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Using a Constant Time Delay Procedure to Teach Foundational Swimming Skills to Children With Autism

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Abstract

The purpose of this study was to evaluate the effectiveness of using a constant time delay procedure to teach foundational swimming skills to three children with autism. The skills included flutter kick, front-crawl arm strokes, and head turns to the side. A multiple-probe design across behaviors and replicated across participants was used. Results of the study indicated that the constant time delay procedure was effective in teaching foundational swimming skills to the three children. Implications for future research and practice are presented.

Keywords

autism, instruction, swimming, time delay

The constant time delay (CTD) procedure is a response-prompting strategy promoting near errorless learning (Wolery, Ault, & Doyle, 1992). The CTD procedure has been used successfully to teach a variety of discrete behaviors such as expressive signing, reading sight words, and naming pictures (Wolery et al., 1992). CTD has been implemented in 1:1 arrangements, small groups, and embedded into ongoing activities and routines (Wolery et al., 1992). It also has been used to teach a variety of chained skills such as making a snack, responding to lures from strangers, applying first aid, and putting on clothing (Schuster et al., 1998). In research on CTD, the procedure has been implemented by research staff, teachers, teaching assistants, and peers in a variety of settings. The individuals who have been taught include preschoolers to adults with a full range of disabilities (Schuster et al., 1998; Wolery et al., 1992). Children diagnosed with an autism spectrum disorder also have been taught successfully with CTD (Ault, Wolery, Gast, Doyle, & Eizenstat, 1988; Tetkin et al., 2001). Thus, the procedure is both effective and flexible.

The CTD procedure also has been compared to other response-prompting procedures (e.g., increasing assistance and progressive time delay). Across both discrete and chained behaviors, two replicated findings emerge from these comparative studies (Ault et al., 1988; Ault, Gast, & Wolery, 1988; Doyle, Wolery, Gast, & Ault, 1990; Wolery, Ault, Gast, Doyle, & Griffen, 1990). First, both procedures result in learning; second, the CTD procedure results in more rapid learning. Rapidity of learning is often measured in terms of number of trials or sessions to criterion, number of minutes of instruction to criterion, and number and percentage of errors to criterion. Based on these studies, it appears that CTD is an efficient, evidence-based instructional strategy.

CTD also has been effective in teaching leisure skills such as playing Jenga, Checkers, UNO, croquet, bean bag toss, and using a walkman to individuals with developmental disabilities (Wall & Gast, 1997; Wall, Gast, & Royston, 1999). Few studies exist, however, using the CTD procedure to teach leisure skills to young children with autism (Tetkin et al., 2001). Unlike some leisure activities and skills taught to young children with autism that are primarily important during childhood (e.g., playing games with peers on the playground), swimming has a number of desirable characteristics. First, swimming is a longitudinal leisure activity; that is, it is age appropriate throughout the individual's life—as a child, adolescent, or adult. Second, swimming may have health promotion benefits because it constitutes vigorous exercise. This exercise occurs in a defined space (i.e., pool), which when supervised constitutes a safe

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activity as compared to running, which may occur in less well defined areas and pose potential for pedestrian hazards. Third, swimming is an exercise and leisure activity with an appropriate mix of isolate and social skills. Swimming laps allows for minimal contact with others, but many other types of swimming set the stage for the use of social skills. Families can incorporate swimming into naturally occurring outings with appropriate socialization. Fourth, having the ability to swim increases the individual's safety when near bodies of water; as such, it is a safety skill.

Some studies have reported that water exercises and swimming activities are enjoyable for children with autism and can be used to promote aquatic orientation and decrease stereotypic behavior (Killian, Joyce-Petrovich, Menna, & Arena, 1984; Yilmaz, Yanardag, Birkan, & Bumin, 2004). Current, published literature contains one example of a study using a CTD procedure to teach aquatic play skills to children with autism (Yilmaz, Birkan, Konukman, & Erkan, 2005). However, no studies exist on the effects of using a CTD procedure to teach specific swimming skills to children with autism. The purpose of the current study was to address the following research question: Will the use of a 4-second CTD procedure be effective in teaching foundational swimming skills to three children with autism? These foundational swimming skills include flutter kick, front-crawl arm strokes, and head turns to the side.

Method

Participants

Three children met the inclusion criteria, which were as follows: (a) the child possesses gross motor abilities necessary to perform the target skills, (b) the child does not correctly perform the specific target behaviors, (c) the child does not demonstrate behaviors indicating fear of the water, and (d) the child enters the pool to his waist level independently or with minimal assistance. Six children were screened, three of whom met inclusion criteria and became participants. During the screening sessions, the trainer and child entered the pool. Inclusion criteria were assessed by the trainer through direct observation and interviews with the parent. The parent sat at a table on the pool deck while the trainer and child approached the water. During pool entrance, the trainer followed the child's lead as much as possible and provided minimal assistance when necessary (e.g., holding hands). During these sessions, the trainer and child played simple trainer-assisted games without strict format (e.g., pulling child across water, blowing bubbles, splashing). During the screening sessions, the trainer did not provide prompts for the child to use the target skills. Each child had one screening session, which lasted 20 to 30 min. These sessions helped familiarize each child with the pool, the kickboard, and the trainer. The trainer also gained an understanding of what particular activities each individual child found to be reinforcing in the pool (e.g., splashing, jumping). This information helped the trainer determine individualized reinforcement procedures for participants.

The three participants were boys. Richie was 4 years old and had been diagnosed with autism; he celebrated his fifth birthday during the last few weeks of the study. Richie attended an inclusive early childhood education program located on the campus of Vanderbilt University. He received services from a speech–language pathologist (SLP) in his preschool classroom. Richie could name colors and shapes. On average, he spoke in three- to four-word sentences at the beginning of the study. During the course of this study, Richie was a participant in another study using a response-prompting procedure (progressive time delay) to teach feeding skills. The other study was conducted by a graduate student colleague and took place each day in Richie's early childhood classroom. Prior to these two studies, however, Richie had not had any systematic experience with response-prompting procedures. Two years prior to this study, Richie attended eight swimming classes at a local YMCA with his father, where instructors sought to teach the flutter kick skill and promote basic water exploration for young children. During Richie's screening session and initial probe sessions, Richie demonstrated a brief flutter kick; however, this behavior was not demonstrated consistently.

Bobby was 4 years old and had been diagnosed with pervasive developmental disorder–not otherwise specified (PDD-NOS); he attended a local inclusive early childhood center where he received services from a speech–language pathologist (SLP). Bobby could name colors and shapes. On average, Bobby spoke in three- to five-word sentences at the beginning of the study. He had no prior systematic experience with response-prompting procedures. Bobby's parents reported that he had had no experience being in a swimming pool prior to this study, and he exhibited no foundational swimming skills during his screening session.

Tommy was 5 years old and had been diagnosed with autism; he attended an inclusive early childhood preschool program in a public elementary school. He received services from an SLP two times per week. Tommy could name colors, shapes, and liked to talk about sea animals. He had no prior experience with response-prompting procedures. Before the study, Tommy had never participated in swimming lessons and exhibited no foundational swimming skills during his screening session. Although he had been in a neighbor's swimming pool a few times the previous summer, his mother reported that he always insisted on being carried by his mother and he held her with a tight grip while in the water.

Trainer

The trainer was a graduate student with American Red Cross certification in CPR, Lifeguard, and First Aid. She had 2 years' experience teaching individual swimming lessons to children 3 to 7 years old. The trainer conducted all experimental sessions and acted as the primary observer in this study. While in the pool, the trainer was always within an arm's reach of the participants throughout the course of the study.

Setting

All sessions were conducted in the indoor swimming pool of a student recreation center located on the campus of Vanderbilt University. All sessions were conducted in a one-to-one format in the free-swim section of the pool. The free-swim area was 0.91 m deep, 22.86 m long, and designated by lane lines. Instructional sessions took place two to three times per week, with each session lasting from 45 min to 1 hr.

Materials and Equipment

Instructional materials consisted of a 50.80 cm by 28.58 cm Ocean™ Water Wonder kickboard, which was used across all conditions. For data collection, the trainer used multicolored hair bands strategically placed on each wrist during all sessions. Paper-and-pencil data collection sheets were used to collect interobserver agreement (IOA) and procedural fidelity data.

Table 1. Task Analyses for Foundational Swimming Skills

Skill	Steps
Flutter kick	1. Participant holds onto both sides of kickboard, body extended, facing forward, resting just below water surface.
	2. Trainer pulls kickboard through the water.
	3. Participant's legs and feet alternatively move up and down four times (collectively) at or just below the water surface.
Arm strokes	1. Participant holds onto both sides of kickboard, body extended, facing forward, resting just below the water surface.
	2. Participant's body rests just below water surface while trainer pulls kickboard through the water.
	3. Participant moves one hand off the kickboard, directly down into the water.
	4. Participant rotates arm in circular motion, down past body. Arm breaks water surface near upper thigh, reaches up and over, until hand is brought back to resting position on kickboard.
Head turns	1. Participant holds onto both sides of kickboard, body extended, facing forward, resting just below the water surface.
	2. Trainer pulls kickboard through the water.
	3. Without moving body, participant turns head and neck (about 90 degrees) to the right side (if right-handed; to the left side if left-handed) so the left ear faces down toward the pool floor.

General Procedures

During all conditions, the trainer met the participant and the participant's primary caregiver(s) at the entrance to the Student Recreation Center. Once at the pool, the caregiver then sat at a table on the pool deck, while the trainer and child approached the water. During pool entrance, the trainer followed the child's lead to and down the pool steps, providing minimal assistance (e.g., holding the child's hands) when necessary. Every session began with water play (e.g., blowing bubbles, splashing) for approximately 5 min as a warm-up period. This water play continued throughout the course of the session, before and after the completion of each trial. All sessions occurred in a 1:1 format.

Target Behaviors and Data Collection

The target behaviors were flutter kick, front-crawl arm strokes, and head turns to the side. These behaviors were selected as they are considered to be foundational to learning more sophisticated swimming skills. They also allow the child to be more independent in the water. The trainer developed task analyses for each behavior by completing the behaviors herself as well as observing children without disabilities perform the behaviors. Task analyses for each skill are described in Table 1.

All participant behaviors were recorded by the trainer using an event recording system. The trainer wore multicolored hair bands strategically placed on each wrist during all sessions. Different color hair bands signified different responses. For example, blue hair bands signified correct responses, and red hair bands represented incorrect responses. During 4-s delay trials, hair bands placed on the trainer's left wrist signified unprompted responses. Hair bands placed on the trainer's right wrist signified prompted responses. Thus, blue and red hair bands on the trainer's left wrist signified unprompted correct and unprompted error responses, respectively. Blue and red hair bands on the trainer's right wrist signified prompted correct and prompted errors responses, respectively. The trainer pulled the representative hair band up her arm to record the participant's responding. The first trial's hair band was pulled up the highest on the arm, the second hair band just below that, and so on. At the end of each session, the trainer counted the hair bands by color and transferred the counts to a paper data collection sheet. This data collection system was optimal because it was easy to use during sessions in the pool. The system was portable and unaffected by water, and it allowed the trainer to hold on to the participant with one hand, while moving the hair band with the other hand.

Experimental Design

A multiple-probe design (Horner & Baer, 1978) across three behaviors (foundational swimming skills) and replicated across three participants was used to determine the effectiveness of the CTD procedure in teaching foundational swimming skills. Experimental control was demonstrated by low level of correct responding before CTD was used, followed by criterion-level responding after the implementation of CTD. The multiple-probe design allowed the researcher to probe behaviors concurrently during each probe condition to ensure no target skills had been learned prior to instruction and to assess maintenance. The independent variable was applied to each behavior in a time-lagged fashion.

Probe sessions. Probe sessions were conducted prior to the instruction on each skill. Probe sessions also were conducted after each participant achieved criterion-level performance (100% unprompted correct responding for three consecutive sessions) on a given skill. Prior to beginning instruction, a minimum of three probe sessions was conducted for each foundational swimming skill or until data were stable. Once criterion level of performance was achieved on the first skill, a minimum of three more probe sessions was conducted on all three targeted skills. When criterion was met for the second skill, a third series of three probe sessions was conducted on all three targeted skills. When criterion level of performance was met for the third skill, the final series of three probe sessions was conducted on all three skills.

Each probe session consisted of 12 trials (4 trials per skill), each of which was embedded in aquatic play. Prior to a trial, the trainer handed the child the kickboard and waited until the child was grasping the kickboard before delivering a task direction. Four trials of the flutter kick skill were probed initially, followed by four trials of the front-crawl arm stroke, and finally four trials of head turns to the side were probed. Trials consisted of the trainer securing the participant's attention (e.g., saying participant's name), presenting a task direction (e.g., "kick feet"), and waiting a 4-s response interval. During all probe sessions, three student responses were possible: (a) unprompted corrects, (b) unprompted errors, and (c) no responses. Unprompted correct responses occurred when a participant initiated and completed the steps of the task analysis within 4 s of the task direction. Unprompted correct responses resulted in delivery of nonspecific verbal praise (e.g., "good job") on a continuous reinforcement schedule (CRF). The trainer then moved the correct hair band to record the response. Unprompted errors were recorded when a participant (a) initiated but did not complete the task analysis, or (b) made a topographical error in the task analysis step(s) within 4 s of the task direction. The trainer ignored unprompted errors and recorded the response. No responses were recorded if the participant did not initiate the task analysis within 4 s of the task direction. The trainer ignored no responses, and then recorded the response. After a 30- to 60-s intertrial interval, the trainer delivered the next trial.

Instructional sessions. Each session consisted of eight instructional trials with a 30- to 60-s intertrial interval. The controlling prompt for all target behaviors was physically prompting the child through each step of the task analysis. The controlling prompt presented for the flutter kick behavior was the trainer placing her hands on the child's feet and physically assisting him through the steps of the task analysis. The trainer used a hand-over-hand technique to present the controlling prompt for the front-crawl arm stroke; she placed her hand over the child's hand and wrist and physically guided his hand and arm through the task analysis. Similarly, the trainer physically guided the child's head throughout the task analysis of the head turn behavior.

Instructional sessions consisted of two types of trials: 0- and 4-s-delay trials. All instructional sessions began with the trainer securing the child's attention (e.g., saying his name) followed by administration of a task direction (e.g., "kick feet"). The initial instructional session for each skill consisted of 0-s-delay trials in which the trainer delivered the appropriate controlling prompt immediately following the task direction (no delay between task direction and prompting). During the 0-s-delay trials, criterion-level performance was 100% prompted correct responding for three consecutive sessions. Although much of the literature with CTD uses one or two sessions of 0-s-delay trials (Schuster et al., 1998), three sessions were deemed appropriate for these skills to ensure safety and to provide over learning opportunities. Two child responses were possible during 0-s trials: (a) prompted correct and (b) prompted error. Once the criterion level of performance was met for a skill, a 4-s delay trial was used during all subsequent instructional sessions.

During 4-s-delay trials, criterion level performance was 100% unprompted correct responding for three consecutive sessions. After administering the task direction in these sessions, the trainer waited 4 s for a child response. If the child did not respond within the 4 s, the controlling physical prompt was provided. Four participant responses were possible during these trials: (a) unprompted correct, (b) unprompted error, (c) prompted correct, and (d) prompted error. Unprompted correct responses occurred when the participant initiated the task analysis within 4 s of the task direction and correctly completed the subsequent steps of the task analysis. Unprompted correct responses resulted in specific verbal praise (e.g., "Good job, you kicked feet.") by the trainer on a CRF schedule. Unprompted errors occurred when the child initiated an incorrect response within 4 s of the task direction. Examples of unprompted errors included (a) the boy only moving legs and feet alternately up and down two times, (b) the participant initiating the arm stroke by putting his hand down into the water and paddling underwater, and (c) the participant lifting his head out of the water facing forward. The unprompted error responses were immediately interrupted by the trainer, by saying "wait," followed by provision of the controlling prompt.

Prompted corrects occurred when the participant did not initiate a correct response within 4 s of the task direction, the controlling prompt was presented, and the child did the correct behavior. Prompted correct responses resulted in nonspecific verbal praise (e.g., "Good job.") by the trainer on a CRF schedule. Prompted errors occurred when the participant did not initiate a response within 4 s of the task direction and physically resisted the trainer's controlling prompt. The trainer would immediately stop using the controlling prompt, terminate the trial, and ignore prompted errors for the length of one intertrial interval (30–60 s).

Reliability

Paper-and-pencil data sheets were used to collect IOA and procedural fidelity data. A graduate student collected these data for Richie. Bobby's mother and Tommy's father recorded these data for their children. Data collectors used a written recording system with tally marks, in which each tally mark signified one occurrence or attempt of the target skills.

To ensure the IOA data were collected independently of the trainer's data, the trainer did not explain her data collection system (e.g., the use of rubber bands on her arms) to the reliability observers. Thus, there was no way for them to know which color represented what type of response or how her use of the rubber bands related to their data collection. Other factors decreased the likelihood that the reliability observers could observe the trainer's data collection strategy: (a) the rubber bands were only 2 mm and from a distance, it was difficult to ascertain the color of the rubber band, and (b) most often, the trainer's hands and arms were underwater when the rubber bands were moved up the arm.

IOA and procedural fidelity data were recorded once for each child during each probe condition and twice during each instructional condition. The point-by-point method was used to calculate interobserver agreement. The number of exact agreements was divided by the number of agreements plus the number of disagreements and multiplied by 100 (Ayres & Gast, 2010).

The mean percentage of agreement for Richie during all conditions was 98.8%. The mean percentage of agreement during probe conditions was 100% and during instructional conditions was 97.9% (range = 87.5%–100%). The mean percentage of agreement for Bobby and Tommy during all experimental conditions was 100%.

Procedural fidelity was assessed to determine if the trainer's behaviors were implemented accurately and consistently across all conditions of the study (Billingsley, White, & Munson, 1980). Procedural fidelity data were collected on the same schedule, by the same observer, as IOA data. To calculate procedural fidelity, the number of accurate trainer behaviors observed was divided by the number of trainer behaviors planned and multiplied by 100 (Billingsley et al., 1980). Trainer behaviors observed for procedural fidelity data were (a) securing the boy's attention, (b) presenting the task direction, (c) waiting appropriate amount of delay before delivering the prompt, (d) recording correct responses, (e) delivering correct consequences, and (f) waiting an intertrial interval of 30 to 60 s.

Results

Procedural Fidelity

Procedural fidelity measures for Richie revealed that the trainer implemented procedures with 99.7% accuracy (range = 98.6%–100%) during probe and instructional conditions. The mean percentage of accuracy during probe conditions was 99.3. Two errors were made; in one case, the trainer did not wait the correct length of time for the intertrial interval and in the other, the trainer did not ignore an unprompted error. The trainer implemented procedures during instructional conditions for Richie with 100% accuracy. The trainer implemented procedures with 100% accuracy across all probe and instructional conditions for both Bobby and Tommy.

Effects of CTD

The percentage of unprompted and prompted correct responses for each foundational swimming skill for Richie, Bobby, and Tommy are shown in Figures 1 through 3, respectively. As shown in Figure 1, Richie did the flutter kick on one trial for each of the first two probe sessions. Prior to intervention, for all other probe sessions, all participants, and for each skill before use of the CTD, the percentage of unprompted corrects was 0. The initiation of the 0-s-delay trials resulted in 100% correct prompted responses for all participants and behaviors. Transfer of stimulus control from the prompt to the task direction occurred immediately on introduction of the 4-s-delay trials.

All participants achieved criterion-level responding for each skill. The minimum number of sessions to achieve criterion was six, three sessions at 0-second trials, and three consecutive sessions at 100% unprompted correct responses. Richie required eight sessions to achieve criterion on the first skill (flutter kick), but required the minimum number of sessions (six) for each of the other two skills. Bobby's

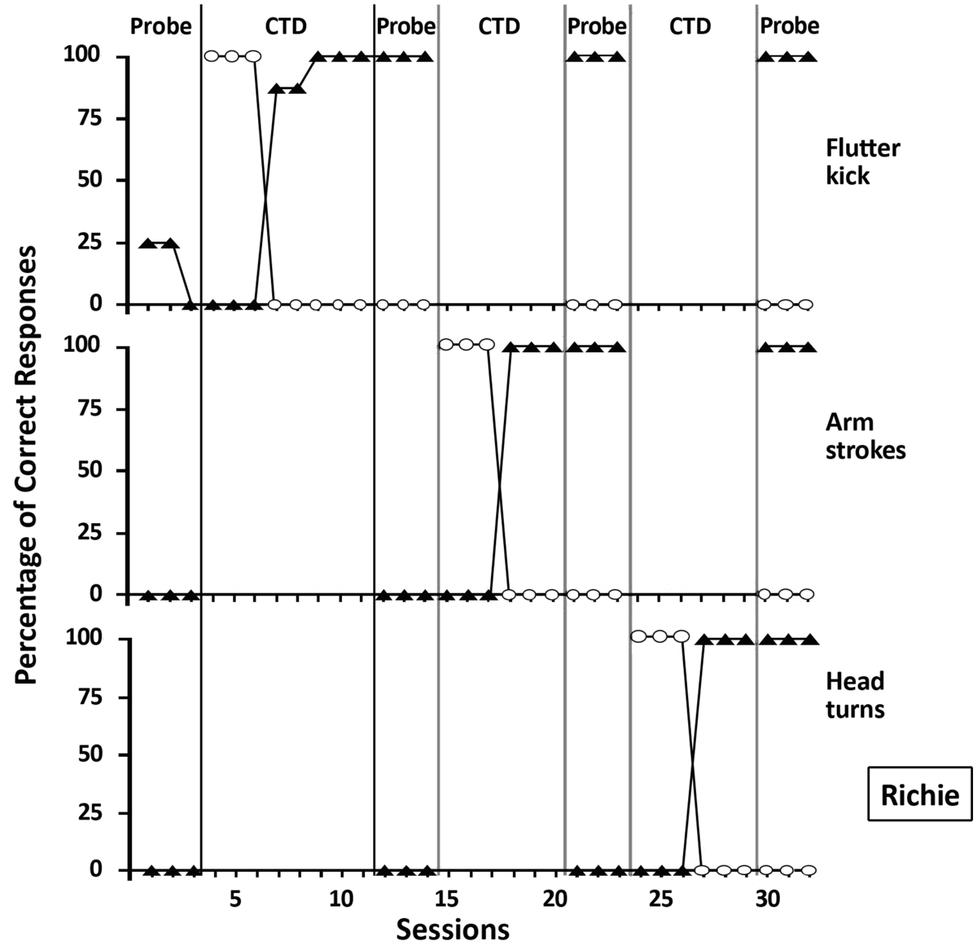

Figure 1. Percentage of correct responses for Richie during probe and instructional sessions
Closed triangles represent unprompted correct responses. Open circles represent prompted correct responses.

performance was identical to Richie's; he required eight sessions for the first skill and six for each of the other skills to achieve criterion-level responding. Tommy required the minimum number of sessions to achieve criterion-level responding on each skill. In terms of errors, Richie made two errors on the first skill and no errors on the other two skills. Bobby and Tommy did not make any errors.

Discussion

The purpose of this study was to evaluate the effectiveness of using a CTD procedure to teach foundational swimming skills to children with autism. Results of the study indicate that the CTD procedure was effective in teaching foundational swimming skills to the three children, and in doing so in a near errorless fashion. In fact, only Richie had errors, and both of his errors occurred on the first skill being taught. These findings support previous research conducted using the CTD procedure with children with autism (Ault et al., 1988; Tetkin et al., 2001) and using the CTD procedure to teach motor and leisure skills to individuals with developmental disabilities (Wall et al., 1999; Zhang, Gast, Horvat, & Dattilo, 1995). A previous study conducted by Yilmaz et al. (2005) found the CTD procedure to be effective in teaching aquatic play skills of kangaroo, snake, and cycling to four children with autism. These play skills were selected randomly from Halliwick's method of swimming rotation skills (Martin, 1981). The present study extends the current research by using the CTD procedure to teach foundational swimming skills to three children with autism.

In addition to the results described above, other changes in children's behaviors were reported anecdotally by families. During the course of this study, the parents of Richie and Bobby frequently commented on the positive effects

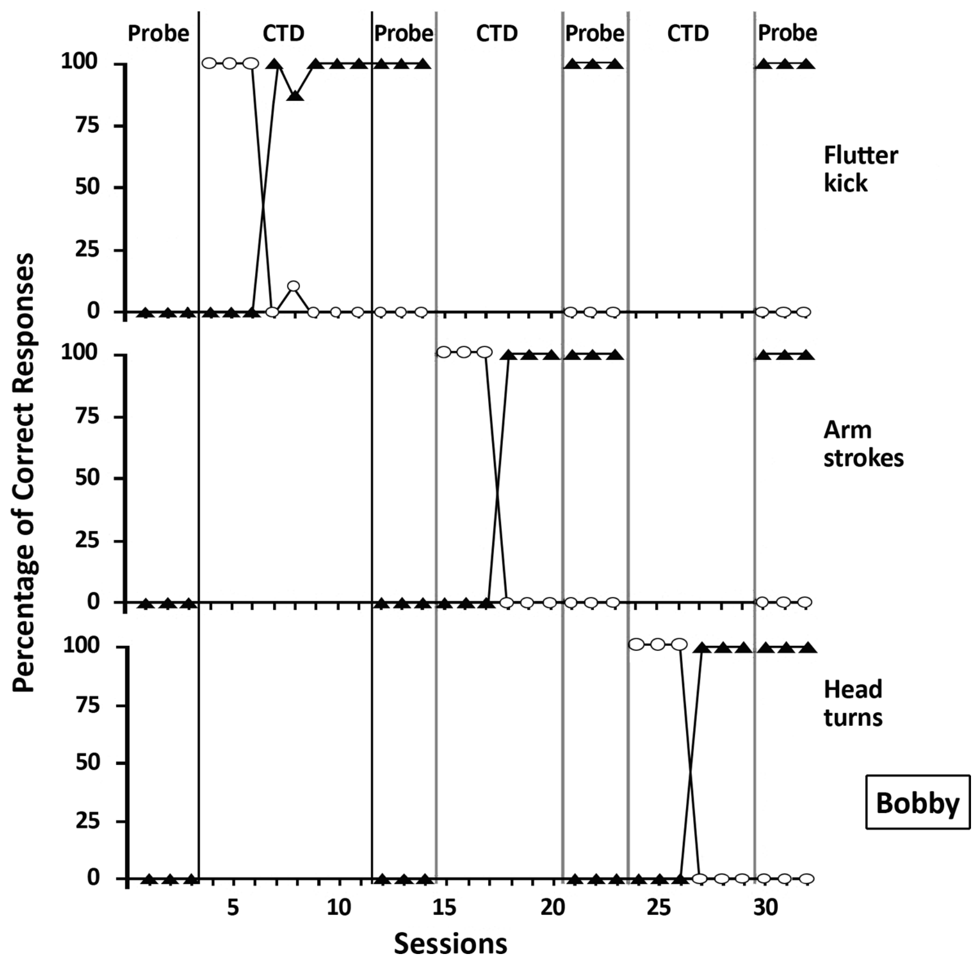

Figure 2. Percentage of correct responses for Bobby during probe and instructional sessions
Closed triangles represent unprompted correct responses. Open circles represent prompted correct responses.

the study was having on their children's language. Richie's parents noted significant increases in vocabulary, frequency of language use, and the length of his utterances. At the end of the study, Richie was speaking in some six- to seven-word sentences. During the period of time in which the study was being conducted, Bobby's classroom teacher and SLP commented to Bobby's parents about increases in the frequency, consistency, and appropriateness of his language both in the classroom and in private therapy. At the end of the study, Bobby was speaking consistently in 5 to 7-word sentences. Parents of both boys described how the changes in language had happened concurrently with the child's participation in the swimming study. Tommy's parents did not mention any gains regarding Tommy's language and communication; however, Tommy's attendance was inconsistent due to frequent illnesses. Previous literature has mentioned a possible positive correlation between aquatic activity and an increase in social and communication skills for children with autism (Yilmaz et al., 2005). Unfortunately, data were not collected systematically on changes in language and communication skills in the current study. In addition, the children were receiving SLP services outside the context of the study. Thus, although it is not possible to attribute the changes in children's language to participation in the study, several factors related to the study provide an explanation for why those changes might have occurred. First, the trainer in this study was highly attuned and responsive to the child's behavior in the pool, including responding to the children's initiations as well as commenting on what they were doing. Second, the time in the pool may have given children something more to talk about—increasing their motivation to be communicative. Third, being in the pool and engaging in

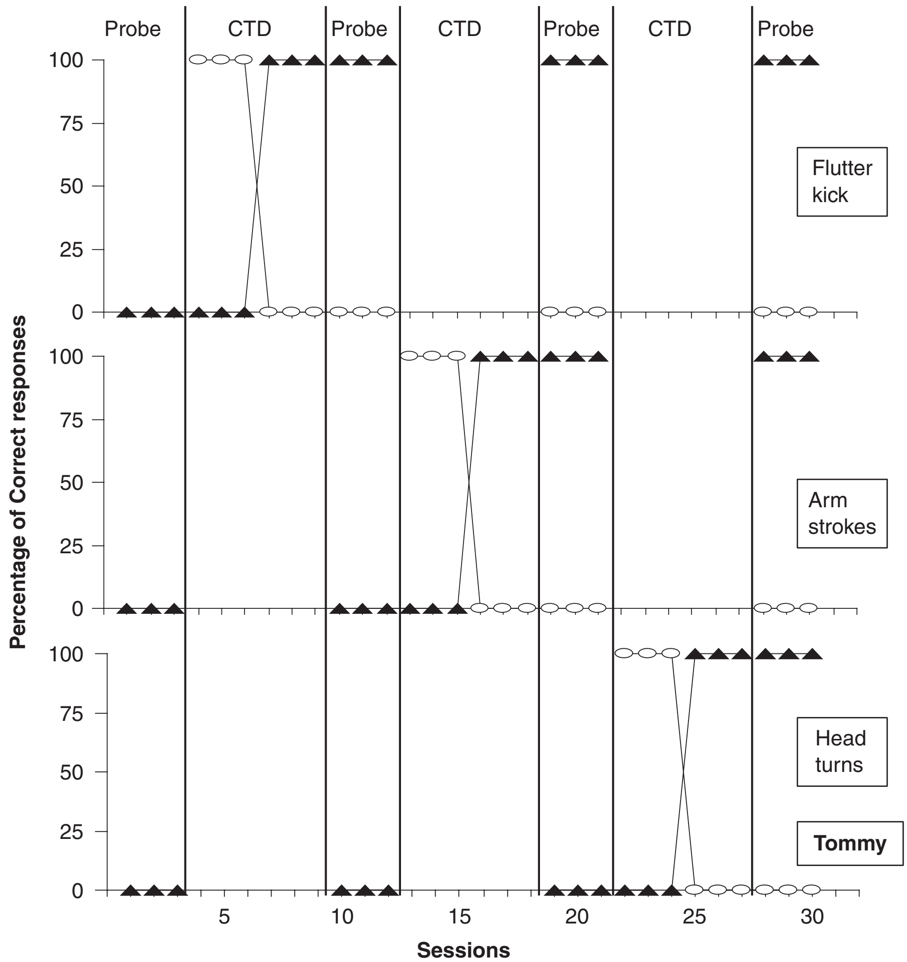

Figure 3. Percentage of correct responses for Tommy during probe and instructional sessions
Closed triangles represent unprompted correct responses. Open circles represent prompted correct responses.

the preswimming skills may have been sufficiently novel to increase the children's affect and motivation to be communicative. The anecdotal reports in the current study and in Yilmaz et al.'s study suggest future research in teaching aquatic play and foundational swimming skills should include at least pre- and post-test measures of language abilities. These might include mean length of utterance, frequency of communicative initiations, vocabulary measures, and perhaps standardized tests.

One limitation of this study was the restricted repertoire of behaviors taught (i.e., flutter kick, arm crawl stroke, and turning head side to side). These behaviors are foundational to swimming independently, but were not the actual act of swimming independently. Although data were not collected, Richie was observed using the flutter kick and front arm crawl stroke to swim independently outside of the teaching trials in the last ten sessions of the study. Future studies should attempt to teach these foundational skills and then move into teaching independent swimming. It is unclear whether the CTD procedure could be used in promoting independent swimming. Another limitation of the current study was the absence of generalization measures across settings and persons (i.e., trainers). All parents reported that their children used at least one of the target behaviors independently in other settings (e.g., other swimming pools, in the bathtub). Ideally, future studies would include periodic assessment of the foundational swimming skills in other pools and when supervised by other adults in the trainer's absence. Although the probe conditions in the current study allowed for the assessment of maintenance of skills learned in the first and second legs of the design, maintenance of the third skill as well as maintenance after the study ended was not measured. Given the importance of swimming as a leisure and safety skill, it will be important to know if these skills maintain across time and how they contribute to the child's progress toward learning to swim.

Although a reduction of stereotypic behavior has been reported previously as a result of physical activity, namely aquatic activity for children with autism (Killian et al., 1984; Sherill, 1986; Yilmaz et al., 2004; Yilmaz et al., 2005), stereotypic behaviors were not measured in this study. Anecdotally, the trainer did not observe any reductive effect, and the parents made no mention of changes in these behaviors during the course of the study. It is possible that changes in stereotypic behavior might have occurred outside the swimming context, and thus were not observed by the trainer. Furthermore, if changes had occurred in another context, the parents might not have associated those changes with the swimming study. Given that the study did not measure changes in stereotypic behavior and parents were not specifically asked about these changes, it is not possible to know if there was any effect on these behaviors. Other investigators may wish to measure such effects in both the pool setting as well as in classroom environments to assess this possibility more precisely.

All parents and the trainer reported that all three children appeared happy to be "swimming" in the pool. Parents reported all three boys frequently asked to go swimming at the pool with the trainer. The parents themselves all expressed satisfaction with the study. Parents mentioned they had trouble finding swimming lessons for their child with special needs and safety near water was a concern. All parents commented on how much their child loved being a part of the study and how beneficial they thought it was for their child. Although this provides some evidence of social validity, future studies should have more systematic approaches for measuring social validity in more objective ways. For example, do families actually take their children to pools to swim when such opportunities are available?

From this study, it is unclear to whom the findings can be generalized with confidence. The inclusion criteria for these boys were the physical abilities to do the targeted behaviors, absence of fear of getting in the water, and entry into the water with minimal assistance. In addition, these children did not resist or avoid the physical prompts delivered by the trainer in the pool. Thus, these elements appear to be the likely abilities of others to whom the findings might be relevant. Also, the trainer in this study was not a person who delivered other educational or therapeutic services to these children. It remains unclear whether the novelty of the trainer was a salient factor in the effectiveness of the procedure.

Authors' Note

The first author conducted this study as her thesis in partial fulfillment of the master's degree in the Department of Special Education, Peabody College, Vanderbilt University.

Declaration of Conflicting Interests

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