TEACHING WATER SAFETY SKILLS TO CHILDREN WITH AUTISM

USING BEHAVIORAL SKILLS TRAINING

Marilyse Tucker, B.S.

Thesis Prepared for Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

December 2016

APPROVED:

Richard Smith, Major Professor
Einar T. Ingvarsson, Committee Member
Manish Vaidya, Committee Member
Jesus Rosales-Ruiz, Chair of the Department of Behavior Analysis
Tom Evenson, Dean of the College of Public Affairs and Community Service
Victor Prybutok, Vice Provost of the Toulouse Graduate School

Tucker, Marilyse. *Teaching Water Safety Skills to Children with Autism Using Behavioral Skills Training.* Master of Science (Behavior Analysis), December 2016, 37 pp., 5 tables, 3 figures, references, 17 titles.

Behavioral skills training (BST) and in situ training (IST) have been evaluated as methods to teach different safety skills to individuals with developmental disabilities. Research on BST has examined topics such as gun safety, abduction prevention, poison avoidance, and sexual abuse prevention. A large safety issue that is missing from the literature is drowning prevention and water safety skills. Drowning is one of the most prevalent issues facing children with Autism Spectrum Disorders (ASD), particularly those who elope from their homes or caregivers. The current study aimed to evaluate the effectiveness of using BST + IST to teach three water safety skills to three children with ASD. The initial form of intervention was BST with total task presentation of the skill, using verbal instruction, modeling, rehearsal, and feedback. If this intervention did not result in an increase in performance, the skill was broken down into individual component presentation, in which each component of the skill was taught using the same procedures. Results from the current study showed that BST + IST was effective in teaching all skills to all participants.

ACKNOWLEDGEMENTS

First and foremost, I would like to give thanks to my advisor and source of wisdom and guidance, Dr. Einar Ingvarsson. You have helped shape me into a better writer, a more critical thinker, and an overall more confident person. Thank you for helping make my dream study a reality and for guiding me through this wonderful journey. Thank you for your interesting conversations over a bar table, which always prove to be enlightening and fun, whether it be about behavior analysis or music. I look forward to growing as a professional alongside you and expanding the field just a little bit further with my research. To Rachel Kramer, thank you for being my first behavior analyst, and for bringing me to Child Study Center, where I feel like I have received some of the best experience I could ever have received.

I would also like to extend my gratitude to my mother, Dr. Karen Cody, for being a role model for me from the very beginning. Thank you for showing me that no matter what life can throws at you, you can push through it. Thank you for being my number one cheerleader, and the most amazing scholar I have ever known.

To my two dogs, Smokey and Penny: thank you staying up with me on those late nights writing papers, thank you for understanding when things got tough, and thank you for making me smile during the most stressful times. You two are amazing.

Lastly, thank you to my wonderful husband, Dason. For the past three and half years, you have been nothing but supportive and encouraging, doing everything from staying up with me while writing papers, to making dinner every weeknight for two years. Thank you for going on this journey with me; I could not have done it without you. I love you to the moon and back.

TABLE OF CONTENTS

LIST OF TABLES

List of Figures

CHAPTER 1
INTRODUCTION

Of the number of children with a diagnosis of Autism Spectrum Disorder (ASD) who have been reported to elope from their homes, 24% were found to be in danger of drowning (Anderson et al., 2012). In a summary of lethal cases of wandering for the period of 2009 to 2011, the National Autism Association reported that 91% of deaths in children who were lost or eloped and had a history of elopement were caused by drowning (Fournier, 2013). Parents take great care to ensure that their children are safe in all situations, from holding their hand while crossing the street, to making sure they do not touch a hot stove. However, there are a number of conditions that can interfere with parents' ability to keep their children safe, including limited control over the environment and lack of knowledge on how to teach and promote safety skills. While parents of typically developing children appear to be generally successful in teaching their children skills related to gun safety, fire safety, abduction prevention, and the like, parents of children with developmental disabilities face special difficulties in this regard. Further, the safety skills may not generalize to a novel situation or environment. This is especially relevant if a child elopes from the caregiver or home and finds him or herself in a novel environment. While gun safety, fire safety, and abduction prevention are relevant in cases of elopement and wandering, falling into a body of water near or at the home and drowning is also a likely and present danger.

There are currently several resources available for those who wish to learn how to swim. These include, but are not limited to, YMCAs, American Red Cross programs, and other private swim schools (e.g., Aquatots and Sunsational Swim School). The majority of these programs, with perhaps the exception of the American Red Cross water safety program, focus predominantly on *swim instruction* rather than water safety skills. The main difference between the two is the focus and the content of the swim lessons. During swim instruction, the goal is to effectively teach a sequence of behaviors in order to make an individual a better swimmer and enable more effective movement in water. Being able to swim can, in and of itself, be a life-saving skill. However, water safety is not a specific focus in these kinds of lessons. During water safety lessons, the primary goal is for the individual to have the skill set to handle most situations in and around water where they might be at risk. These skills may include walking (not running) around the water and recovering into a standing position in the water (Asher, Rivara, Vance, Felix & Dunne, 1995).

Several behavior analytic studies have included a focus on different methods of teaching swimming to individuals with and without disabilities. Fueyo, Saudargas, and Bushell (1975) examined two different types of feedback to teach the sidestroke and the backstroke. Four children between 11 and 17 years of age, who had been diagnosed as intellectual disabled, participated. Each participant was taught one skill using task-specific feedback (e.g., "Great job floating on your back and moving your arms backwards"), while the other skill was taught using arbitrary feedback ("I like that you're in the water"). The type of feedback was counterbalanced across skills and participants. All the participants made significantly more progress on the skill in which task-specific feedback was provided as compared with the skill taught using arbitrary feedback, suggesting that task-specific praise and feedback result in more efficient learning.

Killian (1998) discussed the use of backward chaining to teach several swimming skills, including an approximated backfloat, a prone float (floating face down in the water), an approximated front crawl, and the elementary backstroke. All skills were chosen based on the rationale that teaching these skills should reduce some of the fear and anxiety that some might experience in and around the water.

Most-to-least prompting has also been evaluated as a procedure to teach simple swimming progression skills (Yilmaz, Konukman, Birkan, & Yanardag, 2010). Three young boys with ASD participated. All participants were selected based on meeting several prerequisites: adjustment to water skills, meaning they were able to get in the water; ability to turn and change directions in the water, and being able to control their movement in the water (Yilmaz et al., 2010). During baseline, first opportunity probe data were collected, with a minimum of three consistent probe sessions conducted before implementing most-to-least prompting. Two types of most-to-least prompting conditions were implemented: Physical cues/verbal prompts, and verbal prompt/gesture mimic prompt. Maintenance and generalization probes were conducted two and four weeks and instructions. Results from Yilmaz et al. (2010) showed that no errors were made across training phases and training took a total of 9 sessions for all participants. They also found that all participants maintained the skills at two and four weeks post-teaching and that the skills generalized to novel people. Thus, most-to-least prompting can be an effective procedure to teach swimming skills.

Rogers, Hemmeter, and Wolery (2010) examined the effectiveness of physical guidance and a constant prompt delay to teach foundational swimming skills. Participants were three boys with a diagnosis of ASD, ages four to five years old. Participants were included if they possessed the gross motor abilities necessary to perform the skill, if they did not show a fear of the water, if they were unable to perform the skills already, and if they were able to enter the water to their waist independently or only with minimal assistance. Rogers et al. (2010) focused on the skills of flutter kick, front crawl arms, and side-to-side head turns based on the rationale that these skills are foundational to learning for advanced swim skills. Results showed that all participants reached mastery criterion for each skill while making few errors throughout the study.

While the previous studies demonstrated that behavioral procedures can be effective to teach swimming skills, none of them explicitly examined life-saving water safety skills. Being able to swim can certainly safe one's life, but water safety skills can also be targeted without focusing on all the skills involved in swimming. Asher et al. (1995) set out to evaluate both in-water and on-deck safety skill instruction using a system developed by the American Red Cross. The study included 109 typically developing children between the ages of 2 – 4, who were randomly assigned to an 8-week or a 12-week teaching program. Skill sets taught included "deck behavior" (e.g., no running on the pool deck, don't push your friends into or around the pool), swimming ability (e.g., jumping into the water, basic flutter kicking, rudimentary forward progress in the water), and in-water safety skills (e.g., recovering into a standing position, jumping in and swimming to the side). While Asher et al. (1995) did not explicitly state how any of the skills were taught, results showed a significant improvement in the swimming ability in both groups, appropriate deck behaviors, and ability to perform safety skills that are meant to be life-saving in a dangerous situation.

As noted above, several studies have evaluated the use of behavioral procedures to teach swimming skills (e.g., Fueyo et al., 1975; Killian, 1988; Rogers et al., 2010; Yilmaz et al., 2010). However, the literature on behavioral procedures to teach water safety skills is scarce.

However, behavior analytic procedures have been used to teach a variety of other safety skills to children and adults, both typically developing and those with intellectual or developmental disabilities. The skills range from abduction prevention (e.g., Beck & Miltenberger, 2009; Carrol-Rowan & Miltenberger, 1994; Gunby, Carr, & LeBlanc, 2010; Johnson et al., , 2005; Johnson et al., 2006), gun/firearm safety (e.g., Himle & Miltenberger, 2004; Himle et al., 2004; Miltenberger, 2008), sexual abuse prevention (e.g., Egemo-Helm et al., 2007; Lumley, et al.,, 1998), food safety skills (e.g., Madaus et al., 2010), fire safety (e.g., Jones, et al., 1981), seeking assistance when lost (Taylor et al., 2004), avoidance of poison hazards (e.g., Dancho, Thompson, & Rhoades, 2008), and how to remove broken/hazardous materials from an area (Winterling, et al., 1992). Most of these studies have included Behavioral skills training (BST), which is a multi-component intervention package that includes instructions, modeling, rehearsal, and feedback. BST alone has been used to teach a variety of safety skills including sexual abuse prevention (Lumley et al., 1998) and gun safety (Himle & Miltenberger, 2004; Himle et al., 2004). Miltenberger (2008) argues that BST is the most effective training approach for teaching safety skills. The individual is able to practice the skill(s) multiple times within a session, and praise and corrective feedback are delivered immediately after attempting the skill.

Lumley et al. (1998) used BST to teach sexual abuse prevention to women with an intellectual disability. Prior to training, the women were given an assessment to determine their level of knowledge pertaining to sexual abuse prevention. The assessment took the form of closed-ended questions, role playing, and naturalistic probes. These assessments were also completed 1 week after training had ended (Lumley et al., 1998). Following baseline, BST training was employed for 5 sessions on all types of lures that were used in the assessment procedures, with each session lasting approximately 60 to 90 minutes. The results showed that all participants, with the exception of one, improved to the criterion level performance following the sexual abuse prevention curriculum on the verbal report (questions) and role play measures. However, none of the participants reached criterion level performance in the naturalistic probes, suggesting a failure in generalization to more "realistic" situations and lures. Similarly, the performance of the participants who had reached criterion level performance failed to maintain 1 month after the cessation of the sexual abuse prevention curriculum, suggesting issues in the maintenance of these skills.

Generalization and maintenance can potentially be improved by conducting BST trials in naturalistic environments. This approach has been referred to as in situ training (IST) (Miltenberger, 2008). IST has been found to result in higher levels of generalization than BST alone, both when combined with BST in a training package and also when added to a previous publicly available intervention package that had been shown not be effective when used in isolation (e.g., Beck & Miltenberger, 2009; Himle et al., 2004).

Some of the more recent research on safety skills has examined using BST in conjunction with IST (e.g., Egemo-Helm et al., 2007; Gunby et al., 2010; Johnson et al., 2005; Johnson et al., 2006). Gunby et al. (2010) evaluated BST to teach abduction-prevention skills to children with autism. The children were 6, 7, and 8 years old and attended an intensive behavioral intervention program for a minimum of 27 hours per week. The experimenters conducted probes prior to and after training to assess the efficacy of BST plus in-situ feedback (Gunby et al., 2010). Each probe involved a confederate of the study, unknown to the child, approaching the child, who was left alone. The confederate then attempted to "abduct" the child by using one of four types of "lures." A lure was considered a verbal statement made by the "abductor" in an attempt to have the child leave with the "abductor." The lure could be simple ("Come with me"), incentive, authority, or assistance request. During baseline probes, if a child agreed to leave with the abductor, the abductor verbally stated that they had forgotten to run an errand and left the area without the child. If the child left the abductor and found a familiar adult to report the abductor, the child was thanked. No further feedback was delivered during the baseline probes. Training consisted of verbal instruction, video modeling, live modeling, rehearsal, praise, and corrective feedback. Results from the study showed that BST with IST was effective in teaching abduction prevention safety skills in response to four different lures, and those results maintained throughout follow-up probes that occurred three to seven weeks after the final teaching session. This study provides further evidence that the combination of BST and IST is the most effective method for teaching safety skills to individuals, and is more likely to ensure maintenance of the skills (Miltenberger, 2008).

In another example of in situ training, Taylor et al. (2004) taught three children, ages 13-17, to respond to a vibrating pager in order to seek assistance when lost. The target behavior consisted of exchanging a communication card located in the participant's pocket or purse that had the participant's name, a statement about they were lost, and instructions as to how to reach a parent or teacher, either by the pager or by phone. Experimenters used verbal instruction, proximity fading, and modeling of the correct verbal response during training sessions, which initially took place in a school setting and subsequently in the community. Generalization probes were conducted at additional community locations. All three participants learned to exchange the communication card when prompted by the vibrating pager; further, all three participants demonstrated the same response when generalization probes were conducted with their parents. This study did not include the use of BST to teach the safety skill, but the experimenters targeted one of the dangers that might occur when a child has eloped.

As it stands, there does not appear to be any published research explicitly examining teaching in-water survival skills to children with ASD for the explicit purpose of drowning prevention. The purpose of the present study was to evaluate the effectiveness of a BST+IST model to teach in-water safety skills to children with ASD.

CHAPTER 2
METHOD

Participants

The participants were three boys, ranging in age from 7 to 8 years. They were recruited from a private school or an early intervention program located in a center serving children with developmental disabilities. All participants had a diagnosis of Autism Spectrum Disorder (ASD), which was comorbid with other disorders (see Table 1). All of the participants were able to follow simple one-step instructions, were able to follow general rules (i.e., do not run on the pool deck), and generally had low levels of problem behavior (i.e., less than 10% of 5-minute intervals across the day). The participants attended school Monday through Friday, from 8:30 AM until 3:00 PM. Student-to-teacher ratios for the students who participated in the study varied from 2.5/1 (Sam), 5/1 (Castiel), and 8/1 (Dean) students to teacher. Participants were included in the study if they were able to follow one-step instructions, some multi-step instructions, had low levels of problem behavior and noncompliance (10% or lower throughout the typical day), had moderate communication skills, understood simple instructions, and had a generalized imitation repertoire.

Castiel was an 8-year-old boy with diagnoses including attention deficit hyperactivity disorder, ASD, conduct disorder, disruptive behavior disorder, and a sleep disorder. Intelligence Quotient (IQ) testing showed that he had an IQ of 91. According to the Woodcock-Johnson III Test of Achievement (WJ III; Woodcock, McGrew, & Mather, 2001) within the domain of “understanding directions,” Castiel scored within the 89-month range. He was able to follow simple and multi-step directions most of the time and could engage in rule-governed behavior (e.g., “Do not jump into the water before I tell you it is okay”).

Dean was an 8-year-old boy with diagnoses of developmental reading disorder, ASD, anxiety, and developmental speech disorder. He received a score of 83 on his IQ test, and was shown to be at 97 months within the “understanding directions” domain of his WJ III. He was able to follow multi-step instructions easily, rarely engaged in noncompliance, and was able to ask clarifying questions regarding instructions (e.g., “What do I need to yell when I’m supposed to be yelling for help?”).

Sam was a 7-year-old boy with diagnoses of anxiety disorder, attention deficit hyperactivity disorder, ASD, and a sleep disorder. Sam received a score of 74 on his IQ test. Within the “understanding directions” domain on his WJ III, Sam tested at a 47-month-old level. He was able to follow most one-step instructions, and some multi-step instructions. He was occasionally non-compliant with rule following (e.g., experimenter would say “wait until I say it is ok to get in the pool” and Sam would immediately jump in the pool, regardless).

Although three participants completed the study, two additional participants were initially recruited. Bobby, an 8-year-old boy diagnosed with Autism Spectrum Disorder, was dismissed from the study due to parental nonadherence with attendance and study policies as well as other conflicts. Crowley, a 4-year-old with a diagnosis of Autistic Disorder and Delayed Milestones, was dismissed due to the experimenter being unable to get him in the water after 11 sessions (i.e., the experimenter wound up spending the entire 30-minute session attempting to get him in the water to no avail).

Setting

All teaching sessions and maintenance probe sessions were conducted in a metropolitan gym natatorium. The natatorium had 5 lanes, with each lane approximately 25 yards long and 2.75 yards wide. The pool was surrounded by a tiled pool deck, with showers on one side of the pool and windows on 3 sides of the natatorium. Benches were set up on all sides of the pool, where participants' guardians could sit and observe sessions. All sessions were conducted in the same lane, closest to the showers and entry doors. Although the entire lane was reserved, only a portion of the lane was used. The depth of the lane ranged from 3 ft. to 7 ft. All procedures were conducted within the 4-5 ft. deep section, or slightly deeper, ensuring none of the participants were able to touch the bottom of the pool and maintain their head above water.

Measurement and Interobserver Agreement

Direct Measures

Data were collected using a pen and paper datasheet on a clipboard. Only the first opportunity to emit the skill was scored by the student experimenter, either immediately or from a video recording of the session. Data were scored according to a scale ranging from 0-3 for each water safety skill. The rating scale signified how many components of each particular skill the child completed independently. Scoring rubrics were different for each of the three skills. See Tables 2, 3, and 4 for a full description of what each number on the scale signified for each of the three skills. The three skills were: (1) Push/turn/grab, defined as jumping into the water, making forward progress for at least 3 seconds, and grabbing hold of the side of the pool within 10 seconds. (2) Floating and yelling, defined as floating on back and yelling for help for 15 seconds, loudly enough for someone to nearby to hear. (3) Rolling front to back, defined as rolling from being face down in the water onto back, face up in the water.

The target skills were selected from the most recent YUSA (national YMCA) curriculum to teach swim lessons. These skills were also part of a larger program created by a metropolitan YMCA to address drownings in high-poverty communities. The program sent YMCA trained lifeguards and swim instructors to apartment communities that were deemed high-poverty and high-risk (who had also agreed to take part in the program) and taught several foundational and safety skills to children within the community. Anecdotal evidence showed the skills taught, including the three used in the present study, were able to save several lives of the children who had previously enrolled in the course.

Almost all of the sessions were video recorded, with a few exceptions caused by malfunctioning video equipment. The skills were chosen for their usefulness in a true drowning scenario. The "jump" aspect of "push/turn/grab" is meant to simulate the chaos produced by falling into a body of water and is meant to help teach how to respond in that situation. During float & yell, while the participant was yelling, the experimenter would look towards the lifeguard who was stationed approximately 15-20 feet away. The lifeguard signaled whether he or she was able to hear and understand the participant's yelling by giving a thumbs up or thumbs down signal. This was done to ensure that in a real drowning situation, participants would be able to yell loudly and clearly enough to attract attention and receive assistance. During the training for push/turn/grab, all participants were taught to jump as far away from the wall as possible. The primary reasons for this was to lower risk of injury (e.g., hitting their head on the wall).

To obtain interobserver agreement (IOA), independent observers watched the video recordings of sessions and independently recorded the participants' first opportunity to emit each targeted skill. Both secondary observers were given copies of the baseline and treatment procedures along with operational definitions of the three skills. IOA was completed for 40%, 30%, and 25% of trials for Sam, Castiel, and Dean, respectively. IOA distribution across phases for Sam was: 3, 4, and 3 sessions for baseline, total task presentation, and individual component presentation, respectively. IOA distribution across phases for Dean was: 1, 3, and 1 session for baseline, total task presentation, and individual component presentation, respectively. IOA distribution across phases for Castiel as: 2, 4, and 4 sessions for baseline, total task presentation, and individual component presentation, respectively. Agreements were scored when both the experimenter and the secondary observer scored the first opportunity identically. IOA scores were calculated by adding up the total number of agreements across sessions, dividing that sum by the sum of agreements plus disagreements, and multiplying by 100. Mean agreement for all direct measures was 90%, 100%, and 90% for Sam, Dean, and Castiel, respectively. Treatment integrity (TI) data were collected for 28%, 25%, and 30% for Sam, Dean, and Castiel, respectively. TI scores were 100% across all participants. See Table 5 for procedural steps scored for each condition.

Procedure

General Procedures

Sessions occurred 3 days per week, unless holidays or illness occurred, in which case sessions resumed at the next regularly scheduled day. All sessions were conducted individually, with only one participant in the natatorium at a time. All sessions took place on a weekday evening, and at times that fit best with the families' schedules. Sessions lasted between 10 and 15 minutes, depending upon the length of time each participant was able to focus on the task without losing concentration, as judged by the experimenter. One participant (Castiel) suffered a non-study related head injury and therefore was absent from sessions for 3 weeks during the teaching of his first skill. Two government recognized holidays and three school/program recognized holidays occurred during the course of the study but only resulted in 2 total days of missed sessions. Average session length for Castiel was 15 minutes, with an average of 12 teaching trials presented per session. Average session length for Dean was 10 minutes, with an average of eight teaching trials presented per session. Average session length for Sam was 13 minutes, with an average of 8.5 teaching trials presented per session. Approximately 5-10 minutes of reinforcement time or breaks were given to each participant throughout each session.

The student experimenter served as the sole instructor throughout all teaching sessions and maintenance probes. The student experimenter had approximately 4 years of previous swim lesson instructor experience and held certifications for a YMCA swim lesson instructor, Cardio Pulmonary Resuscitation (CPR)/first aid, and Automatic External Defibrillator (AED). The student experimenter also had 2 years of experience as a lifeguard, but did not have current certifications during the time of the study.

All participants were allowed to pick 1-2 prizes from a prize bucket at the end of each session, provided that they had followed instructions, did not engage in problem behavior, cooperated with instructions, or made progress. Before the first session, the experimenter held a meeting with each of the participants' parents and asked them to list edibles/toys their child enjoyed. These items were used as prizes in subsequent sessions.

One participant, Castiel, had a jackpot reinforcer (a larger, potentially more reinforcing item) available to earn for his first skill due to a hypothesized lack of motivation to complete the skill and earn the standard prizes. A jackpot reinforcer was used only for this participant and only with his first skill.

While running sessions, a behavior level system was in place for two of the participants. The behavior level system was a fluid system that is used in the private school classrooms and with some children in the ABA therapy program at the center that the participants attended. If the child engaged in noncompliance or problem behavior during the session, the child was told that he had not earned a prize for that session and that he could try again next time. Castiel engaged in noncompliance/problem behavior during approximately 4 sessions out of the 30 total sessions, and Sam engaged in noncompliance/problem behavior during approximately 3 sessions out of 25 total sessions. For both of these participants, a behavior level system was put in place to manage occasional noncompliance and problem behavior. The level system had 4 levels: Blue, green, yellow, and red. A participant started in the green level, and if he stayed at that level, one prize was available at the end of session. If the participant attempted the skill or indicated that they were unable to complete the skill in an appropriate manner (e.g., “I don’t know how to do push”), without problem behavior, he moved up to the blue level, and if he remained at that level at the end of session 2 prizes were offered. If a participant moved down from blue to green, only one prize was available to earn at the end of the session. If a participant moved down to yellow or red (the two lower levels), the child was told that no prize would be available to earn for the remainder of the session. A participant moved down in levels after one warning if they engaged in dangerous behavior (e.g., running on the pool deck, jumping into the pool without prior permission, etc.). A participant immediately moved down a level if they engaged in inappropriate behaviors (e.g., attempting to pull up the experimenter's foot to smell it, attempt to touch the experimenter's chest, etc.). Inappropriate behaviors occurred a few times for both Sam and Castiel, but Sam was most frequently moved down in the level system due to dangerous behavior and occasional noncompliance. Participants were allowed to play for 3-5 minutes at the end of session if they had followed instructions and did not engage in problem behavior throughout the session. Sam earned tokens throughout the session to earn play periods. Dean used a sticker system in which 10 stickers were exchangeable for one prize from the prize bucket. Stickers could be earned by following instructions, attempting the skill, and demonstrating closer approximations or demonstrating all components of the skill correctly within the session.

At the start of every session, prior to getting in the water, the experimenter told the participant what skill(s) they would be working on in that session. The participants were told that unless the experimenter was in the water and asked them to attempt the skill, they should remain out of the water. The experimenter was always in the water with the participant. At the end of session, if the participant met criteria, he was allowed to pick from the prize bucket. When a participant correctly demonstrated a correct skill or made a closer approximation to the skill, the experimenter provided enthusiastic praise. For Sam, enthusiastic praise and tokens were delivered for a correct response or a closer approximation. The student experimenter delivered all praise, instruction, and feedback the participants during the study. Mastery criterion for all skills was three consecutive sessions with a score of 3 for the first opportunity trial. After a skill was mastered, maintenance probes were scheduled for the mastered skill, and the next skill was introduced in BST teaching sessions. If the participant refused to attempt the skill, the session ended. If three sessions were terminated due to participant refusal, a child's participation in the study was re-evaluated by the experimenter and the parent.

Probe Trials

The dependent variable was performance of water safety skills in probe trials. Each probe trial began with the experimenter telling the participant what skills they would be working on that session. The experimenter stated that although they may not know how to demonstrate a particular skill, attempts should be made to the best of their ability, and that if they did not feel comfortable or did not wish to attempt the skill, the participant should state "I do not know how to do (skill name)". If the child attempted the skill or stated they did not know how to demonstrate the skill, the experimenter delivered praise and moved on to the next skill. Baseline sessions consisted of probe trials only, and one probe trial was conducted prior to each BST teaching session throughout the experiment.

Baseline

During initial baseline sessions, the experimenter conducted probe trials for each of the three skills. The order of the probe trials varied within and across participants. After intervention began for the first skill, and later the second skill, baseline consisted of probe trials for the skills that remained in baseline. Instructions and consequences were delivered as described above. No prompts or corrections were implemented during baseline.

BST + In Situ – Total Task Presentation Sessions

Each training session started with a probe trial targeting the skill to be taught, as described above. Immediately following the probe trial, the BST+IST session began. The training began with the experimenter providing verbal feedback pertaining to the performance on the preceding probe trial (e.g., “Great job floating with your head tilted back in the water. However, you need to yell louder so everyone around you can hear you”). After feedback was presented, the experimenter verbally described the skill and subsequently modeled the skill. When the experimenter had modeled the skill, the experimenter asked the participant if he had any questions, and then asked him to attempt the skill again. This process was repeated until the session ended. Consequences were delivered as described under general procedures.

BST + In Situ – Component Teaching Sessions

If three consecutive sessions occurred without progress on a skill (indicated by probe trial performance), individual component teaching sessions started. Prior to training, the experimenter determined which component of the skill the participant was having difficulty with. In subsequent training sessions, the experimenter taught these components individually, and then returned to teaching the entire skill contingent on mastery of the components. For example, Castiel had difficulty learning the push/turn/grab skill when it was demonstrated as an uninterrupted sequence. He had the most difficulty with turning his body back towards the wall, and making forward progress efficiently in the water. Therefore, the experimenter first taught the turning component, followed by the making forward progress in the water component. When the participant was able to demonstrate the individual components of a skill, the experimenter asked the participant to perform the total skill (i.e., the participant should perform the full push/turn/grab skill, not just turning or making forward progress in the water). Mastery criterion was three consecutive sessions in which the participant emitted all components of the targeted skill during the first opportunity probe. Other than teaching individual components, the procedures in this condition were identical to the BST/IST condition.

Maintenance Probes

Maintenance probes were conducted approximately 1 week and 1 month after each skill had been mastered. Sessions began with the experimenter reviewing what skill the child would be working on for that session. When the experimenter was in the water, the experimenter asked the child to perform the skill. If a skill did not receive a score of 3 for the first opportunity, the experimenter implemented booster training consisting of another session of BST + in situ teaching. Mastery criteria during booster training consisted of the participant emitting all components of the skill independently after re-teaching had occurred.

Experimental Design

A multiple baseline across skills design was used to determine the effectiveness of BST + IST on the acquisition of all three skills for each of the participants. Each participant started in baseline for the first 3 sessions. Within each baseline session, first opportunity probe data were collected for each of the three skills. After the initial baseline sessions, the experimenter began to teach the first skill, using the BST + in situ – total task presentation model. When a skill had been mastered, another baseline probe was conducted for the two remaining skills. Following the baseline probe, the second skill was taught, starting with the BST + in situ model. After the second skill was mastered, a final baseline probe was conducted. If the skill was not mastered, the experimenter began teaching the final skill. If a maintenance probe fell on the same day as the teaching of another skill, the experimenter started with the maintenance probe first before moving on to the skill that was currently in acquisition (e.g., push/turn/grab maintenance probe was conducted prior to the first opportunity probe for the acquisition target of float and yell for Castiel).

CHAPTER 3

RESULTS

Figure 1 shows the results for the baseline probes, BST + in situ probes, and maintenance probes for Dean. Data points on the Y-axis represent the scores received for the first opportunity probe at the start of each session, with the description of the score on the side. Data points marked with an asterisk (*) signify the follow-up probes conducted one week and one month following the mastery of the skill. Session numbers are represented along the X axis. Figure 2 shows the results for the baseline probes, BST + in situ probes, and maintenance probes for Sam. Figure 3 shows the results for the baseline probes, BST + in situ probes, and maintenance probes for Castiel.

During baseline, none of the participants was able to demonstrate all components of any of the skills. During BST + in situ total task presentation, Dean acquired all three skills, Sam acquired two skills, and Castiel acquired one skill. Sam and Castiel both required individual component teaching of the skill to reach mastery of the remaining skills. The number of sessions to mastery of all skills, including follow-up probes, was 13 for Dean, 18 for Sam, and 24 for Castiel. Both Sam and Castiel required a booster training session following the 1-month probe for float and yell. Dean did not need a booster session for any of his maintenance probes.

Individual component teaching proved to be sufficient for the Sam and Castiel to acquire the skills not acquired during the total task presentation of each skill. Once the skill was broken into components, both participants were able to acquire the skills quickly. It is important to note that no generalization across skills occurred during either of the teaching interventions for any of the participants. It was found, however, that the participants seemed to be able to acquire the skill of roll front to back the fastest of all the skills (it only took one teaching session for all participants to reach a level 1 on the skill; it was therefore mastered within 3 sessions following the first teaching session). Similarly, the skill that both Sam and Castiel needed a booster session for was float and yell, suggesting it may have been the hardest of all skills taught. Both participants also needed the booster session at the 1-month follow-up probe, possibly showing that this particular skill is the least likely to maintain across time.

CHAPTER 4

DISCUSSION

In the current study, we evaluated the use of behavioral skills training + IST to teach in-water safety skills to children with developmental disabilities. The first level of instruction consisted of total task presentation of the skills using BST + in situ training. The intervention in this level consisted of verbal instructions, modeling, rehearsal, and corrective feedback and praise in a total task presentation (i.e., all components of each skill were to be performed at once). The second level of intervention was only implemented when three sessions passed without an increase in performance level, and targeted individual components of the skill. While the level of instruction necessary to master a skill varied across participants and across skills for each participant, all participants were able to master all three skills.

The total task presentation of each skill using BST, although sufficient for some of the participants and some of the skills, it was not effective for all participants or skills. Only one of the participants, Dean, was able to master all three skills with the total task presentation intervention. Dean also maintained all skills at one week and one month past mastery date. Sam and Castiel both maintained two of the three skills at the one week and one-month maintenance dates. This study is consistent with other findings that the inclusion of IST with BST increases skill maintenance (Miltenberger, 2008). It should be noted, however, that completing these skills in a setting other than a pool (thus no longer being "in situ") would be nearly impossible, especially with push/turn/grab. The skills taught during this study necessitate a pool setting, which qualifies as "in situ" training due to the nature of the skills.

BST + IST as an intervention package was sufficient and efficient in teaching three individuals with a diagnosis of developmental disabilities three water safety skills. It took Dean 13 sessions, or approximately 5 hours to learn all three skills. Sam required 18 sessions, or approximately 7 hours, to learn all three skills. Castiel required 24 sessions, approximately 11 hours, to master all three skills. While the skills are geared towards being lifesaving and helpful in preventing drowning, the time spent teaching and practicing is short enough that efficient workshops and programs could developed. Additionally, using a BST approach to training instructors how to teach these skills could be an ideal method to help spread this intervention package. By using video-modeling, written instructions, and a short workshop, it might be possible to train instructors on how to use the procedures described in this study to help teach other children with developmental disabilities these potentially life-saving skills. A total treatment package of consisting of videos modeling correct teaching, manuals describing procedures and troubleshooting techniques, as well as data sheets and lists of possible materials needed could be developed for this purpose. Future research could target procedures to disseminate this training package.

This study is significant in that no study to had attempted to evaluate in-water safety skills with children with ASD. Given that such a large portion of children with developmental disabilities is prone to elope from caregivers and their homes (Anderson et al. 2012) and may be at risk of drowning when this occurs, this study may prove important in helping teach these children how to stay alive in and around the water.

There are several limitations to this study that should be noted. First, all participants were able to imitate gross motor movements, were generally able to follow instructions, were able to understand and repeat back contingencies, and had adequate language and communication skills (see Table 1 for further participant information). The generality of the findings may therefore be limited to portion of the total population of those with ASD, albeit a fairly large portion. Future research could evaluate what pre-requisite skills are necessary for this training approach to be successful.

Second, although the skills are meant to be used together, they were not taught together as a chain (i.e., the experimenter did not have the child attempt push/turn/grab, then roll onto their back and yell for help, then roll back and reach the fixed point of safety). While each of the skills, in theory, could be useful in isolation (e.g., if the child fell into the family pool without a life jacket on), they can also be used together as a behavior chain. After the conclusion of the study, the experimenter informally probed the skills as a chain with Sam. The experimenter modeled the complete chain a few times and observed the child perform it with moderate accuracy. Further research should focus on whether teaching all the skills individually is sufficient or if the chained performance should be taught as a fourth skill. Despite this concern, there are several situations that children could face in which one of the skills would be useful. For example, a child could use push/turn/grab if they fell into their backyard pool and were within 3-4 feet from the side. In addition, float and yell could be used if a child fell off a boat and was not near a fixed point of. However, if a child was further than 5 feet away from a fixed point of safety but it was in sight, the chain of push/turn/grab, roll front/back, and float and yell could be used to draw attention to themselves or get themselves to safety.

The results of the current study suggest several additional avenues for future research. First, further research should examine more closely what prerequisites a child should have prior this training. All participants in this study were able to imitate gross motor movements and follow one-step and some multi-step instructions. It is clear that a strong receptive language repertoire was necessary, because much of the feedback and instruction was provided verbally. In addition, visual models were presented, necessitating an imitative repertoire in the learners. It is possible that the intervention may not have been effective in the absence of these prerequisites. Due to the fact that not all children with developmental disabilities have the same level of prerequisite skills, it is important to determine what modes of training are necessary and sufficient to accommodate different learners.

Second, all the skills were taught separately and, with the exception of Sam, were never probed together to see if a behavior chain could be emitted without explicit teaching. As mentioned previously, while each of the skills are important in isolation, different combinations of the skills may also prove helpful in numerous situations. Further research should evaluate if any combinations generalize without teaching. If no behavior chains emerge without explicit teaching, research should further examine a total task presentation approach as a method of teaching the skills, along with evaluating the maintenance of the skills once they have been taught.

In addition, although several mainstream programs state they offer swim instruction to children with ASD, not all of them offer training for staff regarding how to interact with students with ASD or how to teach them. Future research should not only examine teaching others how to teach individuals with disabilities but also should compare standard swim lessons with the present method of teaching the same skills.

Lastly, the present study shifted intervention from total task presentation of the skill to individual component presentation after 3 sessions had passed without an improvement in performance. It is unclear whether the time provided for was long enough to evaluate if this specific intervention approach could have been effective. Further research should examine whether or not total task presentation of the skill using BST + IST is sufficient for skill acquisition given a more extended time frame for the acquisition to occur (e.g., the intervention shifts to individual component presentation after 10, 12, or 15 sessions without progress in the total task presentation of the skill).

Anderson et al. (2012) found that of the caregivers who reported that their child eloped, 56% of them listed their child's elopement behavior as being one of the highest stressors in their life. A child who elopes from the home will often encounter greater risks that children who remain near a parent, including drowning in a nearby body of water. The present study sought to start a new line of safety skills research and evaluate a method of teaching in-water safety skills to children with developmental disabilities, with the ultimate goal of reducing the number of drowning related deaths in children with disabilities.

Table 1

Participant Demographics Including Age, IQ, and Diagnosis

Participant	Age	IQ	Diagnosis
Bobby	8	60	Autism Spectrum Disorder
Castiel	8	91	ADHD
			Autism Spectrum Disorder
			Conduct Disorder
			Disruptive Behavior Disorder
			Sleep Disorder
Crowley	4	*	Autistic Disorder
			Delayed Milestones
Dean	8	83	Autism Spectrum Disorder
			Developmental Reading Disorder
			Anxiety Disorder
			Developmental Speech Disorder
Sam	7	74	Anxiety Disorder
			ADHD
			Autism Spectrum Disorder
			Sleep Disorder

Table 2

Scale Rating For Push/Turn/Grab Skill

Scale Rating	Description
0	Did not attempt skill/did not demonstrate any components of the skill
1	ımped in, but did not make forward progress for at leas seconds.
2	Jumped in, made forward progress for at least 3 seconds, but did not locate fixed point of safety within 10 seconds.
3	Jumped in, made forward progress for at least 3 seconds, located and grabbed onto fixed point of safety within 10 seconds.

Table 3

Scale Rating For Float and Yell

Scale	Description
0	Did not attempt skill/did not demonstrate any components of the skill
1	Floated for at least 5 seconds with face out of water but did not call for help
2	Floated for less than 15 seconds but may or may not have called for help
3	Floated for 15seconds and called for help until help arrives

Table 4

Scale Rating For Roll Front to Back

Scale	Description
0	Did not attempt skill/did not demonstrate any components of the skill
1	Required total assistance to roll
2	Made independent attempt but needed assistance to complete the roll
3	Independently rolled from front to back

Table 5

Procedural Steps for Baseline, Total Task Presentation, & Individual Component Presentation

Intervention Phase	Procedural Steps
Baseline	* Experimenter is in the pool prior to giving any instructions pertaining to the participant being in the water. * Experimenter ensures safety during attempts, if applicable, by retrieving child if unable to get to the side or holding on to the side.
Total Task Presentation	* Experimenter conducts probe prior to beginning intervention. * Experimenter models the behavior 2-3 times. * Participant asked to complete skill. * Experimenter will provide feedback (can be verbal or modeling of correct skill) and praise (can be verbal praise, high fives, tickles, etc.).
Ind. Component Presentation	* Experimenter is in the pool prior to giving any instructions pertaining to the participant being in the water. * Experimenter asks participant to attempt the skill. * Experimenter provides feedback (can be verbal feedback or modeling of the correct response. * Experimenter models skill for participant. * Experimenter provides physical prompting, if necessary. * Experimenter breaks skill into smaller components, if necessary.

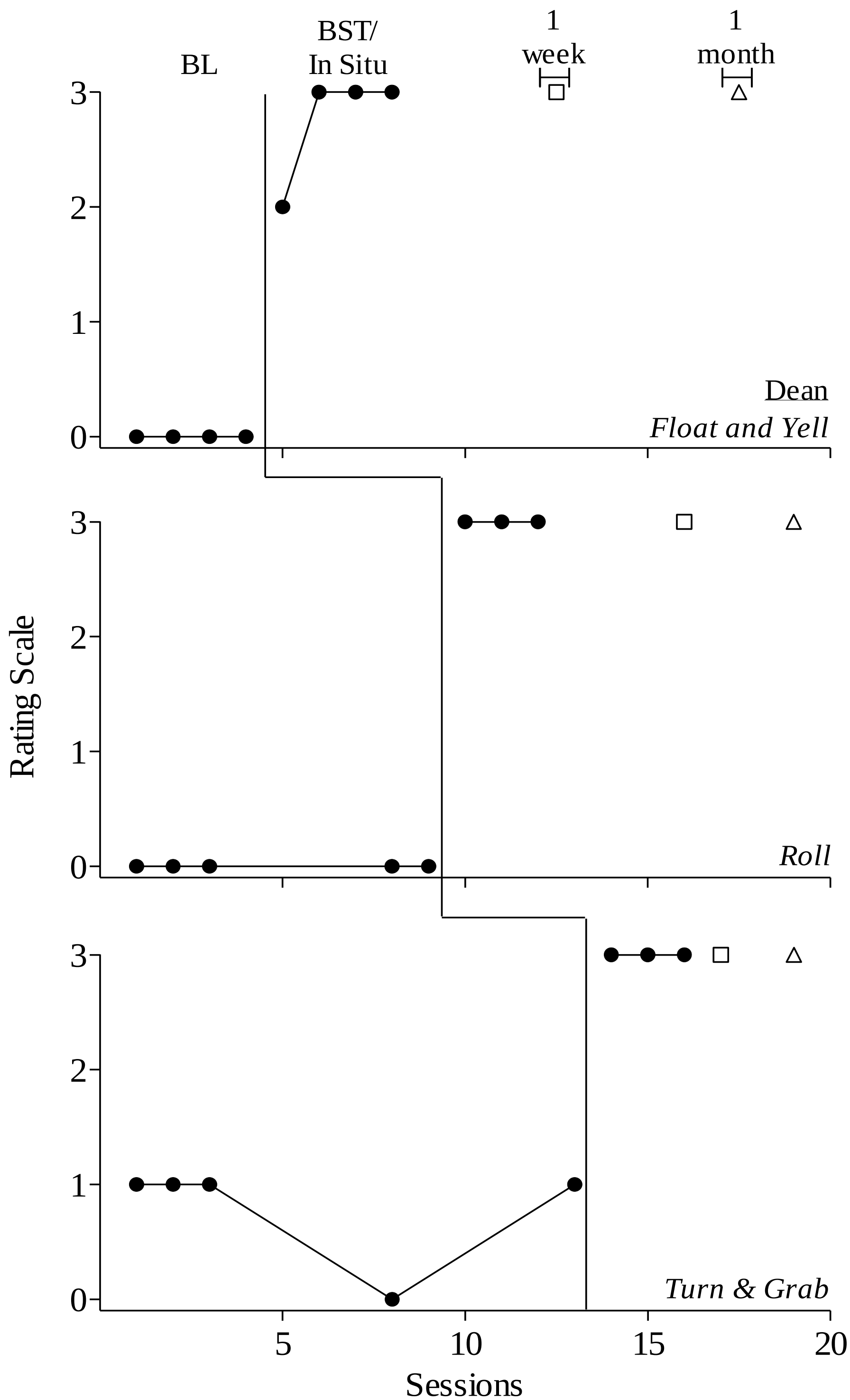

Figure 1. Results for skills float & yell, roll front to back, and push, turn grab for Dean.

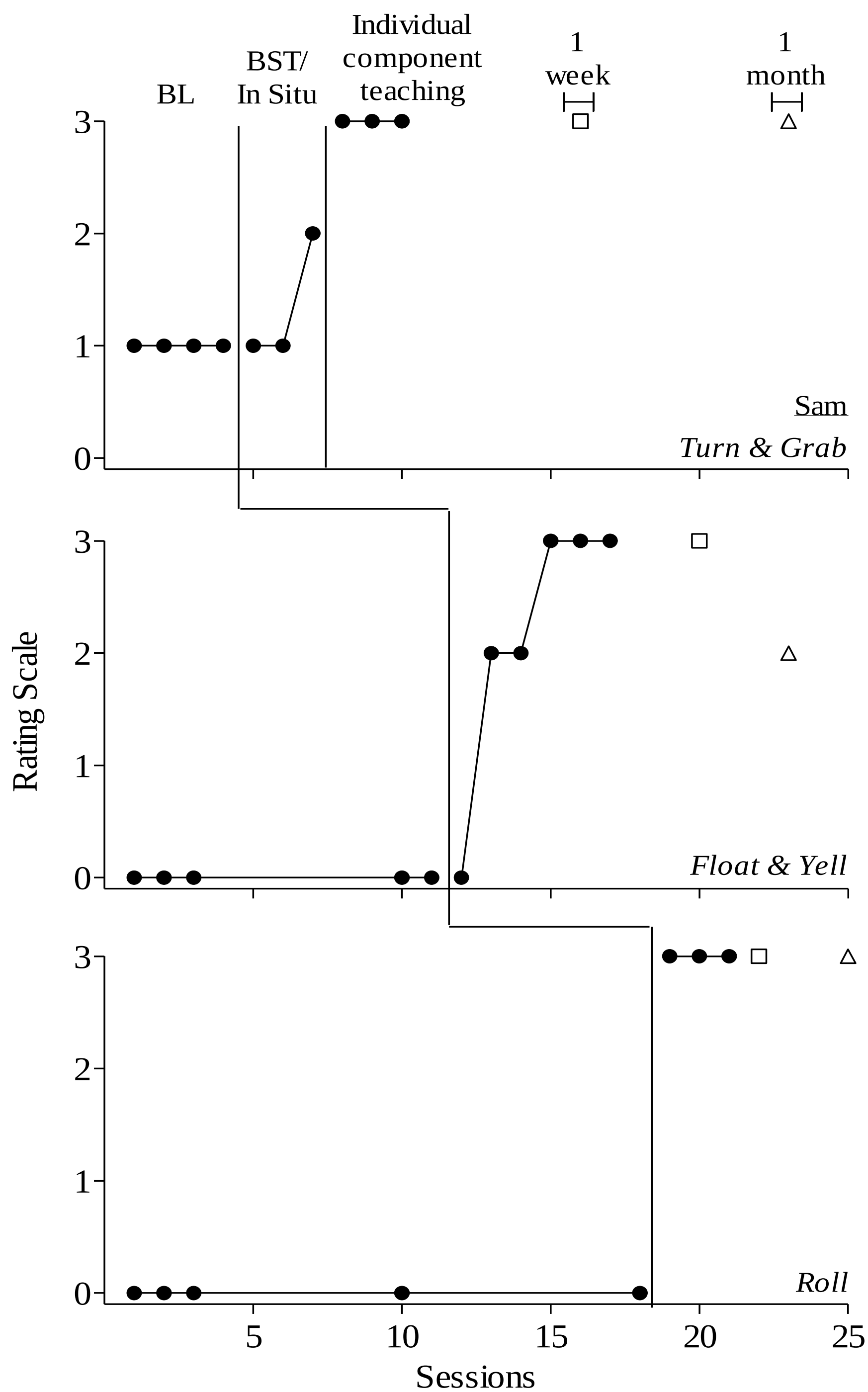

Figure 2. Results for push/turn/grab, float and yell, and roll front/back for Sam.

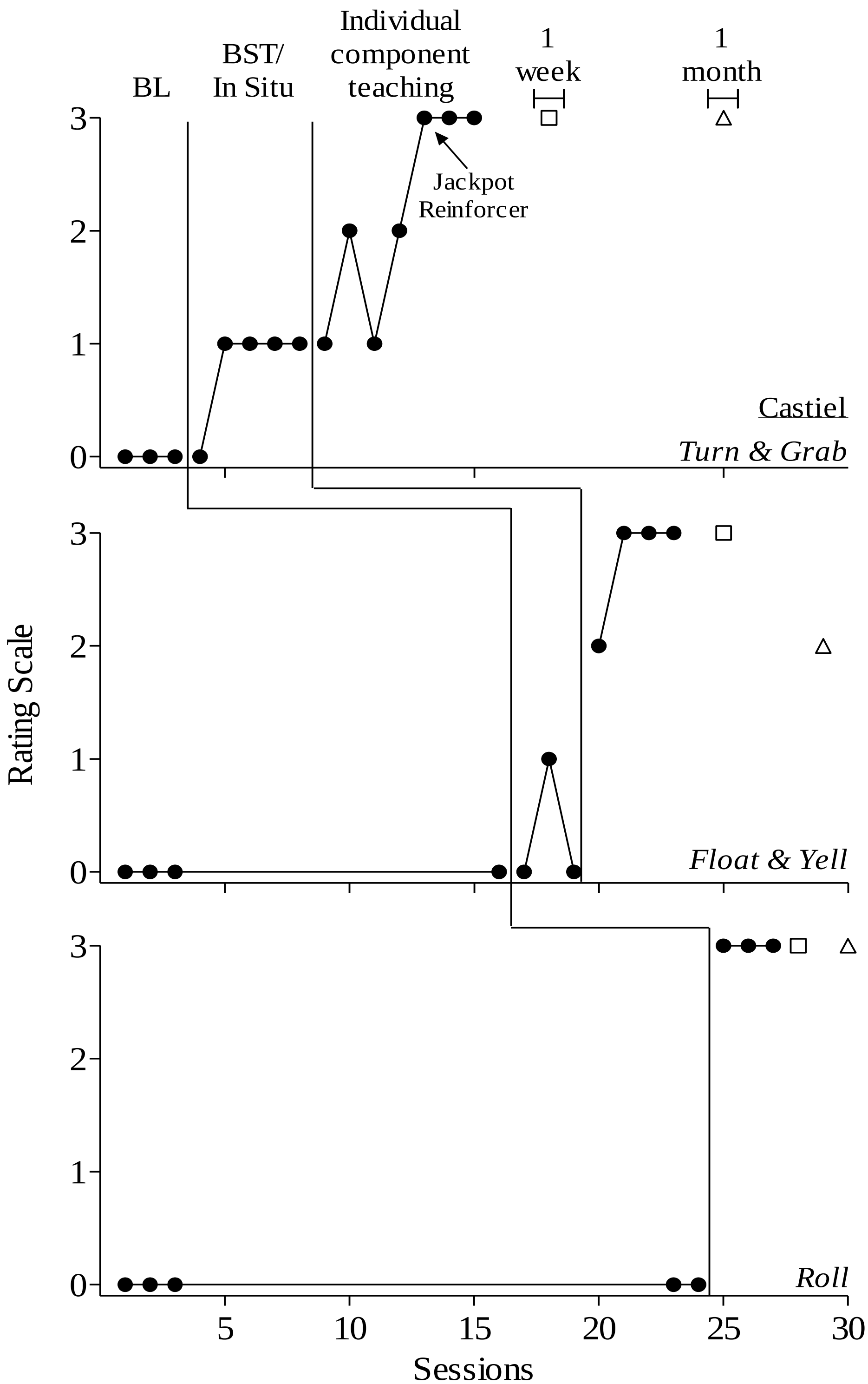

Figure 3. Results of push/turn/grab, float & yell, and roll front/back for Castiel.

REFERENCES

Anderson, C., Law, J. K., Daniels, A., Rice, C., Mandell, D. S., Hagopian, L., & Law, P. S. (2012). Occurrence and family impact of elopement in children with autism spectrum disorders. *Pediatrics, 130,* 870-877.

Asher, K. N., Rivara, F. P., Felix, D., Vance, L., & Dunne, R. (1995). Water safety training as a potential means of reducing risk of young children's drownings. *Injury Prevention, 1,* 228-333.

Gunby, K. V., Carr, J. E., LeBlanc, L. A. (2010). Teaching abduction-prevention skills to children with autism. *Journal of Applied Behavior Analysis, 43,* 107-112.

Fournier, W. (2013). *Wandering and Autism: What we know and what we need [PowerPoint Slides].* Retrieved from: http://iacc.hhs.gov/events/2013/slides_wendy_fournier_070913.pdf

Fueyo, V., Saudargas, R. A., & Bushell, D. (1975). Two types of feedback in teaching swimming skills to handicapped children. *Perceptual and Motor Skills, 40,* 963-966.

Killian, K. J. (1988). Teaching swimming using a backward chain sequence. *Journal of Physical Education, Recreation, & Dance, 59,* 82-86.

Lumley, V. A., Miltenberger, R. G., Long, E. S., Rapp, J. T., & Roberts, J. A. (1998). Evaluation of a sexual abuse prevention program for adults with mental retardation. *Journal of Applied Behavior Analysis, 31,* 91-101.

Miltenberger, R. G. (2008). Teaching safety skills to children: prevention of firearm injury as an exemplar of best practice in assessment, training, and generalization of safety skills. *Behavior Analysis in Practice, 1,* 30-36.

Rogers, L., Hemmeter, M. L., & Wolery, M. (2010). Using a constant time delay procedure to teach foundational swimming skills to children with autism. *Topics in Early Childhood Special Education, 30,* 102-111.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III.* Itasca, IL: Riverside.

Yilmaz, I., Konukman, F., Birkan, B., & Yanardag, M. (2010). Effects of most to least prompting on teaching simple progression swimming skill for children with autism. *Education and Training in Autism and Developmental Disabilities, 45,* 440-448.