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## Teaching advance movement exploration skills in water to children with autism spectrum disorders



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### ABSTRACT

This study evaluated the effectiveness of the 'most to least' prompting (MLP) procedure on the teaching of advance movement exploration skills in water to children with autism spectrum disorders (ASD). Three 6-year old children with ASD, participated in the study and were taught 3 different aquatic skills, essential for movement exploration in water and swimming, in a one-to-one training format at three sessions per week. A multiple probe design across behaviors was used and was replicated across subjects to analyze the effects of MLP. The results of the study showed that MLP was effective in teaching advance movement exploration skills in water to children with ASD. Performing the exploration skills in water was continued after the training process during maintenance and generalization probe sessions. In addition, social validity results reflected that parents' opinions were positive on the learning skills in terms of functionality, beginning swimming and participation in other aquatic settings for their children. The enjoyable intervention and appealing setting are recommended to increase the repertoire of leisure skills and level of physical activity for children with ASD.

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## 1. Introduction

The severity of autism spectrum disorders (ASD) in children is demonstrated by impaired social communication and restricted, repetitive patterns of behavior (American Psychiatric Association, 2013). Children with ASD also have difficulty in maintaining eye contact, participating in social games, making friends, turn-taking and reciprocal conversation, and engaging in physical activity (Pan & Frey, 2006; Reid, 2005). These failures and disadvantages of children with ASD could predispose them to a lower physical activity level and limited participation in leisure skills such as physical activity and sports programs (Lee & Porretta, 2013). According to the results of some studies, children with ASD have a lower physical activity level than peers without ASD during their weekly routine (Pan & Frey, 2006; Reid, 2005). This restricted participation in physical activity and sports programs could be due to various reasons for children with ASD, such as an insufficient repertoire and needing extra prompts for physical activity and sports skills, that the team and individual sports programs in

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schools and community are competitive-based, and sedentary behaviors such as dependence on technology, and a lower consciousness of quality of life (Fragala-Pinkham, O'Neil, & Haley, 2010; Reid, 2005).

Regular physical activity participation is essential to reduce the mortality and morbidity risks of chronic disease such as cardiopulmonary disease, cancer, diabetes and obesity, which are seen in children and adolescents (Ortega, Ruiz, Castillo, & Sjörström, 2008). In addition, physical activity stimulates the improvement of physical fitness, motor performance, self-esteem, behavior, and social outcomes for children (Pan & Frey, 2006). These positive effects of physical activity interventions have been determined in several studies of children with ASD (Fragala-Pinkham et al., 2010; Huettig & Darden-Melton, 2004; Yilmaz, Yanardağ, Birkan, & Bumin, 2004). Children with ASD tend to choose the kinds of physical activities which do not involve great social cues or rules, such as walking, running, aquatic intervention, and individual sports such as swimming (Srinivasan, Pescatello, & Bhat, 2014; Yilmaz et al., 2004). Similarly, a review study revealed that jogging and swimming were the two most often utilized physical activity interventions for children with ASD (Sowa & Meulenbroek, 2012). Some authors have stated that many children with ASD enjoy and are successful in movement skills in aquatic settings (Huettig & Darden-Melton, 2004; Killian, Joyce-Petrovich, Menna, & Arena, 1984; Prupas, Harvey, & Benjamin, 2006; Yilmaz et al., 2004). A number of researchers have used an aquatic environment in order to develop physical performance (Fragala-Pinkham et al., 2010), learning (Rogers, Hemmeter, & Wolery, 2010; Yilmaz, Konukman, Birkan, & Yanardağ, 2010), behavior (Yilmaz et al., 2004) and social outcomes (Pan, 2010) for children with ASD. Aquatic programs and swimming provide some essential advantages. First, it is a lifetime activity and facilitates learning daily living skills such as social behaviors, dressing, bathing and hygiene skills. Second, it stimulates body and cognitive awareness aiding fitness, sensory-perceptual integration, orientation, and motivation. Third, these are functional skills which can be incorporated into family life. Finally, it is a safety skill which may prevent drowning during vacations in community-based settings such as a swimming pool, sea, or lake (Lepore, Gayle, & Stevens, 2007).

Children with ASD may have impairment in cognitive skills and display fluctuations in behaviors depending on the diagnostic features. Attention problems, intellectual delay, low orientation skills, repetitive behaviors, and poor eye contact have a negative effect on learning performance for both academic and leisure skills, which are essential to enhance social integration and to increase physical activity level (Bryson, Bradley, Thompson, & Wainwright, 2008; Srinivasan et al., 2014). Therefore, educators, therapists, and parents are needed to utilize evidence-based teaching strategies for the permanent learning of new skills for children with ASD (National Autism Center, 2009). Errorless teaching strategies and applied behavioral analysis are essential learning-based interventions for children with ASD, and several studies have applied these interventions to teach new skills such as work skills, self-care skills, leisure skills, independent living skills, hygiene skills, and feeding skills (Matson, Hattier, & Belva, 2012). One of the most common approaches to teach a new movement skill to children with ASD is the 'most to least' prompting (MLP) procedure into errorless teaching strategies (Fentress & Lerman, 2012; Lang et al., 2010). In MLP, decreasing assistance, prompts are provided hierarchically from the most intrusive to the least intrusive. The prompting hierarchy begins with physical prompts that gradually fade and the trainer delivers less intrusive prompts such as modeling or a verbal prompt (Duker, Didden, & Sigafos, 2004).

In current literature, MLP has been used in only two studies, which taught water exercises and backstroke skills for swimming to children with ASD in current literature (Best & Jones, 1974; Yilmaz et al., 2010). However, there are no studies on the effects of an MLP procedure to teach advance movement exploration skills in water to children with ASD. Therefore, the purpose of this study was to answer the following question: Will the use of MLP procedure be effective in teaching advance movement exploration skills in a swimming pool to three children with ASD? In addition, the maintenance and generalization effects of the procedure were evaluated. The advance movement exploration skills to be taught in the swimming pool were blowing bubbles, face submersion, and retrieving an object from the bottom of the pool.

## 2. Methods

### 2.1. Participants

The study comprised 3 boys with ASD, aged 6 years. Before the study, written informed parental consent and verbal assent were obtained from all the parents of the participants in compliance with the Declaration of Helsinki. The names of the participants have been substituted with pseudonyms for the study. To be able to teach the three advance movement exploration skills in the swimming pool using 'most to least' prompting, some prerequisite conditions were identified before the intervention: (a) ability to follow verbal prompts, (b) ability to imitate motor skills, (c) no physical dysfunction or health issue such as an open wound, (d) no hypersensitivity to water, and (e) ability to have toilet control. The 3 participants met all these criteria.

Sacit was a 6-year old boy with ASD. He had benefited from an early special education program, since he was 4 years old. He was receiving both individual special education (two sessions a week) and group based special education (five sessions a week). He had difficulty in social integration and displayed inappropriate behaviors such as crying and disobedience. He had learned the concepts of color, shapes and matching skills. He had participated in a group-based aquatic play program (one session a week) for three months. He learned some aquatic play skills such as snake, kangaroo, and train during the program, but he had a fear of water and needed to be given physical prompts.

Erdal was a 6-year old boy with ASD. He had benefited from an early special education program, since he was 3 years old. He had difficulty in social integration and expressing himself. He was receiving individual special education (two sessions a

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