

# DO AQUATIC ACTIVITIES BOOST SOCIAL SKILLS FOR CHILDREN WITH AUTISM SPECTRUM DISORDERS?

DEZVOLTĂ ACTIVITĂȚILE ACVATICE COMPETENȚELE SOCIALE ALE  
COPILOR CU TULBURĂRI DIN SPECTRUL AUTIST?

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## DO AQUATIC ACTIVITIES BOOST SOCIAL SKILLS FOR CHILDREN WITH AUTISM SPECTRUM DISORDERS?

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### **Abstract**

This paper provides a number of aquatic programmes, and critically analyzes methods and techniques used to develop social skills in young children with Autism Spectrum Disorders (ASD). Social skills are interpreted through a ToM theory lens, emphasizing interactions, such as understanding, explaining, predicting, and manipulating the behavior of themselves and others. Based on these elements, the purpose of this review is to study the role of adapted group aquatic programmes and its effect on children with ASD to understand the concept of peers and learning the benefits of two important social skills, teamwork, and relationships. An online search through ProQuest and First Search resulted in seven studies of diverse methodologies. All these studies support the value of these programmes as a means of social skills' development. Qualitative as well as quantitative data which included, checklists, interviews, and tests, indicated these programmes benefit ASD children's' social skills, such as cooperation, communication and increase in self-esteem. Findings suggested that children with ASD have opportunities to make new friends, feel more comfortable in a group and reduce anxiety through swimming. These relationships can continue, as they discover other common interests. More longitudinal studies are needed to develop aquatic activities as an extracurricular activity and the planning process to achieve the intended outcomes. By synchronizing theory with sports activities and teamwork, children with ASD can feel a deep sense of accomplishment upon achievement.

**Keywords:** autism spectrum disorders, interactions, social skills, swimming, teamwork.

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**Rezumat**

Articolul trece în revistă o serie de programe acvatice și analizează metode și tehnici pentru dezvoltarea abilităților sociale la copiii mici cu tulburări ale spectrului de autism (ASD). Abilitățile sociale sunt interpretate prin intermediul teoriei minții (ToM), punând accent pe interacțiunile de tipul în elegerii explică iilor, a predicțiilor și a gestionării comportamentului propriu și al celorlalți. Pe baza acestor elemente, scopul prezentei de față este de a studia rolul programelor acvatice de grup adaptate și efectul acestora asupra copiilor cu autism pentru a înțelege conceptul de „colegi” și pentru a înțelege beneficiile a două abilități sociale importante, respectiv munca în echipă și relaționarea. O cercetare online prin ProQuest și First Search s-a finalizat cu șapte studii cu metodologii de cercetare diverse. Toate aceste studii susțin valoarea programelor acvatice ca mijloace de dezvoltare a abilităților sociale. Datele calitative, precum și cele cantitative care au inclus liste de verificare, interviuri și teste, au indicat că aceste programe dezvoltă abilitățile sociale ale copiilor cu autism, cum ar fi cooperarea, comunicarea și creșterea stimei de sine. Rezultatele au sugerat că prin aceste programe copiii cu autism au avut oportunități de a-și face prieteni noi, de a se simți mai confortabil într-un grup și de a-și reduce anxietatea prin înot. Aceste relații pot continua, pe măsură ce descoperă alte interese comune. Sunt necesare mai multe studii longitudinale pentru a dezvolta activitățile acvatice ca activități extracurriculare printr-o proiectare adecvată pentru a atinge rezultatele intenționate. Prin sincronizarea teoriei cu activitățile sportive și munca în echipă, copiii cu autism au experiența unui profund sentiment de realizare personală.

**Cuvinte cheie:** abilități sociale, interacțiuni, înot, muncă în echipă, tulburări ale spectrului autist.

**1. Introduction**

The phrase “exercise is socialization” is a common refrain among adapted physical educators and health practitioners. A wealth of sport and psychological research gives credibility to this truism by evaluating different sports training programmes which develop and improve social skills, such as cooperation, communication, and social awareness in young children with ASD (Horvat et al., 2019). On this basis, swimming is a good all-round activity which has a myriad of extraordinary benefits for the body and mind that can boost the quality of life and socialization for children with ASD. The vast majority of the studies are primarily based on experts’ and/or parents’ views, beliefs, perceptions or observations about the effect

of aquatic activities and the way children with ASD reduce the risk of accidental drowning-and bring more confidence, and coordination into their lives (Buchanan, Miedema & Frey, 2017; Sato et al., 2015).

Most of the aquatic objectives for children with ASD according to Kraft and Leblanc (2018) focus on combining water and play activities as a dynamic set that causes social interactions since it is a great way for them to meet new friends in a fun environment within no-pressure situations. This condition also can help them “break the ice” and avoid awkward silences that can happen when they are meeting one or more other children. Aleksandrovi et al. (2015) also highlight the important role of aquatic group activities in changing behaviours, building confidence, connecting with others, and having a sense of purpose, as well as in developing social initiative. Different studies have also stressed the physical educator’s role on the beneficial impact of aquatic activities and sharing their aspirations and strategies supporting a healthy body and social development in young children with ASD (e.g., Winnick & Porretta, 2016).

Given these facts, the author’s aim is to further investigate the impact of aquatic programmes on promoting the development of social skills in children with ASD within an inclusive and fun environment by making use of literature review.

### 1.1. Theoretical Perspective

In recent years, research in physical education has increasingly been developed by the work of a range of prominent theorists in social theory (e.g., Foucault, Giddens, Bernstein, and Bourdieu). According to Bourdieu (1990), day-to-day activities are produced by an interaction of individuals in a social environment, and it is through participation in social practices that the logic of the field is embodied and reproduced. Today, Bourdieu’s concept is characterized as a helpful measure which can determine individuals’ motility in the physical activity and improvement of their social skills.

On the other hand, children with ASD present a multifaceted social deficit

and limitations to interact with other children or/and not participate easily in the physical activity. According to Premack and Woodruff (1978) and the Theory of Mind (ToM), social behaviors are not impaired; some abilities are preserved, especially in high-functioning autistic (HFA) individuals. One explanation of the mix of core challenges and preserved abilities could be explained by a single deficit – an inability to attribute mental states to oneself and others. Andrés-Roqueta et al. (2016) argue that in the case of children with ASD, the Theory of Mind (ToM) and the skills that derive from it can be acquired through a cooperative learning process, such as play. More specifically, Lee and Porretta (2013) asserted that water is an essential part of the daily life and therefore, plays an important role in a child's development. On this basis, aquatic programmes are an optimal form of physical activity which may affect their ability to remain focused on a task at hand. Several studies support the idea that aquatic activities or programmes incorporate a number of promising strategies for social skills training such as providing a fun environment, and natural reinforcement (Dartt, 2015; Jull & Mirenda, 2016; Pan, 2010).

## 1.2. Benefits of aquatic activities

Based on contemporary literature, aquatic programmes are usually supervised by a multidisciplinary team involving adapted physical educators or instructors and psychologists. According to Lepore et al. (2015), a successful aquatic programme includes: (1) a structured teaching model; (2) supplementing with adult teaching and peer mediation to increase initiation; and (3) the use of adapted environments established for water play activities to increase spontaneous communication. Furthermore, aquatic activity is an important part of a healthy social lifestyle, it is fun and has a great potential to be a lifetime activity. For this reason, according to Kanupka et al. (2016), children with ASD should be introduced to it early in aquatic classes.

A carefully designed group aquatic programme that includes a pre- and post-assessment and an ongoing review of instruction can improve social skills, such as cooperation and communication. Because those children with ASD find many experiences easier in the pool, participation in aquatic

programmes feels more comfortable, improves their ability to play cooperatively and boosts their overall health and well-being. In general, aquatic activities are not always easily adaptable to those with multiple mental or neurodevelopmental disorders, and physical educators often need more information on how to include such children.

Based on these assumptions and theoretical perspective, these recommendations are critical to aquatic programmes research because small, but consequential adaptations in a study’s design for children with ASD, or on the way a study is reported, can affect how physical educators view a study in particular, and aquatic programmes in general.

## 2. Method

The current review was conducted to locate, evaluate and synthesize all the empirical evidence which addresses three primary areas: (1) what does research on aquatic activities or programmes tell about their impact on social skills development for children with ASD? (2) Are there any robust results that can help and train physical educators or instructors to select the right activities for children with ASD on the basis of: a) its suitability for adaptation, b) the degree of difficulty, and c) both direct and indirect third-party involvement? (3) Are there particular points that need to be borne in mind for future research, through the same body of research? As suggested by Templier and Paré (2015), there are just six steps to conduct a review, which were followed by the researcher in this study (Table no. 1)

*Table no. 1. Six steps of the review*

First part	Second part	Third part
1. Formulating the research question(s) & objective(s) 2. Searching the literature	3. Evaluating the applicability of the material 4. Assessing the quality of primary studies	5. Extracting data 6. Analyzing data

The first step which conducted the review has been presented above and was used to identify studies for possible inclusion in this review. The

remaining five steps were conducted in a manner that becomes clear in the remaining part of the article. In the next step, searches were conducted in multiple electronic databases via Education Resources Information Center (ERIC), via EBSCOhost, Scopus, Wiley Online Library WorldCat, and in Semantic Scholar. A specific set of words were selected as the ones that had the most results: (swim OR aquatic activities \*autism OR aquatic techniques \*ASD OR water play activities \*autism) AND (social skills OR social interactions OR social development OR social evaluation\*) AND (autistic childhood OR adolescence). In this review, the researcher selected particular terms to refer to very distinct concepts, some of them using the same terms to denote different conceptual constructs.

*Table no. 2. List of search terms*

Electronic databases	Aquatic activities terms	Social skills terms	Participants parameters terms	Excluding terms
ERIC EBSCOhost Scopus Wiley Online Library WorldCat	Aquatic exercise Swim Water exercise Water fun play Swim sports Pool play Recreational aquatic	Social interaction Communication Social ability Social relationships Cooperation Understanding Initiative	Asperger High Functioning Autism High cognitive level (IQ) Borderline level Age: 5-17 years-old	Abnormal\$ Aphas\$ Disab\$ Disord\$ Hyperact\$ Impair\$ Retard\$

*Note. \$ is a database search convention that indicates a search for the preceding word stem with all possible endings*

All searches were done by the author, thus resulting 139 studies, which were limited to 75 after scanning through the titles and subtitles, for possible inclusion. In the next step, abstracts of these studies were reviewed to identify studies meeting the inclusion criteria (see Table no. 2). In the third step, reference lists of studies meeting these criteria were then reviewed to identify additional articles for possible inclusion. In the fourth step, the applicability of the material was evaluated and the quality of studies was assessed (e.g., participants, measures, outcomes). Many studies were excluded mainly because they came from other disciplines, such as medicine. This analysis

is investigating only the educational process and how children with ASD can manage social behavior in aquatic activities in a pool environment and interact through time with children. As shown in Table no. 3, in order to be included in this review, studies had to contain participants with an ASD diagnosis (i.e., autism, Asperger’s, or PDD-NOS). Aquatic activities were defined as fun and play actions requiring physical exertion.

*Table no. 3. Inclusion and exclusion criteria*

Criteria	Inclusion	Exclusion
Publication date	September 2010 to May 2019 (e.g., research journals and thesis)	Published pre 2010 (e.g., discussion editorial, abstracts unofficial data)
Language(s)	English language	Other languages
Research population	Children and adolescents 5 to 17-year-old of both genders with ASD (high or borderline IQ)	Children, adolescents or adults with moderate and severe IQ or/and any other disorders or disabilities
Intervention type	Original studies with mixed research methods (i.e., interviews, observations, test, etc.)	Meta-analysis, longitudinal or Cross-sectional studies, single case study or reviews
Results	Aquatic activities or programmes only as an educational method for children with ASD and social skills development	Studies with no specific or clearly social outcomes or studies which focus on aquatic activities as therapy process

## 2.1. Search procedure

The list of studies as mentioned was collected from electronic databases. A final set of seven papers were included in the review for analysis (Figure no. 1). All of the studies in this review employed an intervention that met the construct definitions of aquatic fun play and activities interventions.

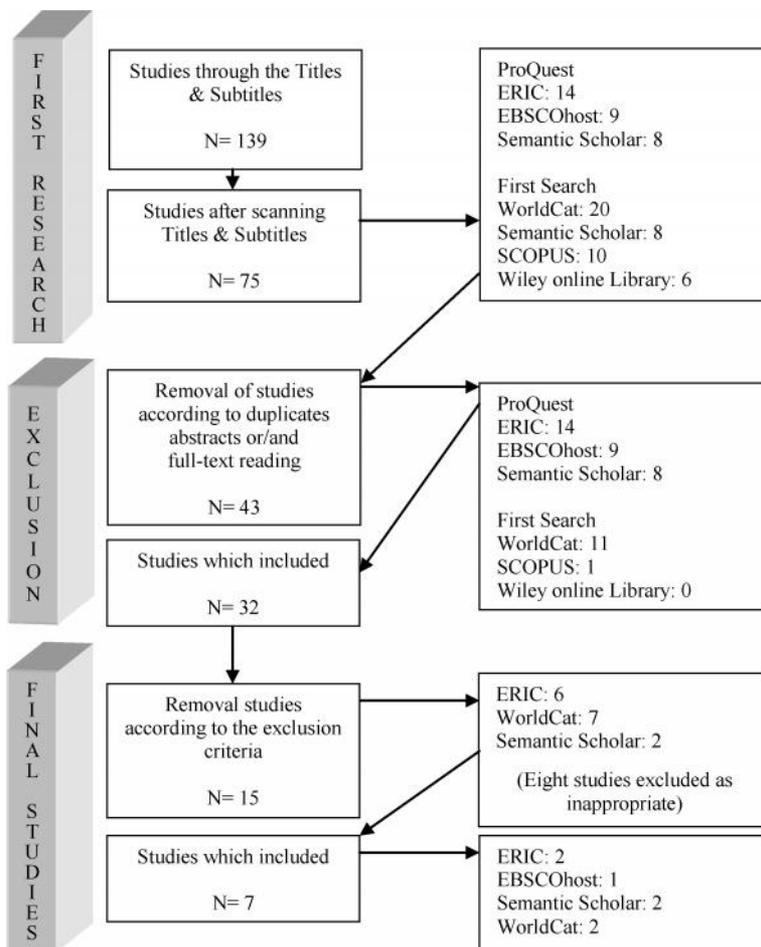


Figure no. 1. Search procedure

## 2.2. Data extraction

Each study was assessed for inclusion, and exclusion criteria and included studies that summarized the features, such as (a) participant characteristics, (b) social behavior taught, (c) teaching procedures, (d) outcomes, and (e) methodology. The effects of aquatic activities and the changes in the

frequency of social behavior and interactions were summarized through reporting the statistical findings of designs. Furthermore, there was a wide set of methods and measures used for evaluating participants with ASD and activities or programmes, but the wide range of methodologies made the comparison among all the studies difficult, and in some cases impossible.

### **3. Results**

#### **3.1. Participants**

Collectively, the 7 studies provided intervention to a total of 72 children and adolescents with ASD. Forty-one (56.9%) of the participants were male and four (5.5%) were female, consistent with the male to female ratio within the ASD population (American Psychiatric Association, 2013). The gender of the remaining 28 participants' (38%) was not identified. The mean age was 12.5 years old (range, 5–17). High Functioning Autism (HFA) and Asperger Syndrome were the most common diagnoses ( $n=30$ ) followed by Pervasive developmental disorder otherwise not specified (PDD-NOS) ( $N=24$ ) and invasive developmental disorder with features of autism spectrum ( $N=18$ ). Furthermore, the largest number of participants had a high cognitive level or relevant disabilities ( $N=42$ ) who were included in primary and secondary schools.

#### **3.2. Settings**

In most studies, aquatic activities occurred in one setting and the effects on dependent variables were assessed in the same setting (Battaglia et al., 2019; Pan, 2010; Pimenta et al., 2016; Tucker, 2016). The researcher has employed a large vocabulary of terms to refer to the same, similar, or related constructs like the one defined here as aquatic activities. In this review, most of the studies were designed to investigate the effects of aquatic activities as an educational method for specific social skills development for individuals with ASD. All studies were conducted in private pool centres.

### 3.3.    Aquatic exercises training protocols

The majority of studies (N=4) included 10 to 15 weeks adapted aquatic sessions which were divided into categories, such as social and floor warm-up activities, one-to-two small group instruction, whole group games/activities, and cool-down activities (Fragala-Pinkham et al., 2011). In only one of the rests of the studies, participants engaged in three different aquatic skills, essential for movement exploration in water and swimming, in a one-to-one training format (Yanardag, 2015). Finally, three studies used a structured intervention programme, such as SPARK programme, which consisted of 36 sessions (Najafabadi et al., 2018), a twenty-one weeks water exercise swimming program (WESP) (Pan, 2010) and a twelve weeks multi-systemic aquatic programme (CI-MAT) as a form of therapy (Battaglia, 2019).

#### 3.3.1.    *Exercises for social skills*

All programmes which were presented in this review provide games and group activities that are specific to the principles of research goals. Participants work to gain independence in water, they are also able to become active members of the group while maintaining the one-to-two instructional setting. Through aquatic activities, participants were able to take advantage of social interaction with other members of groups and yet still benefit from the constant attention of their physical educator.

### 3.4.    Procedures

The procedures used to teach social skills were reported in 6 of the 7 studies (90%). Groups with fun aquatic activities and/or exercises were used in 80% percent of the studies in this review. It is clear that this technique promotes effective interpersonal relations and social transactions among participants. As shown in the study by Pan (2015), water exercise swimming programme allowed participants to explore properties of water by interacting with other participants in a managed way to develop experience in a supported environment.

According to Tucker's observations (2016), children or/and adolescents with ASD who participated in aquatic actions had the possibility for significant learning, allowing the experience to encourage, to develop and start with a deep understanding of the situation from the 'opposite' point of view. Some activities which were used to measure social and emotional integration and interdependence by Battaglia (2019) showed that aquatic techniques have benefits for participants with ASD because it reflects the real-life as a model to their playing. In this research, the effect of aquatic activities agrees with one more study which had the same target.

In the research by Primenta et al. (2016), aquatic activity intervention is based on the parameters of aquatic skills development for individuals with disabilities as proposed by Lepore, Gayle, Stevens (1998) and Winnick (2004) which emphasizes orientation in the water, as well as both physical and social development. The findings showed an important rate of development of social communication and interaction skills. Based on these findings, the general conclusion is that this technique has a positive effect on teaching social skills for participants with ASD.

Although in a few studies, such as the one of Fragala-Pinkham et al. (2011) and Najafabadi et al. (2018) there are provided descriptions in which parents assessed participants with structured scales and subscales. The findings showed that on the programme satisfaction questionnaire, parents reported high levels of satisfaction with the programme activities. Overall, parents reported that their children enjoyed the programme and also the programme provided an opportunity for exercise. Finally, only in one study (Yanardag, 2015) a structured instruction method (Most Least Prompting - MLP) was used to teach skills and evaluate the effectiveness of aquatic activities to participants with ASD. The results of the study showed that MLP was effective in teaching advance movement exploration skills in the water to participants with ASD.

### 3.5. Outcomes of reviewed studies

All the reviewed studies reported improvements in social behavior of participants with ASD (e.g., reduced anxiety, increased social interactions and play). More specifically, SPARK program by the study of Najafabadi

et al. (2018) showed that participants with ASD display a substantial improvement in social interaction. Aquatic activities promoted psychological and social development such as self-esteem, self-confidence, and self-competence which are crucial factors for socialization. Furthermore, it seems that aquatic activities are a fun alternative exercise which encourages positive response and provides opportunities for children and adolescents with ASD to develop social and communication skills with other individuals. Pan (2010) who investigated the effects of a ten-week aquatic exercise program on pool skills and social behaviors of sixteen children with ASD covered both social competencies, such as peer relations, self-compliance, and anti-social behaviors (e.g., antisocial-aggressive). Results showed that aquatic activities programs have a potential effect on the development of social skills for individuals with ASD. As for the study of Fragala-Pinkham et al. (2011), all participants liked the aquatic programme and reported improvements in swimming skills and playing water games. In addition, parents reported high levels of satisfaction with the aquatic activities and reported that their children enjoyed the programme. Ôucker (2016) evaluated in her study the use of behavioral skills teaching in-water safety skills to children with ASD and showed that the participants improved in targeted individual components of potentially life-saving and social skills. On the other hand, Battaglia et al. (2019) found that swimming pool activities trained psychomotor skills and increased adaptive behaviors in children with ASD. Moreover, Primenta et al. (2016) found in their study that children with ASD demonstrated positive results for the evolution of aquatic skills, and better participation in the proposed activities. The results of the study by Yanardag et al. (2015) showed that MLP was effective in teaching advance movement exploration skills in the water to children with ASD. This enjoyable intervention and appealing setting increased the repertoire of leisure skills and level of physical activity.

## 2.6.    Research methodology

Three studies collected data using an observation schedule (Battaglia et al., 2019; Primenta et al., 2016; Tucker, 2016) with a video recording of the sessions. Data were scored according to a scale which aimed to identify the number of components of each skill or behavior, the participants completed independently. Because groups were not randomly selected, Fragala -

Pinkham et al. (2011) examined the extent of differences in key confounding variables between experimental and control groups. Responses to the open-ended questions on the parent satisfaction questionnaire were reviewed and key themes were identified. The same data analysis was used in the study by Najafabadi et al. (2018), by Yanardag et al. (2015) and by Pan (2010) (see Table no. 4).

**Table no. 4. Description of studies**

<p>Pan (2010)</p>	<p>8 (N=8) boys with High-Functioning Autism (HFA) 8 boys (N=8) with Asperger syndrome (n=8) 6 to 9 years old</p>	<p>10-week WESP intervention 20 sessions/90 minutes per session) (social &amp; floor warm-up activities, one-to-two small group instruction, whole group activities cool-down activities).</p>	<p>Group A had a significantly lower score on hostile/irritable (<math>t = -6.99, df = 7, p &lt; 0.01</math>), antisocial/aggressive (<math>t = -4.40, df = 7, p &lt; 0.01</math>) Defiant/ disruptive (<math>t = -7.07, df = 7, p &lt; 0.01</math>) and antisocial behavior total (<math>t = 7.88, df = 7, p &lt; 0.01</math>)</p> <p>Group B displayed a significant difference on social competence total (<math>t = 6.24, df = 7, p &lt; 0.01</math>) also had a lower score on hostile/irritable (<math>t = -4.71, df = 7, p &lt; 0.01</math>) &amp; antisocial Behavior total (<math>t = -3.95, df = 7, p &lt; 0.01</math>)</p>	<p>2 groups of children with ASDs were paired up with the same instructor for 10 week WESP intervention (2 times per week/90 min per session)</p> <p>SSBS-2 was used to assess both social competence &amp; antisocial behavior</p> <p>Percentage scores in each stage for aquatic skills &amp; T-scores for social behaviors were examined in relation to treatment using a two-way ANOVA (group <math>\times</math> time) with repeated measures on one factor.</p>
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Citation	Participants	Procedure	Outcomes	Research Methodology
Najafabadi et al. (2018)	28 children with ASD 5-12 years old	SPARK program: warm up & cool down activities-36 sessions (40 min)	ATEC questionnaire Positive effect on sociability (self-esteem, confidence, competence) ( $F=7.86$ , $p=0.01$ )  GARS-2 questionnaire effect on social interaction ( $F=7.81$ , $p=0.01$ )	Pre/Posttest design was used. Effect of intervention on participants performance across two groups (EG-CG) Repeated measures were used. Post-hoc analysis, ( $p=0.05$ )
Battaglia et al. (2019)	Two boys (N=2) with ASD One girl (N=1) with ASD 11-15.11 years old	CI-MAT protocol: Ludic water activities (dance bubbles with water), 12 weeks (45-50 min)	The higher proportion of gains was observed in the sensitivity of other's presence and eye contact Communication=2, 10-3.7y Daily Skills=2.8-2.10y Socialization=2-2.6y	VABS-Vineland Adaptive Behavior Scales to measure adaptive behaviors for independent life  Children were videotaped (8 behaviors) by a trained operator for 50 min & their coach in the pool.

Citation	Participants	Procedure	Outcomes	Research Methodology
Primenta et al. (2016)	4 boys (N=4) with Autism 1 girl (N=1) PPD with traces of Autism 9-25 years old	15 classes, with a duration of 80 min. Four moments of different activities (floating, breath control & propulsion, swim strokes).	Positive developments in three tasks of inputs/outputs (taking a shower, getting in and out of the pool by the ladder).  Most of the students only performed with verbal & gestural instruction & without the teachers physical conduct.	Instructions explained verbally & directly  Explanation was performed with images by the teachers who helped physically (driving physics)  A camera was used for recording (e.g., what happened at the moment).
Tucker (2016)	3 boys (N=3) with Mild & High-Functioning Autism (HFA) 7-8 years old	Training for push/turn/grab 12 weeks/3 days per week for 15 min	One of three participants was able to master all three skills (Push/Turn/Grab Skill). The first participant maintained all skills at one week and 1-month past mastery date. 2 of three participants maintained two of the three skills at the one week and one-month maintenance dates.	A multiple baseline across skills design was used to determine the effectiveness of BST + IST on the acquisition of three skills for each of the participants.

Citation	Participants	Procedure	Outcomes	Research Methodology
Fragala-Pinkham et al. (2011)	11 boys (N=11) 1 girl (N=1) with Asperger syndrome, HFA or PDD-NOS 6.3-12.9 years old	Aquatic exercise program two times per week for 14 weeks/40 min per session (20-30 min aerobic exercise, 5-10 min muscular strength 5 min cool down/stretching activities).	Participants playing water games & also liked being with the other children and instructors during the class.  A significant difference ( $p < 0.01$ ) was found between the amount of time children were able to exercise at the beginning of the programme and the last 4 weeks.	Satisfaction was measured with a Questionnaire at the end of the 14-week programme by children and their parents.  Response percentages were calculated for the Close-ended items & were reviewed, key themes were identified.
Yanardag et al. (2015)	Three boys (N=3) with ASD 6 years old	Aquatic play skills & exercise training/12 weeks at three sessions per week, each lasting 1 hour.	MLP was effective in teaching advance movement exploration skills through aquatic activities to children with ASD.  Parents' opinions were positive on the learning skills in terms of functionality & this enjoyable intervention increased the repertoire of leisure skills and the level of physical activity for their children with ASD.	Three 6-year old children with ASD participated in 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 to analyze the effects of MLP.

## 4. Discussion

Summaries of these seven studies revealed that the existing literature can be described as limited with respect to the overall corpus of studies, and the relatively few numbers of participants with ASD (N=72). In terms of methodological quality, the most important limitation is that many of these studies provide the use of a strong experimental design and the positive findings across a wide range of dependent variables do suggest that increasing water exercise and/or activities of individuals with ASD is likely beneficial.

Results of Zanobini and Solari's (2019) study argue with the findings of this review. The two researchers suggested that perhaps aquatic activities are an advantage in relational skills. In addition, water exercise may produce positive changes both in behavior and physical fitness. According to Blankenship (2017), physical education in different environments, in this case, aquatic environment, focuses not just on physical benefits but also on the psychological principles and strategies which help children to develop prosocial behavior, and self-perception. One possible explanation for the improvements that involve increases in social behavior in both children and adolescents with ASD are the activities which provide a way to meet new people in a fun, no-pressure situation. In general, swimming pools serve as a hub for all sorts of activities, social gatherings, and community activities. For instance, study results of Pan (2010) and Najafabadi et al. (2018) argue that group aquatic activities create an adapted atmosphere in which a child or an adolescent with ASD interact with other people, even if he or she has never met before. From a social development standpoint, this aspect of group work in the water can be valuable as a child learns how to interact and be confident around different personalities. Similar results involving increased social behaviors were also found in Battaglia et al. (2019) and Primenta et al. (2016) studies. The active practice facilitated social changing perspective. Fragala-Pinkham et al. (2011) and Yanardag et al. (2015) argued that the opportunity of young children with ASD to dynamically engage with others in a skilled, supportive, and reciprocal manner is a key contributory element of aquatic programs. Based on the results of Tucker's (2016) study, individuals with ASD can learn social skills and attitudes during an aquatic play, as they learn how to be cooperative and be empathetic with others.

Regarding the first aim of this paper, there is a general consensus across the studies of this review that aquatic activities have developed social skills among children and adolescents with ASD, at least as measured by tests and observations. It appears that aquatic playing activities have a more pronounced effect than other swimming exercises. Aquatic playing activities were compared in four studies involving a total of 60 participants and, in all cases, aqua activities produced more substantial improvements (Battaglia et al., 2019; Fragala-Pinkham, 2011; Pan, 2010; Primenta et al., 2016). Observations of positive effects following aquatic activities were assessed in three studies involving a total of twenty-two participants (Battaglia et al., 2019; Pan, 2010; Tucker, 2016). This suggests that in some cases multiple sessions per day may be preferable (Battaglia et al., 2019). Similar results across other studies indicate the need for more longitudinal studies. Regarding the second aim, the most interesting result is that all of the studies agree that aquatic activities can be applied better by physical educators and instructors who have training in these techniques because these activities need more adaptations for participants with ASD. The primary goal of physical educators is the combination of exercise or play and cooperation among participants with ASD. Finally, referring to the third aim, aquatic activities/programmes researchers worked to establish lines of research.

#### 4.1. Limitations and Recommendations

The effect of aquatic activities on social skills and specifically on communication, friendship and cooperation are totally conclusive, thus it can be suggested that it enhances the theoretical framework which supports the practice by offering opportunities to individuals with ASD to enhance their social skills through social interactions with others. In this review, the researcher chose to present articles which have as participants only children and adolescents with ASD. Research in future studies can present and analyze numerous strategies of aquatic and swim activities and demonstrate to physical educators how to reinforce the social skills of individuals with ASD and other disabilities.

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