CBST probes. Open circles denote generalization probes. During baseline, Ethan engaged in 0%

correct responding across three probes. Following CBST, Ethan engaged in variable levels of correct responding during the first two probes and then engaged in 100% correct responding during the next three probes, meeting mastery criteria. High levels of correct responding maintained during generalization probes. During baseline, Natalia engaged in low to zero levels of correct responding across six probes. Following CBST, Natalia immediately engaged in 100% correct responding across three consecutive probes, meeting mastery criteria. Natalia continued to engage in 100% correct responding across all three generalization probes. During baseline, Rachel engaged in 0% correct responding across nine generalization probes. Following CBST, Rachel immediately engaged in 100% correct responding across three consecutive probes, meeting mastery criteria. Rachel engaged in 100% correct responding during the first generalization probe; however, a decreasing trend was observed during the two subsequent generalization probes to 0% correct responding on the third generalization probe.

The results of the caregiver social validity questionnaire are depicted in Table 6. For items related to acceptability of the safety skills training, all three caregivers reported they would have their child complete the dog safety skills training again (100%), recommend the dog safety skills training to others (100%), and were satisfied with the results (100%). One caregiver reported the training could be enhanced with an in-vivo training component. Three caregivers noted they liked that the training was interactive and used videos of dogs. Additionally, all three caregivers noted the pace of the training was moderate (100%). Two of three caregivers reported they would be interested (66.7%) and one reported they might be interested (33.3%) in additional training and learning additional dog safety skills. Finally, two of three caregivers reported behavioral changes in their child following our training (66.7%) and one reported no behavioral changes (33.3%). Ethan's caregiver reported that their new puppy was nipping Ethan at which

point he “became a tree” and the dog stopped nipping him and walked away. Rachel’s caregiver reported she was more reserved and careful around dogs but did not specify if they were known or unknown and did not elaborate about any specific instances.

The results of the participant social validity questionnaire are depicted in Table 7. The questionnaire was conducted with Ethan and Natalia. While waiting for the dog to leave or help to arrive, Ethan reported he would sing in his head (e.g., Star Wars theme song) and then wait as time progressed. Natalia reported she would count in her head. Both participants reported they enjoyed the study a lot. Ethan reported the study training method should include different dog videos rather than repeat videos and he would like more breaks. Natalia reported no changes needed to be made to the study. When asked how they felt towards dogs following the training, Ethan reported he felt good and still liked to play with them, whereas Natalia reported she still wanted to play but wanted to be careful. Both participants reported they liked the online format of the training but did not note any reasons. When asked to rank the training methods of CBST, Ethan reported the most effective training method was the video model followed by rehearsal, feedback, and instructions. Natalia reported the most effective training method was rehearsal followed by the video model, feedback, and instructions.

Discussion

The purpose of Study 2 was to evaluate the effectiveness of remote CBST on teaching “be a tree” in response to videos of unknown, off-leash dogs. Similar to other safety skills studies that demonstrated children can acquire safety skills with BST (e.g., Dancho et al., 2008; Gunby et al, 2010; Rossi et al., 2017), the results of our study suggest that participants were able to acquire dog safety skills in the presence of videos of unknown, off-leash dogs using CBST. That is, all three participants acquired the “be a tree” response in that they stopped, crossed their arms,

looked down at feet, and waited until the dog left or help arrived. Additionally, “be a tree” generalized to novel videos of unknown, off-leash dogs for two of three participants. Our results suggest that remote, CBST may be effective in teaching dog safety skills to children between the ages of 5 and 9.

CBST was effective for all three participants. That is, following two CBST sessions, all three participants acquired the skills. Natalia and Rachel immediately met mastery criteria following three probes, and Ethan met mastery following five probes. These findings suggest that CBST was effective in increasing dog safety skills. It is likely that CBST is effective due to the combination of instructions, modeling, rehearsal, and feedback. The implementation of instructions allows participants to identify the target behavior that will be reinforced. Modeling allows the participant to observe accurate implementation of the target behavior. Rehearsal and feedback allow the participant to practice the target skills and contact feedback in the form of praise or corrective feedback. Likely, praise functions as a reinforcer and corrective feedback may function as a punisher, thereby increasing correct responses and decreasing incorrect responses (Skinner, 1953). It is also possible that individuals engaged in correct responding during CBST to avoid rehearsal and corrective feedback, thereby increasing correct responses. In addition, CBST was conducted in the presence of an unknown, off-leash dog video. It is possible that the videos of unknown, off-leash dogs became discriminative stimuli, evoking correct responding (Dinsmoor, 1995; Miltenberger et al., 2015). There are two notable differences between the current study and other safety skills studies. First, we programmed praise across all sessions for completion of “be a tree.” This may have influenced responding, particularly following CBST such that participants were more likely to engage in “be a tree” to access praise. It is possible that praise functioned as a reinforcer (Skinner, 1953), thereby increasing the

likelihood of correct responding. Therefore, it is unclear whether "be a tree" would maintain in the absence of praise. Second, prior to each video, the experimenter stated, "Show me what you would do if you saw this dog." This instruction may have functioned as the discriminative stimulus rather than the video of an unknown, off-leash dog. Anecdotally, participants seemed to be responding to the video of the dog rather than immediately following the instruction. However, it is important that the presence of an unknown, off-leash dog acquire stimulus control over the participant's behavior rather than the instruction in dog safety skills trainings. Therefore, researchers should consider not providing a supplementary discriminative stimulus when using CBST in future safety skills studies.

Although CBST was effective for all three participants, generalization to novel videos occurred for two of the three participants (Ethan and Natalia) and to one novel video for one participant (Rachel). It is possible that generalization occurred due to stimulus generalization (Catania, 2012). That is, following training using three novel videos, "be a tree" occurred in the presence of different videos. Thus, it is possible that responding occurred in the presence of novel, unknown dog videos due to the similarity of features within the videos. It is also possible that multiple exemplar training facilitated generalization as we trained across three different videos during CBST instead of one (Stokes & Baer, 1977). As discussed above, it is also possible that a stimulus other than the unknown, off-leash dog (e.g., instruction, video in general, presence of experimenter) acquired stimulus control over behavior, thereby increasing the likelihood of "be a tree" occurring. Although generalization occurred for two of three participants, it is unclear whether "be a tree" would generalize to in-vivo situations. Our social validity data suggest that some generalization may have occurred. For example, Ethan's caregiver reported he used "be a tree" when their new puppy was engaging in nipping behavior

which resulted in the puppy leaving him alone. Similarly, Natalia's caregiver reported she observed Natalia practicing "be a tree" when not in training or probe sessions. Additionally, some simulation research suggests that skills trained generalize to in-vivo situations (e.g., Neef et al., 1989; Page et al., 1976). Therefore, an important next step would be to evaluate generalization of CBST for dog safety skills to in-vivo situations.

There are several reasons why generalization was not observed to all three videos for Rachel. First, Rachel had a longer history of engaging in incorrect responses in the presence of unknown, off-leash dog videos during baseline as compared to the other participants. Therefore, it is possible that her history of errors in the presence of unknown, off-leash dog videos attributed to limited generalization (e.g., Bergmann et al., 2017; Hirst & DiGennaro Reed, 2015). Second, it is possible that Rachel needed additional exposure to CBST to generalize "be a tree." Thus, booster CBST or IST may have enhanced or facilitated generalization for Rachel. Finally, there were several external factors that may have influenced responding during Rachel's generalization probes for which we could not control. For example, before the second generalization probe, Rachel's father could be heard in the background stating that she needed to finish the session so that they could leave. This external contingency may have competed with the contingencies we had in place, thereby affecting Rachel's responding during generalization.

Our social validity data suggest that caregivers and participants were satisfied with the training and outcomes of the training. All caregivers noted that they would do the training again, that they would recommend the training to others, and that they felt the training was moderately paced. These data support and enhance the outcomes of Study 1 in which 99.2% of caregivers noted the importance of dog safety skills training, thereby suggesting that dog safety skills are important to learn (Study 1) and training was well received by caregivers (Study 2).

Additionally, our participants indicated several waiting strategies they used while they waited such as signing or counting in their head. These data may suggest that in addition to teaching "be a tree," it may also be important to teach a covert behavior to help bridge the delay to the dog leaving or help arriving and to vary the duration in which a child needs to wait in the presence of an unknown dog. Assessing the child's ability to wait and tolerance of delays should be assessed within the pre-interview with parents to provide researchers a better understanding of the child's delay tolerance threshold and if needed provide strategies to aid with waiting and self-control. Researchers should consider collecting data of natural occurrences to identify the range in which an unknown dog interacts with an individual who is "being a tree" prior to leaving and use this information to program more accurate delays into training.

In addition to the limitations noted above, there are several additional limitations of our study worth noting. First, we did not collect any maintenance measures. Therefore, it is unclear whether these skills would maintain across time. Unlike other low-probability events (e.g., abduction attempts), it is possible that encountering unknown dogs is a high-probability event. When asked about how often they encountered unknown dogs within the community, over half of the caregivers (i.e., 56.7%) reported that they frequently or always encounter unknown dogs, indicating that encountering unknown dogs may be a high-probability event and resulting in more practice opportunities. If skills do not maintain across time, the next step would be to evaluate the effects of IST on "be a tree." Second, when conducting training remotely, there are often uncontrolled variables that may affect responding such as the presence of caregivers and siblings. Caregivers would sometimes interrupt sessions by asking the child what they were doing or prompting them verbally to do something, and siblings would sometimes join the periphery of sessions. For example, Ethan's sibling would attempt to be a part of session and see

what was going on. Because the sessions are remote, it is difficult to control other contingencies within the natural environment. It may be important when conducting remote training with children to have training guidelines that are reviewed with caregivers prior to the start of trainings to help reduce the likelihood of extraneous variables affecting responding. Third, there are some limitations in remote research and training worth noting. The devices that were sometimes used (e.g., phones) resulted in difficulties with seeing the participant's full body to be able to accurately score "be a tree" and difficulties for the participant in viewing the videos. Therefore, it may be important to require a specific type of device (e.g., laptop) when conducting remote trainings. Similarly, the use of touch screen devices sometimes interfered with sessions in which the participant's video camera would turn off accidently. An important piece to conducting successful remote research and training is a stable internet connection. There were a few times in which internet connectivity was lost. Researchers should consider these limitations when developing efficient and effective remote training procedures.

A final limitation of our study is that we trained dog safety skills is response to unknown dogs. Our data and other sources suggest (e.g., Holmquist & Elixhauser, 2010; For Kids' Sake, 2020) the majority of dog bites and injuries are sustained from known dogs, suggesting that it may be more important to target dog safety skills with known dogs rather than unknown. For example, Debra Murray from Smarty Paws suggests that children should not approach a dog. Rather, the child should invite the dog to interact with them by tapping on their leg. If the dog approaches, the child should pet the dog from the shoulders down their back and stop petting contingent on behaviors that signal the dog is done interacting. Children should never interact with a dog that is eating, sleeping, or chewing on items. In addition, it may be important to teach discriminations of dog behavior such that children can identify safe and unsafe behaviors of

known dogs. For example, if a dog wags its tail, people may assume that it is engaging in a safe behavior; however, there are other behaviors that may suggest the tail wag is unsafe such as the dog following you with their eyes, crouching, ears alert, and pacing. These discriminations may be important in teaching safety skills to children around known dogs as well as unknown dogs.

An exciting finding of this study is CBST was effective in training dog safety skills remotely. Technology-based trainings may facilitate greater opportunities to develop and disseminate dog safety trainings. Additionally, technology-based trainings may be effective in providing individuals specific visual stimuli important in the training of dog safety skills. That is, virtual display allows for more specific control and adjustment over stimuli if needed. Enhanced accessibility and control over environmental scenarios may increase learning across fine discriminations that need to occur in dog safety skills. Because of this, virtual reality (VR) may be an effective training method that should be pursued. For example, Self and colleagues (2007) used VR to teach fire and tornado drills to children. They found that VR was effective, and the trained skills generalized to in-vivo situations (Self et al., 2007). Thus, it may be possible to use this technology to train dog safety skills such that the stimuli are more similar to in-vivo situations as compared to two-dimensional videos to further enhance generalization of skills.

Overall, the results of both Study 1 and Study 2 are important first steps in developing effective dog safety skills trainings. The results of Study 1 suggest that most bites and injuries are sustained by known dogs regardless of gender, age, or disability. Additionally, children often engage in behaviors that increase the likelihood of dog bites and injuries. The behaviors taught in Study 2 address those common behaviors in which children engage by minimizing movement and eye contact with an unknown dog, which should decrease the likelihood of bites and injuries. Additionally, Study 2 demonstrated that CBST was effective in teaching “be a tree.” Finally,

caregivers reported the importance of dog safety skills training in Study 1 and the social acceptability of the training procedures used in Study 2. The data suggest that teaching dog safety skills is socially valid in that it directly addresses and improves both the safe of children and dogs. Therefore, it is important that research on dog safety skills continues.

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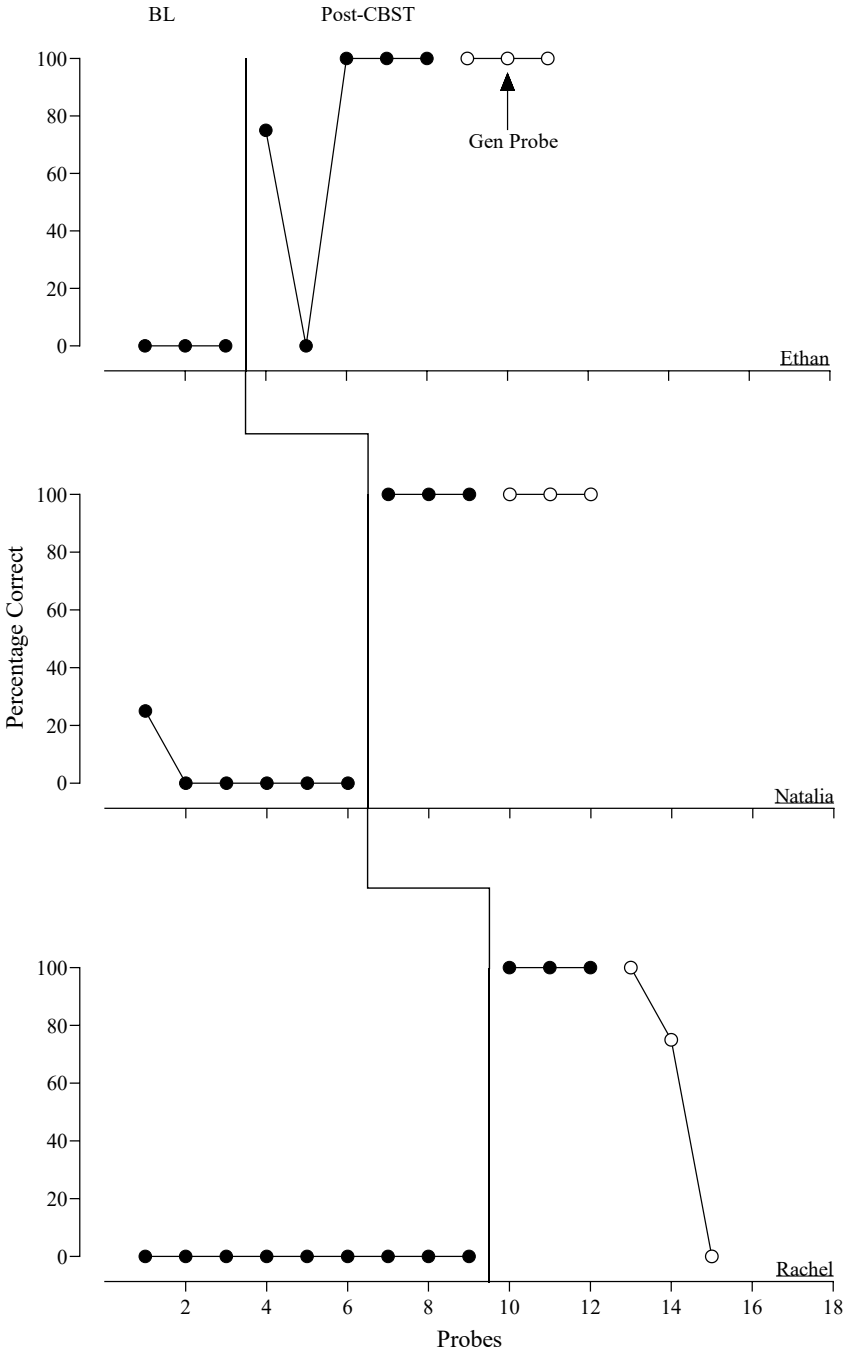
Figure 1

Percent Correct for Ethan, Natalia, and Rachel



Note. Percent correct across baseline (BL), post-computerized behavioral skills training (CBST), and generalization (gen) probes for Ethan (top panel), Natalia (middle panel), and Rachel (bottom panel).

Table 1

*Demographics of Children Reported in Survey (*N = *124)*

Demographic	*n*	%
Total	124	100
Gender		
Female	61	49.2
Male	63	50.8
Age		
0-4	66	53.2
5-9	35	28.2
10-14	15	12.1
15-18	8	6.5
Diagnosis		
IDD	7	5.6
N/A	117	94.4
Household Pets		
Pets	110	88.7
Dogs	100	80.6
No Pets	14	11.3
Dog Encounters		
Rarely	14	11.3
Sometimes	36	29.0
Frequently	58	46.8
Always	16	12.9
Dog Safety Trainings		
Yes	5	4.0
No	119	96.0

Table 2

Known and Unknown Dog Bites and Injuries by Gender, Age, and Disability

Demographic		Dog Incidents							
		Total		Known		Unknown		Both	
	n	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Bites									
Total	124	13	10.5	12	92.3	1	7.7	0	0.0
Gender									
Female	61	8	13.1	7	87.5	1	12.5	0	0.0
Male	63	5	7.9	5	100.0	0	0.0	0	0.0
Age									
0-4	66	5	7.6	5	100.0	0	0.0	0	0.0
5-9	35	3	8.6	3	100.0	0	0.0	0	0.0
10-14	15	3	20.0	2	66.7	1	33.3	0	0.0
15-18	8	2	25.0	2	100.0	0	0.0	0	0.0
Diagnoses									
IDD	7	2	28.6	2	100.0	0	0.0	0	0.0
N/A	117	12	10.3	11	91.7	1	8.3	0	0.0
Injuries									
Total	124	48	38.7	42	87.5	2	4.2	4	8.3
Gender									
Female	61	21	34.4	17	80.9	1	4.8	3	14.3
Male	63	27	42.9	25	92.6	1	3.7	1	3.7
Age									
0-4	66	20	30.3	18	90.0	1	5.0	1	5.0
5-9	35	22	62.9	20	90.9	0	0.0	2	9.1
10-14	15	4	26.7	2	50.0	1	25.0	1	25.0
15-18	8	2	25.0	2	100.0	0	0.0	0	0.0
Diagnoses									
IDD	7	3	42.9	2	66.7	0	0.0	1	33.3
N/A	117	45	38.5	40	88.9	2	4.4	3	6.7

Table 3

*Behavior of Children (*N *= 124) Around Known and Unknown Dogs by Age*

Behavior	Age Group									
	Total		0-4		5-9		10-14		15-18	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Known Dogs										
Runs towards dog	49	39.5	27	40.9	15	42.9	3	20.0	4	50.0
Approaches dog	74	59.7	43	65.2	22	62.9	5	33.3	4	50.0
Makes loud noises	57	46.0	34	51.5	18	51.4	3	30.0	2	25.0
Pulls ears, tail, or leash	26	21.0	16	24.2	9	25.7	0	0.0	1	12.5
Hands in or near mouth	37	29.8	20	30.3	13	37.1	1	6.7	3	37.5
Engages when eating	25	20.2	11	16.7	11	31.4	1	6.7	2	25.0
Engages when sleeping	42	33.9	22	33.3	17	48.6	1	6.7	2	25.0
Engages when chewing toys/sticks	51	41.1	26	39.4	18	51.4	3	20.0	4	50.0
Teases dog	14	11.3	5	7.6	7	20.0	0	0.0	2	25.0
Yells at dog	17	13.7	9	13.6	8	22.9	0	0.0	0	0.0
Scares dog	8	6.5	4	6.0	4	11.4	0	0.0	0	0.0
Attempts to hurt dog	4	3.2	2	3.0	2	5.7	0	0.0	0	0.0
Runs from dog	19	15.3	10	15.2	8	22.9	1	6.7	0	0.0
Pets dog on head	99	79.8	52	78.8	31	88.6	9	50.0	7	87.5
Puts face near dog	78	62.9	39	59.0	25	71.4	8	53.3	6	75.0
Takes items from dog	44	35.5	21	31.8	19	52.3	1	6.7	3	37.5
Other	21	16.9	13	19.7	2	5.7	5	33.3	1	12.5
Unknown Dogs										
Runs towards dog	16	12.9	9	13.6	6	17.1	1	6.7	0	0
Approaches dog	24	19.4	10	15.2	11	31.4	2	13.3	1	12.5
Makes loud noises	16	12.9	12	18.2	3	8.6	1	6.7	0	0
Pulls ears, tail, or leash	1	0.1	1	1.5	0	0	0	0	0	0
Hands in or near mouth	4	3.2	0	0	3	8.6	1	6.7	0	0
Engages when eating	1	0.1	0	0	1	2.9	0	0	0	0
Engages when sleeping	2	1.6	1	1.5	1	2.9	0	0	0	0
Engages when chewing toys/sticks	5	4.0	1	1.5	4	11.4	0	0	0	0
Teases dog	0	0.0	0	0	0	0	0	0	0	0
Yells at dog	3	2.4	1	1.5	2	5.7	0	0	0	0
Scares dog	1	0.1	0	0	1	2.9	0	0	0	0
Attempts to hurt dog	0	0.0	0	0	0	0	0	0	0	0
Runs from dog	17	13.7	8	12.1	7	30	2	13.3	0	0
Pets dog on head	42	33.9	18	27.3	18	51.4	4	26.7	2	25
Puts face near dog	11	8.9	5	7.6	5	31.4	1	6.7	0	0
Takes items from dog	3	2.4	1	1.5	2	5.7	0	0	0	0
Other	51	41.1	25	37.9	12	34.3	10	66.7	4	50

Table 4

*Behavior of Children (*N = *124) Around Known and Unknown Dogs by Disability*

Behavior	Disability					
	Total		IDD		N/A	
	n	%	*n*	%	*n*	%
Known Dogs						
Runs towards dog	49	39.5	4	57.1	45	38.5
Approaches dog	74	59.7	3	42.9	71	60.7
Makes loud noises	57	46.0	5	71.4	52	44.4
Pulls ears, tail, or leash	26	21.0	3	42.9	23	19.7
Hands in or near mouth	37	29.8	2	28.6	35	29.9
Engages when eating	25	20.2	2	28.6	23	19.7
Engages when sleeping	42	33.9	3	42.9	39	33.3
Engages when chewing toys/sticks	51	41.1	3	42.9	48	41.0
Teases dog	14	11.3	2	28.6	12	10.3
Yells at dog	17	13.7	1	14.3	16	13.7
Scares dog	8	6.5	1	14.3	7	6.0
Attempts to hurt dog	4	3.2	1	14.3	3	2.6
Runs from dog	19	15.3	2	28.6	17	14.5
Pets dog on head	99	79.8	5	71.4	94	80.3
Puts face near dog	78	62.9	5	71.4	73	62.4
Takes items from dog	44	35.5	2	28.6	42	35.9
Other	21	16.9	1	14.3	20	17.1
Unknown Dogs						
Runs towards dog	16	12.9	4	57.1	12	10/3
Approaches dog	24	19.4	4	57.1	20	17.1
Makes loud noises	16	12.9	3	42.9	13	11.1
Pulls ears, tail, or leash	1	0.1	0	0.0	1	0.9
Hands in or near mouth	4	3.2	0	0.0	4	3.4
Engages when eating	1	0.1	1	14.3	0	0.0
Engages when sleeping	2	1.6	0	0.0	2	1.7
Engages when chewing toys/sticks	5	4.0	0	0.0	5	4.3
Teases dog	0	0.0	0	0.0	0	0.0
Yells at dog	3	2.4	0	0.0	3	2.6
Scares dog	1	0.1	1	14.3	0	0.0
Attempts to hurt dog	0	0.0	0	0.0	0	0.0
Runs from dog	17	13.7	2	28.6	15	12.8
Pets dog on head	42	33.9	4	57.1	38	32.5
Puts face near dog	11	8.9	1	14.3	10	8.5
Takes items from dog	3	2.4	1	14.3	2	1.7
Other	51	41.1	2	28.6	49	41.9

Table 5

*Importance of Dog Safety Skills as Reported by Caregivers (*N = *124)*

	Not Worried		Somewhat Worried		Worried		Very Worried		Unknown	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Child being bitten	59	47.6	54	43.5	7	5.6	4	3.2	0	0.0
Child being injured	58	46.8	51	41.1	7	5.6	2	1.6	6	4.8

	Not Important		Somewhat Important		Important		Very Important		Unknown	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Dog Safety Skills Training	1	0.8	9	7.3	35	28.2	79	63.7	0	0.0

Table 6

Caregiver Social Validity Questionnaire

	No		Maybe		Yes	
	n	%	*n*	%	*n*	%
Repeat Training	0	0	0	0	3	100
Recommend to others	0	0	0	0	3	100
Satisfied with results	0	0	0	0	3	100
Parent interested in training/ learning dog safety	0	0	1	33.3	2	66.6
Behavior change	1	33.3	N/A	N/A	2	66.6
	Slow		Moderate		Fast	
	n	%	*n*	%	*n*	%
Pace of training	0	0	3	100	0	0

Table 7

Participant Social Validity Questionnaire

	Ethan	Natalia	Rachel
Wait strategy	Singing then just waiting	Counting	N/A
Study enjoyment	A lot	A lot	N/A
Changes to training	No repeat dog videos and more breaks	N/A	N/A
Feeling towards dogs after training	Good, still like to play with them	Still want to play but being careful	N/A
Acceptability of online training	A lot	A lot	N/A
Why?	N/A	N/A	N/A
Ranking of training procedures	Instruction – 4 Model – 1 Rehearsal – 2 Feedback – 3	Instruction – 4 Model – 2 Rehearsal – 1 Feedback – 3	N/A

Note. Participants were asked to rank the training methods (i.e., instruction, model, rehearsal, and feedback) from most-to-least effective. The most effective training method was ranked as 1 and least effective as 4.

Appendix A: Study 1 Survey

Thank you for your interest in participating in our study! Please review the information statement prior to proceeding.
Completion of this survey indicates your willingness to take part in this study and that you are at least 18 years old. Please acknowledge your willingness by clicking on the appropriate selection below. In doing so, you indicate that you have read the informational statement, understand the risks and benefits of participation, and that you know what you will be asked to do. You also agree that you have had the opportunity to ask any questions regarding the study and are clear on how to stop participation in the study.

- o Yes, I am willing to take part in this study.
- o No, I choose not to participate.

Skip To: End of Survey If Completion of this survey indicates your willingness to take part in this study and that you are... = No, I choose not to participate.

Part I: Demographics

What sex is your child?

- o Male
- o Female

How old is your child currently? ____
Does your child have any diagnosis(es)? (If none put N/A) _____
List any household pets (type and how many)? _____
Siblings (current ages and gender)? _____

Part II: Prevalence

How often do you encounter dogs in the community?

- o Never
- o Rarely
- o Sometimes
- o Frequently
- o Always

Has your child ever been bitten by a dog such that skin was broken due to contact with the dog's teeth and mouth?

- o Yes
- o No

Display This Question:

If Has your child ever been bitten by a dog such that skin was broken due to contact with the dog's... = Yes

How many times has your child been bitten by a dog (where the skin was broken due to contact with dogs' mouth)? _____

Display This Question:
If Has your child ever been bitten by a dog such that skin was broken due to contact with the dog's... = Yes

Was the dog bite(s) from a known or unknown dog?

- Known
- Unknown
- Both

Display This Question:
If Has your child ever been bitten by a dog such that skin was broken due to contact with the dog's... = Yes

Please explain the circumstances under which the bite(s) occurred (and approximate age the event(s) occurred):

Has your child ever been injured by a dog (e.g., scratches, bruises, not including bites)?

- Yes
- No

Display This Question:
If Has your child ever been injured by a dog (e.g., scratches, bruises, not including bites)? = Yes

How many times has your child been injured by a dog?

Display This Question:
If Has your child ever been injured by a dog (e.g., scratches, bruises, not including bites)? = Yes

Were the injuries from a known or unknown dog?

- Known
- Unknown
- Both

Display This Question:
If Has your child ever been injured by a dog (e.g., scratches, bruises, not including bites)? = Yes

Please explain the circumstances under which the injuries occurred (and approximate age the event(s) occurred):

What is your child's behavior around KNOWN dogs (Check all that apply, if not listed use other):

- Runs towards dog
- Approaches dog from any direction
- Makes loud noises
- Pulls the dog's ears, tail, or leash
- Puts hands in or near the dog's mouth
- Engages with dog when the dog is eating (e.g., attempts to stick hands in dog bowl, pets dog)
- Engages with dog when the dog is sleeping
- Engages with dog when the dog is chewing on toys/sticks
- Teases the dog
- Yells at the dog
- Scares the dog
- Attempts to hurt the dog
- Runs away from dog
- Pets dog on the head
- Puts face near the dog's face (e.g., hugs, kisses)
- Takes items away from dog (e.g., dog toys, sticks)
- Other: _____

What is your child's behavior around UNKNOWN dogs? (Check all that apply, if not listed use other):

- Runs towards dog
- Approaches dog from any direction
- Makes loud noises

- Pulls the dog's ears, tail, or leash
- Puts hands in or near the dog's mouth
- Engages with dog when the dog is eating (e.g., attempts to stick hands in dog bowl, pets dog)
- Engages with dog when the dog is sleeping
- Engages with dog when the dog is chewing on toys/sticks
- Teases the dog
- Yells at the dog
- Scares the dog
- Attempts to hurt the dog
- Runs away from dog
- Pets dog on the head
- Puts face near the dog's face (e.g., hugs, kisses)
- Takes items away from dog (e.g., dog toys, sticks)
- Other: _____

Part III: Importance of Safety Skills

Please rank the following questions on how much you worry.

	Not Worried (1)	Somewhat Worried (2)	Worried (3)	Very Worried (4)
How worried are you about your child being bitten by a dog?			○	○
How worried are you about your child being injured by a dog?			○	○

Please rank the following questions on importance to you.

	Not Important (1)	Somewhat Important (2)	Important (3)	Very Important (4)
How important is it to you that your child learns dog safety skills?				

Has your child participated in dog safety skills training before?

- ○ Yes
- ○ No

Display This Question:
If Has your child participated in dog safety skills training before? = Yes

Describe the training in which your child partook:

Would you be interested in receiving materials on dog safety skills or your child participating in dog safety skills training?

- Yes
- No

Display This Question:
If Would you be interested in receiving materials on dog safety skills or your child participating i... = Yes

If interested, please include your contact information such that we can follow-up with you:

Appendix B: Caregiver Pre-Interview

Name:_____
Age:_____
Gender:_____
Diagnosis:_____

1. Does your child engage in problem behavior such as aggression, self-injurious behavior, elopement, property destruction, or noncompliance?
    a. If Yes, how often does your child engage in problem behavior?
    b. If Yes, when does your child typically engage in problem behavior?
2. Is your child able to complete multiple-step instructions (e.g., clap your hands, touch your nose, and say your name)?
3. Can your child speak in two- to three-word sentences using language, PECS, or an AAC device?
4. Can your child answer WH- questions (e.g., What is your favorite color?)
5. Can your child identify safe and unsafe scenarios if shown a photo?
6. Does your child demonstrate an interest in dogs (e.g., talks about dogs, pets)?
7. Does your child engage in unsafe behaviors around unknown dogs (e.g., running at a dog, approaching an unknown dog, hopping on dog)?
8. Is your child afraid of dogs?

Appendix C: Safety Pre-Assessment Example Photos

Safe Photos

Unsafe Photos

Appendix D: Modified RAISD (Fisher et al., 1996)

1. Some individuals really enjoy watching TV shows, YouTube videos, music videos, movies, etc. What are the things [child's name] likes to watch on the computer?
2. Some individuals really enjoy listening to music, interviews, animal sounds, sing-a-longs etc. What are the things [child's name] likes to listen to?
3. Some individuals really enjoy attention from other people such as saying, "Good job," clapping, "woohoo," etc. What are forms of verbal attention [child's name] most enjoys?
4. Some individuals really enjoy certain online games or activities like angry birds, tic-tac-toe, cartoon network games, etc. What online games [child's name] likes to play on the computer?
5. What are some other online items or activities that [child's name] really enjoys?

Appendix E: Caregiver Social Validity Questionnaire

	Response Options (if applicable)		
If your child were to repeat a dog safety training, would you have them complete this training again?	Yes	No	Maybe
Would you recommend this training to a friend or family member?	Yes	No	Maybe
How did you feel the pace of the study was (speed)?	Slow	Moderate	Fast
Did you see any changes in behavior regarding your child and their behavior around dogs?	Yes		No
If Yes, what changes did you observe in your child's behavior around dogs?			
Are you satisfied with the results of this dog safety training?	Yes	Maybe	No
What did you like about the dog safety training?			
What did you dislike about the dog safety training?			
Would you be interested in learning more about dog safety skills and parent training?	Yes	Maybe	No
If Yes, what type of training would you be interested in:			

Appendix F: Participant Social Validity Questionnaire

	Response Options (if applicable)		
What wait strategy did you use while waiting for the dog to leave or help to arrive?	Singing	Counting	Other
Did you enjoy playing this game online (list any aspect they enjoyed)?	Not at All	Somewhat	A lot
If yes, what did you like about the online game?			
What changes would you make to the online game?			
How do you feel about dogs after this game?			
How did you like the online format?	Not at All	Somewhat	A lot
Rank instructions, modeling, rehearsal, and feedback from most effective to least effective for playing the online game. Most effective will be ranked 1 and least effective will be ranked 4.			