Effects of Constant Time Delay Procedure on the Halliwick’s Method of Swimming Rotation Skills for Children with Autism

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Abstract: Effects of a constant time delay procedure on the Halliwick’s method of swimming rotation skills (i.e., vertical and lateral rotation) for children with autism were investigated. A single subject multiple baseline model across behaviors with probe conditions was used. Participants were three boys, 8–9 years old. Data were collected over a 10-week period using the single opportunity method as an intervention. Results revealed that all subjects increased their correct rotation skills significantly during intervention. In addition, subjects maintained their successful skills during first, second and fourth week of generalization phases. Results showed that constant time delay was an effective way of increasing and maintaining Halliwick’s method of swimming rotation skills of children with autism.

The therapeutic use of water activities or swimming can facilitate language, self concept and improve adaptive behaviors for children with disabilities. In addition, these activities provide an appropriate educational setting for many early interventions (Killian, Joyce-Petrovic, Menna, & Arena, 1984; Yılmaz, Birkan, Konukman, & Erkan, 2005a). For example, Best and Jones (1974) used swimming as a main component of their movement therapy on three children with autism. Subjects participated in an individualized 15-week swimming program which utilized manipulation, imitation, command and self motivation as a progress. Researchers reported that the subjects improved their confidence and body awareness as well as skills of front, back float, and kicking.

Autism is a lifelong developmental disability that causes delays in verbal and nonverbal communication and social interaction as well as exhibition of ritualistic and compulsive behaviors (Loovis & Ersing, 1979). Children with autism have severe communication, language, and social interaction problems compared to their nondisabled peers. Therefore, teaching games and physical activity is an important need to improve vital social skills of children with autism (Leaf & McEaching, 1999; Maurice, Green, & Fox, 2001).

Autistic children have several stereotypical motor behaviors (e.g. swinging their bodies backward and forward, playing with their fingers, moving their head in a circular motion and jumping). These behaviors cause communication and learning problems for children with autism. However, it is possible to reduce these behaviors via teaching physical activity and games (Leaf & McEaching, 1999; Smith, 2001). Sherrill (1986) stated that some of these stereotypical behaviors can be used to

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teach skills similar in behavior such as swimming (e.g., swinging their bodies backward and forward, moving arms up and down).

Research indicated that children with autism have an interest in aquatic activities and these activities reported as enjoyable and helpful to improve motor skills. Moreover, these studies reviewed aquatic and swimming activities as popular activities among the children with autism (Campion, 1985; Dewey, 1973; Killian et al., 1984; Mosher, 1975; Oppenheim, 1977; Wing, 1976; Yılmaz, Birkan, Yanardağ, & Konukman, 2005b). Although past research showed that children with autism have normal motor development patterns, a recent study found that autistic children have very low performance in motor skills. Therefore, it is recommended that autistic children be encouraged to participate in games and other physical activities for motor skill development (Smith, 2001). There are several studies that showed the possibility of teaching individuals with autism or moderate to severe intellectual disabilities play skills such as playing darts (Schleien, Kiernan, & Wehman, 1981), pinball (Hill, Wehman, & Horst, 1993), frisbee (Horst, Wehman, Hill, & Bailey, 1981), Also, Cameron and Capello (1983) taught specific sport skills to individuals with autism or severe intellectual disabilities. Moreover, a recent study revealed that most to least prompting was an effective method in teaching leisure skills to an adult with autism (Vuran, 2008).

Constant time delay is an effective method in teaching children with severe mental disabilities (Bozkurt & Gürsel, 2005; Schuster, Gast, Wolery, & Guiltinan, 1988; Stevens & Schuster, 1987; Tekin & Kircali-Iftar, 2001; Wolery, Ault, & Doyle, 1992). In several studies, constant time delay was utilized to teach play skills such as playing darts, pool, pin knocking, hotshot basketball, golf, and frisbee to children with autism or intellectual disabilities (Tekin et al., 2001). Constant time delay was also used to teach lifetime sport skills to adolescents with severe to profound intellectual disabilities (Zhang, Gast, Horvat, & Datillo, 1995), playing Uno, croquet, horse shoe to adolescents or young adult with moderate to severe intellectual disabilities (Wall & Gast, 1997), and teaching bowling skill to an adult with mental retardation (Jiabei, Bridget, Shihui, & John, 2004).

Parallel to these findings in the literature, research has shown that constant time delay is an effective instructional procedure in teaching students with autism (Alig-Cybirowsky & Schuster, 1990; Ault, Wolery, Gast, Doyle, & Elizenstat, 1988; Browder, Morris, & Snell, 1981; Kleinert & Gast, 1982; McIlvane, Withstandley, & Stoddard, 1984; Schoen & Sivil, 1989; Schuster et al., 1988; Stevens & Schuster, 1987; Tekin et al., 2001; Yılmaz et al., 2005b).

Although there have been studies about effects of constant time delay procedures on different disabilities in the literature, there was no research on the effects of constant time delay procedures on the Halliwick’s method of swimming rotation skills (i.e., vertical and lateral rotation) for children with autism. Therefore, the purpose of the current investigation was to examine the effectiveness of constant time delay procedures on the Halliwick’s swimming rotation skills of children with autism who acquired mental adjustment to the water. Also, maintenance and generalization effects of the procedure were assessed.

The Halliwick’s method of teaching swimming skills was designed by James McMillan who taught at Halliwick School for Girls in Southgate, London. This teaching method based on scientific principles of hydrodynamics and body mechanics. It has been found very safe for people of all ages, and individual with disabilities as well as for the able bodied (Martin, 1981). Swimmers trained on a one-to-one ratio of instructor until complete independence achieved. The swimmer-instructor pair becomes a unit within a group activity so that the swimmer gains the advantages of social interaction with his peers while at the same time enjoying the unobtrusive but constant attention of an individual instructor. Groups became aware of properties and behavior of water and how to control their own specific balance problems. Swimmers disengaged from instructor when they learned initial mental adjustment to the water and balance control principles learned. In this method, games and activities were performed in a vertical position before the swimmer is subjected to the massive effect of buoyancy and willing to be in activities with horizontal
position where the instructor’s hands used to facilitate balance. Lateral rotation is a movement of the body around the spine and the swimmers are encouraged to move an arm or leg or both across the body. Thus, the body tips over and the swimmer faces down in the water. Finally, the 360 degree roll has to be practiced until it can be performed easily. The Halliwick’s method has ten stages and divided into four phases. Table 1 shows phases of the Halliwick’s method of teaching swimming rotation skills.

**Method**

**Participants**

Three boys with autism, ages 8-9 years, participated. Six prerequisite conditions were established for participants before the study: 1) Ability to respond to visual and audio stimuli for at least 7–10 minutes, 2) Ability to imitate gross muscle skills, 3) Have regular restroom habits, 4) Have no open wound on the body, 5) Ability to keep swimming suit and cap on the body and, 6) Ability to have mental adaptation to the water such as jumping, waiting, sitting, kicking, and splashing in the water. All participants met these criteria.

Osman was an 8 year old boy with autism. He participated in an early special education program when he was 3-5 years old. In addition, he had an individual special education service twice a week when he was 6 years old. At the time of the study, he was a mainstream student at a public school for two years. Osman had reading, writing, and simple mathematical skills. However, he had difficulty in social interaction, communication and language skills. Osman did not have any experience or systematic intervention in constant time delay procedure.

Cemil was an 8 years old boy with autism. He also participated in an early special education program when he was 4–5 years old. He also is mainstream student at a public school for a year, and he had reading, writing, and simple mathematical skills. However, he had problems in communication and language skills. Moreover, he did not get any prior systematic intervention in constant time delay procedure.

Uzan was a 9 year old boy with autism and he is the twin brother of Cemil. He participated in an early special education program when he was 4-5 years old. In addition, he had an individual special education service four times a week when he was 6 year old. At the time of the study, he had been a mainstream student at a public school for a year. Uzan had reading, writing, and all simple mathematical skills. However, similar to other participants he had problems in social interaction, communication, and language skills. Uzan did not have any systematic intervention in constant time delay procedure prior to study.

**Trainers**

The intervention phase was applied by four researchers. All researchers had degrees in

<table>
<thead>
<tr>
<th>Phases</th>
<th>Skills</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Mental adjustment</td>
<td>Adjustment to the water</td>
</tr>
<tr>
<td></td>
<td>Disengagement</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>Vertical rotation</td>
<td>Rotations in the water</td>
</tr>
<tr>
<td></td>
<td>Lateral rotation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combined rotation</td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>Up thrust</td>
<td>Control of movement in the water</td>
</tr>
<tr>
<td></td>
<td>Balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Turbulent gliding</td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>Simple progression</td>
<td>Movement in the water</td>
</tr>
<tr>
<td></td>
<td>Basic progression</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1

Stages of The Halliwick’s Swimming Method

<table>
<thead>
<tr>
<th>Phases</th>
<th>Skills</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Mental adjustment</td>
<td>Adjustment to the water</td>
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<td></td>
<td>Disengagement</td>
<td></td>
</tr>
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<td>Phase 2</td>
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</tr>
<tr>
<td></td>
<td>Lateral rotation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combined rotation</td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>Up thrust</td>
<td>Control of movement in the water</td>
</tr>
<tr>
<td></td>
<td>Balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Turbulent gliding</td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>Simple progression</td>
<td>Movement in the water</td>
</tr>
<tr>
<td></td>
<td>Basic progression</td>
<td></td>
</tr>
</tbody>
</table>
education and prior research experience in special education.

**Settings**

All instructional, probe, maintenance and generalization sessions occurred at the Anadolu University indoor swimming pool. The swimming pool was divided into two parts with a rope. At the beginning, all students participated in fun water activities (e.g. jumping, splashing water, and walking hand by hand) with instructors on the right side of the pool. Each student then was transferred individually to the left side of the pool for instruction and intervention. In addition, all sessions occurred in a one-to-one format for 10 weeks, three times a week, between 7:30 am and 8:30 am. There was also a writing board at the swimming pool.

**Materials**

There was no special equipment used during the study. However, a video recorder, video tapes, data collection forms, a writing board and pencil were used to collect data. Social reinforcements were used for motivational purposes (e.g., free time game activities, jumping in the water up ward).

**Screening Procedure for Target Behaviors**

The main purpose of this study was to teach Halliwick’s method of swimming rotation skills for children with autism (Martin, 1981). Therefore, these skills were selected from this method. Each child trained on water adjustment skills before the implication of study.

**Tasks**

The task analyses were developed by all authors by performing the skills. Later, three of the authors got together and reviewed the task analyses by performing these skills again. Some modifications and revisions were done. These task analyses are presented in Table 2.

The study was designed as a multiple probe model to implicate target behaviors efficiently. However, target behaviors must be selected according to two important characteristics: 1) Target behaviors functionally should be similar to each other; and 2) Target behaviors should be independent from each other (Alberto & Troutman, 1990). At this point, all of these selected behaviors are functionally independent from each other so learning a selected skill does not have a negative effect on the other target skills. Selected target behaviors are functionally independent from each other in the study.

**Experimental Design**

Constant time delay is an errorless teaching procedure in which the stimulus control is transferred from a given stimulus condition (e.g. teacher) to other stimulus conditions (e.g. target stimulus). This is a promising al-

<table>
<thead>
<tr>
<th>Skills</th>
<th>Tasks in the task analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Rotation</td>
<td>1. Participant turns his back to the trainer</td>
</tr>
<tr>
<td></td>
<td>2. Participant slightly bends his head to the trainer</td>
</tr>
<tr>
<td></td>
<td>3. Participant lays back (Trainer supports him behind the shoulders)</td>
</tr>
<tr>
<td></td>
<td>4. Participant bends his head and tucks his legs to the chest</td>
</tr>
<tr>
<td></td>
<td>5. Participant stands still</td>
</tr>
<tr>
<td>Lateral Rotation</td>
<td>1. Participant lays back (Trainer stands behind him)</td>
</tr>
<tr>
<td></td>
<td>2. Participant places both hands to his abs</td>
</tr>
<tr>
<td></td>
<td>3. Participant holds from trainer’s hand with his other hand</td>
</tr>
<tr>
<td></td>
<td>4. Participant takes a deep breath and close his mouth</td>
</tr>
<tr>
<td></td>
<td>5. Participant rotates once with commend of trainer and lays back</td>
</tr>
</tbody>
</table>

TABLE 2

Task Analyses for Making Vertical and Lateral Rotation Skills
ternative for instructing individuals with developmental disabilities because the instructor presents a target stimulus, waits the specific fixed amount of delay interval, and finally presents the controlling prompt. This prompt is then faded by systematically inserting a fixed amount of time between presenting the target stimulus and providing a controlling prompt that will ensure the student does the task correctly (Tekin et al., 2001; Wolery et al., 1992).

Constant time delay is an effective instructional procedure because it reduces the probability of the learner making mistakes. Especially, 0-s constant time delay is a good way of eliminating the number of mistakes made by learner. This procedure also provides reinforcement to the learner, and it could be a more fun and positive experience for both the learner and teacher (Tekin et al., 2001)

**Experimental Procedures**

A 1 to 1 instructional format was used during all experimental sessions. There were probe, probe, maintenance, and generalization sessions in the study. Teacher and participants were face to face in all sessions, and all participants were ready in the pool before the start of the study.

**Baseline (A) Conditions**

A probe condition was implemented before the training of each target behavior, and after the criterion was reached in training of that target behavior for a minimum of three probe sessions. Probe sessions occurred prior to training each target behavior and after the criterion was met in that target behavior. Each probe condition had a minimum of three consistent probe sessions. A single opportunity procedure was used during probe sessions. The teacher presented the task direction and recorded the subject’s response to steps of the task analysis. When the subject initiated an incorrect response, performed an incorrect response or no response, he was interrupted by the teacher and the subject’s response was recorded as a minus (−) and the rest of the steps in the task analysis were recorded as incorrect. When a subject performed a correct step he got a plus (+) (Brown & Snell, 2000). For example, the trainer took his/her place in the pool and said, “Cemil, are you ready to perform lateral rotation movement in the water?” to get attention of subject. Once an affirmative verbal or physical response was received, the trainer delivered the task direction, “Do the lateral rotation movement in the water.” Then the trainer waited 4-s for the subject to initiate a response. Subject was reinforced with a descriptive verbal phrase when he initiated the correct steps in 4-s and kept it 15-s. Incorrect responses were defined as not initiating a step in 4 s, initiating but not completing in 15-s, and initiating an incorrect step of the task analysis is not considered. In addition, if the first response was incorrect then the rest of steps in the task analysis were recorded as incorrect (Wolery et al., 1992).

**Constant Time Delay Instructional (B) Conditions**

The Halliwick’s method of swimming rotation skills were taught by using a 4-s constant time delay procedure. Two types of delay intervals were used: 0-s and 4-s delay intervals. During 0-s trials the trainer secured subject’s attention and said, “Osman are you ready to perform the lateral rotation motion in the water?” Then the trainer said, “Osman do lateral rotation motion”, then presented the controlling prompt immediately and said, “Osman lay back.” The controlling prompt was determined according to the performance and characteristics of each subject and target behavior individually. The 4-s delay, trials were implemented in the same way as 0-s delay except the trainer waited 4-s before providing the subjects a controlling prompt.

There were six types of subject responses during instructional sessions: correct response; anticipations, errors, nonwait, wait, and no response. Correct waits were defined as completing a step of the task analysis correctly within 15-s after the prompt. Anticipations were defined as initiating a step of the task analysis before the prompt and completing the response correctly within 15-s. There were three types of nonwait errors: initiating a step of the task analysis before the prompt but performing it correctly as a topographical error, initiating a step of the task analysis before the prompt but not completing it within 15-s duration as a duration error, performing a different step of task analysis as a sequence
error. Wait errors were completing the response incorrectly or completing the response within 15-s of the prompting. No response was not initiating a response within 4-s of the prompt. All types of correct responses, correct anticipations, and correct waits resulted in descriptive verbal praise. Finally, all incorrect responses were ignored and the task direction for the next step was provided (Tekin & Kırcaali-Iftar, 2001).

**Maintenance and Generalization Sessions**

Maintenance data were collected one, two, and four weeks after the instruction had stopped. Maintenance data showed that the subjects maintained the rotation skills taught to them at criterion level one, two, and four weeks after the instruction. Generalization across persons was examined by a pre-post test design. These sessions occurred before training and at the end of teaching for each targeted leisure skill. Generalization sessions were conducted exactly the same but with another trainer. Generalization data showed that all subjects generalized the rotation skills taught to them across people to a certain extent 100%.

**Reliability**

Reliability data were collected during at least 35% of all experimental sessions. Inter-observer reliability was calculated by using point by point method with a formula of the number of agreements divided by the number of agreements plus disagreements multiplied by 100 (Tawney & Gast, 1984).

The mean percent of the inter-observer agreement for the vertical rotation skill during baseline was 98% (90% to 100%); during instruction was 92% (80% to 100%); during maintenance was 100% and during generalization was 97% (90% to 100%). The mean percent of the inter-observer agreement for the lateral rotation skill baseline during was 100%; during instruction was 96% (80% to 100%); during maintenance was 100%; and during generalization was 100%.

Independent variable reliability (procedural reliability) was calculated by dividing the number of teacher behaviors observed by the number of teacher behaviors planned and multiplied by 100 (Billingsley, White, & Munson, 1980). The following teacher behaviors were observed for procedural reliability during training session: (a) having the materials ready, (b) securing the subject’s attention, (c) delivering the task direction, (d) delivering the controlling prompt in time (if appropriate), (e) waiting for the response interval, (f) delivering the correct behavioral consequences, (g) waiting for the inter-trial interval. The same steps were observed during probe, maintenance, and generalization sessions except delivering the controlling prompts in time.

Procedural reliability measures resulted in an overall percentage of 100% during baseline for the vertical rotation skill. Procedural reliability measures resulted in an overall percentage of 92% (85% to 100%) during instruction for the vertical rotation skill. This teacher implemented maintenance and generalization sessions with 100% accuracy for the vertical rotation skill. Procedural reliability measures resulted in an overall percentage of 100% during baseline for the lateral rotation skill. Procedural reliability measures resulted in an overall percentage of 96% (80% to 100%) during instruction for the lateral rotation skill. This teacher implemented maintenance and generalization sessions with 100% accuracy for the lateral rotation skill.

**Results**

**Constant Time Delay Instructional Data**

Probe and training data for Osman, Cemil, and Uzan are shown in Figure 1 through 2 respectively. The open circles represent the percentage of correct responding during full probe and instructional sessions, maintenance and generalization session. As seen in Figures 1 through 2, all subjects met the criteria after the introduction of 4-s constant time delay. These data revealed that constant time delay was effective on teaching rotation skills of Halliwick method to the children with autism.

The instructional data each subject, the number of training sessions, the number and percentage of training errors, amount of training time are in Table 3. A total of 32
training sessions and approximately 3 hours and 16 minutes training time were required for all students to reach criterion on two rotation skills. Table 3 shows instructional data for each student through the criterion.

Osman needed 9 training sessions to reach criterion on rotation skills. A total of 45 minutes training time was required to reach criterion on rotation skills. Cemil needed 14 training sessions to reach criterion on rotation skills. A total of one hour and 42 minutes training time was required to reach criterion

Figure 1. Percentage of correct responses after the prompt for vertical rotation skill during full probe, instructional, maintenance, and generalization probe sessions. Closed circles represent correct responses during full probe, instructional, and maintenance sessions. Open circles represent correct responses during generalization sessions.
Uzan needed 8 training sessions to reach criterion on rotation skills. A total of 51 minutes training time was required to reach criterion on rotation skills. Percentage of training errors which occurred during training sessions was between 0% and 6%.

Figure 2. Percentage of correct responses after the prompt for lateral rotation skill during full probe, instructional, maintenance, and generalization probe sessions. Closed circles represent correct responses during full probe, instructional, and maintenance sessions. Open circles represent correct responses during generalization sessions.
The main aim of this study was to determine the effects of a constant time delay procedure on the Halliwick’s method of swimming rotation skills for children with autism. In addition, generalization and follow up data was collected. Results of the study were analyzed using graphic illustrations. Results showed that all subjects increased their correct target skills in lateral and vertical rotation with a significant amount during the intervention phase. Moreover, subjects maintained their successful rotation skills during the first, second, and fourth weeks of generalization phases.

According to the graphic illustration of data, it can be concluded that all participants received the same amount of sessions and first and third subject did not have any error in their performance. Only second subject performed with minimal percentage error. Considering the difficulties subjects have with attention and communication skills, this study revealed that constant time delay was an effective method to teach the Halliwick’s swimming rotation skills. In addition, procedural reliability measures showed that all teachers applied constant time delay procedure consistently between 92%-100%. In the literature it is recommended that procedural reliability which is minimally 80% and above 90% is highly regarded (Wolery, Bailey, & Sugai, 1988). This study showed that procedural reliability was highly for teachers during the sessions. It can be concluded that all teachers efficiently applied the procedures of constant time delay to teach The Halliwick’s swimming rotation skills for children with autism. Also all participants performed rotation skills very well in early sessions with this intervention in a limited time. Therefore, this procedure is highly recommended for further studies.

The study has two important contributions to literature: 1) support of the literature that constant time delay was an effective method to teach chain and maintained tasks to individuals with disabilities: 2) first research attempt to

**TABLE 3**

<table>
<thead>
<tr>
<th>Students</th>
<th>Behaviors</th>
<th>of sessions thru criterion</th>
<th>Errors thru criterion</th>
<th>Training time thru criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osman</td>
<td>Vertical Rotation</td>
<td>4</td>
<td>0%</td>
<td>00:20:35</td>
</tr>
<tr>
<td></td>
<td>Lateral Rotation</td>
<td>5</td>
<td>0%</td>
<td>00:25:08</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9</td>
<td></td>
<td>00:45:43</td>
</tr>
<tr>
<td>Cemil</td>
<td>Vertical Rotation</td>
<td>7</td>
<td>6%</td>
<td>00:42:15</td>
</tr>
<tr>
<td></td>
<td>Lateral Rotation</td>
<td>7</td>
<td>2%</td>
<td>00:51:27</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>14</td>
<td></td>
<td>01:33:42</td>
</tr>
<tr>
<td>Uzan</td>
<td>Vertical Rotation</td>
<td>4</td>
<td>0%</td>
<td>00:23:32</td>
</tr>
<tr>
<td></td>
<td>Lateral Rotation</td>
<td>4</td>
<td>0%</td>
<td>00:27:53</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8</td>
<td></td>
<td>00:51:25</td>
</tr>
<tr>
<td>Grand total</td>
<td></td>
<td>32</td>
<td></td>
<td>03:16:08</td>
</tr>
</tbody>
</table>
determine the effects of constant time delay procedure on the Halliwick’s swimming rotation skills for children with autism. Results of this study provide several recommendations for future research. First, 1 to 1 teaching arrangement and single opportunity method to teach swimming rotation skills was used. The results of this study can be replicated using instructional group arrangements and other instructional methods such as direct instruction, peer tutoring. Second, lateral and horizontal swimming rotation skills were selected from the Halliwick’s swimming education program (Martin, 1981). Thus, all children became ready to participate and learn actual swimming skill patterns. Therefore, it is recommended to teach different swimming skills to children with autism for future experimental research. Third, trainers reported that all children enjoyed these aquatic drills during sessions, and children improved their social and communication skills with peers compared to their out of pool behaviors. Fourth, most important, trainers observed autistic children had less stereotypical motor behaviors (e.g., swinging their bodies backward and forward, playing fingers, moving head in a circular motion and, jumping) in the water during training sessions.

Consequently, findings of this study indicated that constant time delay is an effective method of increasing and maintaining the Halliwick’s swimming rotation skills for children with autism. Also, it can be concluded that teachers can teach many different activities via these swimming rotation skills. However, this study has several limitations, such as the characteristics of participants, tests, and the measurements that were applied. Therefore, further studies should address effects of constant time delay procedure on different sport skills, disabilities, gender, and ages of children with autism.

References


Yılmaz, İ., Birkan, B., Konukman, F., & Erkan, M. (2005a). Using a constant time delay procedure to teach aquatic play skills to children with au-

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