

Effects of Most to Least Prompting on Teaching Simple Progression Swimming Skill for Children with Autism

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Abstract: Effects of most to least prompting on teaching simple progression swimming skill for children with autism were investigated. A single subject multiple baseline model across subjects with probe conditions was used. Participants were three boys, 9 years old. Data were collected over a 10-week with session three times a week period using the single opportunity method as an intervention. Results indicated that all the boys increased their simple progression swimming skill significantly during intervention phase. In addition, participants maintained their successful skills during first, second and fourth week of generalization phases. Results showed that most to least prompting was an effective way of increasing and maintaining simple progression swimming skill of children with autism.

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). Autism is a brain disorder that impairs a person's ability to communicate, form relationships, socially interact, and respond appropriately within a given environment.

Children with autism have severe communication, language, and social interaction problems compared to their nondisabled peers. Children with autism have several difficulties in four general areas: Speech, language and communication; relating people, objects, events; responses to sensory stimuli; developmental discrepancies (Houston-Wilson & Lieberman, 2003). Therefore, teaching games and physical activity is an important necessity to improve vital social skills of children with autism (Leaf & McEaching, 1999; Maurice, Green, & Fox, 2001).

Autism is the fastest growing developmental disability in the nation and school districts are

having a hard time finding trained teachers to accommodate the needs of students with the disorder (Block, Block, & Halliday, 2006). There are 1.5 million Americans who have autism and 15 million more Americans, such as family, teachers and health care workers who are indirectly affected (Crollick, Mancil, & Stopka, 2006).

Children with autism 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 decrease these behaviors via teaching physical activity and games (Leaf & McEaching, 1999; Smith, 2001). Several studies found that physical activity interventions such as jogging, ball throwing, swimming, and vigorous physical activity reduced stereotypical motor behaviors (Levinson & Reid, 1993; Richmond, 2000; Yılmaz, Birkan, Konukman, & Erkan, 2005a). In addition, Sherrill (2006) indicated that some of these stereotypical behaviors can be used to teach skills similar in behavior such as swimming (e.g., swinging their bodies backward and forward, moving arms up and down).

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The therapeutic use of aquatic activities or swimming can promote language, self concept and improve adaptive behaviors for children with disabilities. In addition, these activities provide an appropriate educational setting for many early interventions (Prupas, Harvey, & Benjamin, 2006; Killian, Joyce-Petrovic, Menna, & Arena, 1984; Yilmaz et al., 2005a).

Researchers have shown that children with autism have success in aquatic activities and these activities reported as enjoyable and helpful to improve motor skills. Moreover, these studies indicated aquatic and swimming activities as popular activities among the children with autism (Campion, 1985; Dewey 1973; Dulcy, 1992; Huetting & Darden-Melton, 2004; Killian et al., 1984; Mosher, 1975; Oppenheim, 1977; Wing, 1976; Yilmaz, Birkan, Yanardağ, & Konukman, 2005b)

Although in the past researchers have shown 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).

Several studies have been published where successful of teaching of individuals with autism or moderate to severe intellectual disabilities play skills such as bowling has been demonstrated (Zhang, Bridget, Shihui, & John, 2004), playing darts (Schleien, Kiernan, & Wehman, 1981), pinball (Hill, Wehman, & Horst, 1982), frisbee (Horst, Wehman, Hill, & Bailey, 1981), Also, Cameron and Capello (1993) 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).

Most to least prompting is an errorless teaching technique that requires giving the strongest prompt for the student to respond correctly. When the student starts to perform skills independently from the provider, the strength of the prompt is decreased. Thus, the student becomes independent from the cues (Tekin & Kircaali-Iftar, 2001). There are several studies indicated that most to least prompting was an effective teaching method

for individuals with mental retardation and autism. For example, researchers have taught leisure skills (Vuran, 2008), learning pedestrian skills (Batu, Ergenekon, Erbas, & Akmanoglu, 2004), food preparation skills (Kaysar, Billingsley, & Neel, 1986), banking skills (Donnell & Ferguson, 1988), and verbal labeling (Richmond & Lewallen, 1983). Consequently, all of these studies showed that most to least prompting method was an effective intervention in teaching for individual with disabilities.

Although there have been studies about the effects of most to least prompting procedure on different disabilities in the literature, there is no research on the effects of most to least prompting procedure on the simple progression of swimming skill for children with autism. Therefore, the aim of the current investigation was to examine the effectiveness of most to least prompting procedure on the simple progression swimming skill of children with autism who acquired mental adjustment to the water. Also, maintenance and generalization effects of the procedure were assessed.

Simple progression swimming skill was gathered from the Halliwick's method of teaching swimming skills. This method was designed by James McMillan who taught at Halliwick School for Girls in Southgate, London. The Halliwick's method is based on scientific principles of hydrodynamics and body mechanics. It has been found to be 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. This method provides a sport, recreation and exercise as wells as an opportunity for friendship, equality, and competition. The Halliwick's method has ten stages and divided into

TABLE 1

Stages of The Halliwick's Swimming Method

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

four phases. Table 1 shows phases of the Halliwick's method of teaching swimming skills.

Method

Participants

Three boys with autism, ages 9 years, participated. Three prerequisite conditions were established for participants applying three phases of the Halliwick's method before the study: 1) Adjustment to water skills, 2) Ability to use rotations skills in the water, 3) Control of movement in water skills. All participants met these criteria. The names of participants were given pseudonymously in the study.

Ömer was a 9 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 being mainstreamed student at a public school for the past three years. Ömer had reading, writing, and simple mathematical skills. However, he had difficulty in social interaction, communication and use of appropriate language skills.

Yener was a 9 year old boy with autism. He also participated in an early special education program when he was 4–5 years old. Yener also is mainstream student at a public school for two years, and he had reading, writing, and simple mathematical skills. He also had problems in communication and language skills.

Soner was a 9 year old boy with autism and he is the twin brother of Yener. He partici-

pated 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, Soner had been a mainstream student at a public school for a year. He had reading, writing, and all simple mathematical skills. Similar to other participants Soner had problems in social interaction, communication, and language skills. None of the participants had any systematic intervention in most to least prompting method prior to the study.

Trainers

The intervention phase was applied by three researchers. Researchers had degrees in special education and physical therapy with 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

No special equipment was used during the study. However, a video recorder, video tapes, data collection forms, a writing board and pencil were employed to collect data. Social reinforcers 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 simple progression swimming skill for chil-

dren with autism. Therefore, this skill was selected as a main task from the Halliwick's method of teaching swimming (Martin, 1981). Each child trained on water adjustment skills before the implication of study.

Experimental Design and Procedure

A multiple baseline design across subjects was used to determine the effectiveness of the most to least prompting (Alberto & Troutman, 1995; Tawney & Gast, 1984).

A 1 to 1 instructional format was used during all experimental sessions. There were probe, probe, maintenance, and generalization sessions in the study. Trainer 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 the 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 target behavior and after the criterion was met for that target behavior. Each probe condition had a minimum of three consistent probe sessions.

A single opportunity procedure was used during all probe sessions. The trainer presented the task direction and recorded the participants 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 participant performed a correct step he got a plus (+) (Brown & Snell, 2000). For example, the trainer took his place in the pool and said, "Soner, are you ready to perform simple progression movement in the water?" to get his attention. Once an affirmative verbal or physical response was received, the trainer delivered the task direction, "Do the simple progression movement in the water." Then the trainer waited 5-s for the participant to initiate a response. The child was reinforced with a descriptive verbal phrase

when he initiated the correct steps in 5-s and kept it 15-s. Incorrect responses were defined as not initiating a step in 5 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, Ault, & Doyle, 1992).

Most to Least Prompting Instructional (B) Conditions

There are three stages in application of most to least prompting. In the first stage, physical cues and verbal direct prompts were provided. Trainer says how to do this stage to subject as well as a physical cue such as "Lay back now" and trainer provides support with his hands from student's back. In addition, trainer gives verbal reinforcement like "Good Job" and as soon as task is over another step starts. Trainer says "Okay, let's go on. Now, stick your fingers together and place your arms to your side" with a physical assistance to subject. Verbal reinforcement provided when subject completed his task correctly in 100%. In second stage, verbal directed prompt and gesture-mimic prompt provided. Trainer provides verbal cues and reinforces every step in 5 s. The third stage started when the participant could complete his task at 100% correct. In the final stage, only verbal cues were provided and participant asked to swim such as "Ömer let's swim" to get attention of subjects during teaching sessions. Training session was ended when subject completed all steps successfully at the end of the final stage.

There were five types of subject responses during instructional sessions: correct response before cueing; correct response after cueing, wrong response before cueing, wrong response after cueing, and no response. Correct response before cueing was defined as completing a step of the task correctly within 5-s after the prompt. Correct response after cueing was defined as attempt to completing a step of task correctly within 5-s after the prompt and completing it within 5-s. During teaching sessions correct responses recorded as a plus (+) and other responses were recorded as a minus (-). All correct responses were before after cueing reinforced to com-

plete other steps (Tekin & Kırcaali-İftar, 2001).

Reliability

Reliability data were collected during at least 35% of all the 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 simple progression skill during baseline was 98% (90% to 100%); during instruction was 93% (80% to 100%); during maintenance was 100% and during generalization was 96% (90% to 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 participants 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 for delivery of control prompts.

Procedural reliability measures resulted in an overall percentage of 100% during baseline for Ömer. Procedural reliability measures resulted in an overall percentage of 96% (87% to 100%) during instruction for Ömer. This teacher implemented maintenance and generalization sessions with 100% accuracy for Ömer. Procedural reliability measures resulted in an overall percentage of 100% during baseline for Yener. Procedural reliability measures resulted in an overall percentage of 98% (86% to 100%) during instruction for Yener. This teacher implemented maintenance and generalization sessions with 100% accuracy for the lateral rotation skill. Finally, procedural reliability measures resulted in an overall percentage of 100% during baseline for Soner. Procedural reliability measures re-

sulted in an overall percentage of 95% (80% to 100%) during instruction for Soner. Also, this teacher implemented maintenance and generalization sessions with 100% accuracy.

Maintenance and Generalization Sessions

Maintenance sessions were collected two, and four weeks after the instruction had stopped. Maintenance data showed that the participants 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 the simple swimming skills. Generalization sessions were identical baseline but in another settings. One to one teaching arrangement and single opportunity methods were used during both maintenance and generalization. Generalization data showed that all participants retained the simple swimming skills taught to them across people 100%.

Results

Most to Least Prompting Instructional Data

Table 2 shows instructional data for each student through the criterion. Ömer, Yener, and Soner needed 9 training sessions to reach criterion on simple progression swimming skill. Baseline and training data for Ömer, Yener and Soner shown in Figure 1 respectively.

The open circles represent the percentage of correct responding during full baseline and instructional sessions, maintenance and generalization session. As seen in Figure 1, all subjects meet criteria after the introduction of most to least prompting. This data showed that most-to-least prompting was effective on teaching simple progression swimming skill for children with autism.

Ömer, Yener, Soner performed no correct responses during the baseline sessions. When instruction of the simple progression using “physical prompt and verbal prompt” started, they performed with 100% accuracy in the first three session, and continued the performance (100 %) while using “verbal and gesture/prompt” in sessions 4, 5, 6. All subjects’ performance continued 100% in sessions 7, 8,

TABLE 2

Instructional Data for Each Student through Criterion

<i>Students</i>	<i>Behaviors</i>	<i>Thru Criterion</i>	<i>Number of Sessions</i>
Ömer	Simple progression	Physical + Verbal Prompt	3
		Verbal + Gesture/Mimic Prompt	3
		Verbal Prompt	3
		Total	9
Yener	Simple progression	Physical + Verbal Prompt	3
		Verbal + Gesture/Mimic Prompt	3
		Verbal Prompt	3
		Total	9
Soner	Simple progression	Physical + Verbal Prompt	3
		Verbal + Gesture/Mimic Prompt	3
		Verbal Prompt	3
		Total	9

9 while using only “verbal prompt.” During the maintenance and generalization sessions he continued to perform the skill with 100% accuracy.

Discussion

The main purpose of this study was to determine the effects of most to least prompting on the simple progression swimming skills for children with autism. In addition, generalization and follow up data was collected. Results of the study were analyzed using graphic illustrations. Results indicated that all subjects increased their correct target skills in simple progression swimming skills with a significant amount during the intervention phase. Moreover, subjects maintained their successful simple progression skills during the first, second, and fourth weeks of generalization phases.

Literature review proved that most to least prompting method is an effective intervention to teach leisure skills to an adult with autism (Vuran, 2008), learning pedestrian skills (Batu et al., 2004), food preparation skills (Kayser et al., 1986), banking skills (Donnell & Ferguson, 1988), teaching verbal labels (Richmond & Lewallen, 1983). Consequently, similar to these findings, this study demonstrated that most to least prompting was an effective method to teach and maintain a simple progression swimming skill to children with autism.

Based on the graphic illustration of data, it

can be concluded that all participants received the same amount of sessions and all subjects did not have any error in their performance during the intervention. Considering the difficulties subjects such as attention and communication skills, this study proved that most to least prompt was an effective procedure to teach the simple progression swimming skill. Moreover, procedural reliability measures showed that all teachers applied most to least prompting procedure consistently between 87%–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 also showed that procedural reliability was high for teachers during the sessions. As a result, it can be concluded that all teachers effectively applied the procedures of most to least prompting to teach the simple progression swimming skill for children with autism. Also all participants performed this skill very well in early sessions with this intervention in a limited time. Therefore, this procedure is highly recommended for further research attempts.

The present study has two important contributions to literature: 1) support of the literature that most to least prompting was an effective method to teach certain tasks to individuals with disabilities: 2) first research attempt to determine the effects of most to least procedure on simple progression swimming skill for children with autism.

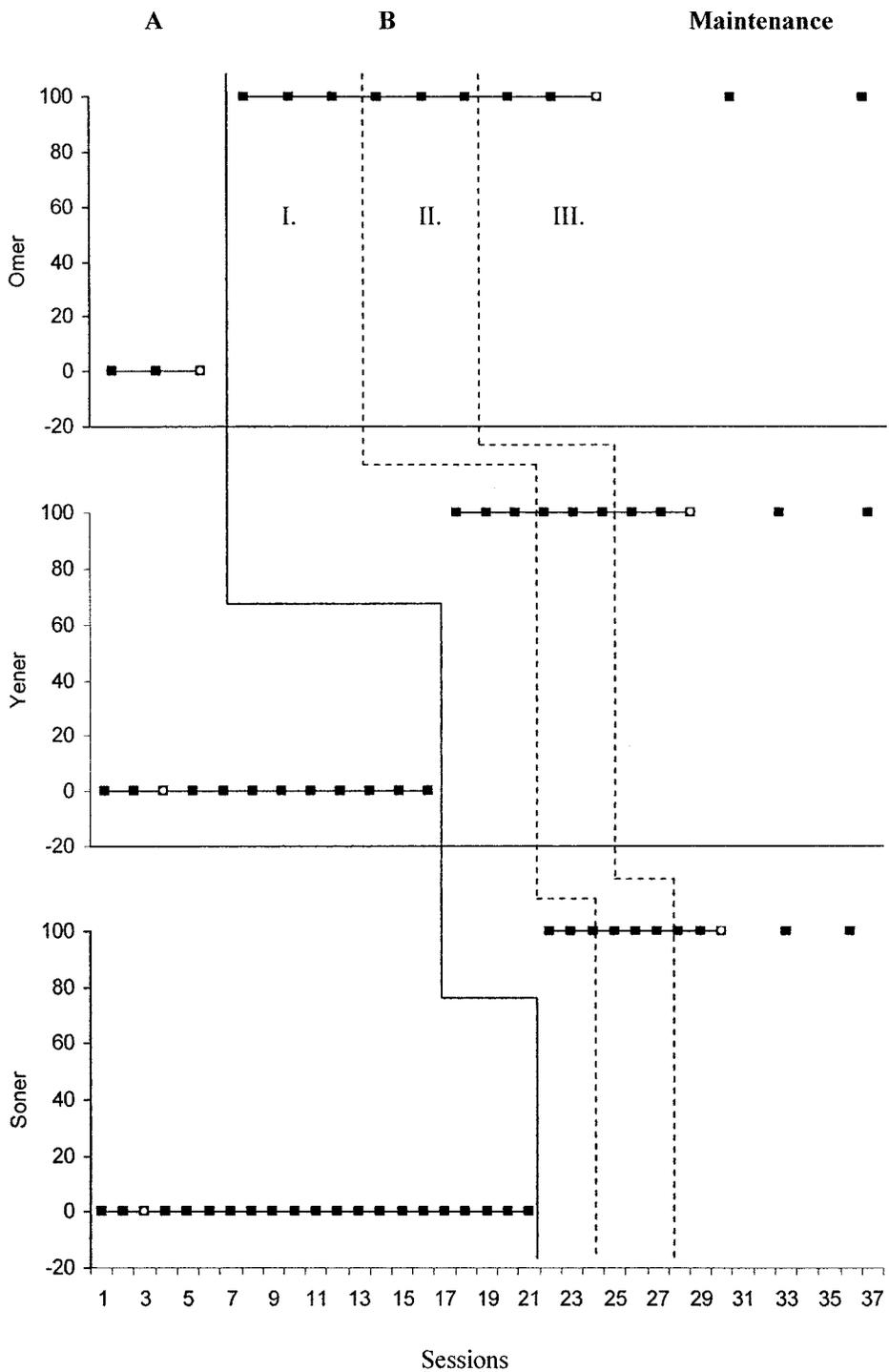


Figure 1. Percentage of correct responses after the prompt for simple progression swimming skill during full probe, instructional, maintenance, and generalization probe sessions. Closed circles represent correct responses during full probe, instructional, and maintenance sessions. Open circles represent correct responses during generalization sessions.

Data from this study resulted in several recommendations for future research. First, 1 to 1 teaching arrangement and single opportunity method to teach simple progression swimming skill was used. The findings from this study can be replicated using instructional group arrangements and other instructional methods such as cooperative learning, direct instruction, peer tutoring, class wide peer tutoring. Second, simple progression swimming skill was 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, and educational games to children with autism for future experimental research. Third, trainers reported that all children enjoyed this aquatic drill during all sessions, and improved their social and communication skills with peers in comparison to their out of pool behaviors. Fourth, most important, trainers witnessed that autistic children had less stereotypical autistic 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.

As a result, findings of this research revealed that most to least prompting is an effective and applicable method of increasing and maintaining a simple swimming skill for children with autism. Also, it is reasonable that teachers can teach many different activities using this simple progression swimming skill.

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