Supplementary materials.

Table S1. The Template for Intervention Description and Replication (TIDieR) Checklist [40].

1. Brief name	Water Specific Therapy-Halliwick (WST) with learning strategies in children with	
	Autism Spectrum Disorder (ASD) for improving social competence and quali	
	life: A mixed method intervention study.	
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2. Why	ASD are multifactorial disorders of neurodevelopment that present significant	
	impairment in social communication and repetitive sensory and motor	
	behaviours. The aim of this study was to implement an aquatic therapy (AT)	
	program WST-Halliwick, using learning strategies specifically designed by the	
	research team for children with ASD. Furthermore, we sought to analyse its effects	
	on perceived competence and social acceptance, aquatic skills and quality of life	
3 What	A WST session consists of four different phases:	
matorial	1 In the first phase (entry ritual) the approach to the new environment (as social	
material	angagement) has to be stimulated. It is necessary to be yowy methodical and to	
	follow door routing for antigination. At home, the equation the routing the routing the second of the	
	follow clear routines for anticipation. At nome, the aquatic therapy session can be	
	introduced by means of a communication board using pictograms or real images	
	of the pool, or by carrying out a programme to make a backpack. A group	
	gathering can also be organized at the entrance. Once in the pool, entry into the	
	water can be announced by pictures or pictograms, stories, song association or	
	group games.	
	2. In the second phase (mental adjustment) the water begins to be experienced as	
	a sensorimotor environment, as a way for the child to enter it through play. This is	
	the phase of the first aquatic perceptions, and it is the child who decides what to	
	explore and how. This is why it is a phase of a certain initial independence	
	(disengagement from the therapist and the task) after having achieved their	
	engagement to the aquatic environment in the first phase. Therapists must follow	
	the child (joint attention, requests, imitations), to allow a close relationship	
	between the two (again, engagement) and motivate the child to continue	
	discovering, but never force him/her; go at the pace set by the child, to avoid	
	rejection, lack of control or dysregulation. Gradually make this process more	
	structured. It is a percentual stage in which without giving a clear guideline at the	
	beginning and leaving the control of the session to the shild at first the shild	
	overlages through activities such as enlaching sinking and neuring filling and	
	explores through activities such as splasning, sinking and pouring, mining and	
	emptying, or moving away and approaching. The mission is to wait, to observe, to	
	ask for permission, to interact with the child in a gradual way. The aim for the	
	child is to connect with the environment and with the therapist (social	
	engagement).	
	3. The main phase (learning) builds on the previous phases by creating rules and	
	norms based on what the child has previously decided to explore. Here the WST	
	offers a multitude of opportunities for interaction, from the 10 points, through play	
	options that are added, as well as all the pedagogical and learning tools that are	
	extremely versatile in this aquatic dynamic. In this phase, in its social aspect, we	
	can again vary between dependence and independence with respect to the	
	therapist, the task, the environment and the family (engagement or	
	disengagement). This is the phase in which we seek. through motor and mental	
	work, to change the behaviour of the children with ASD, as well as to try to	
	consider the transfer of all that has been learnt to their daily life. In order to do this	
	it is important to design specific tasks for each child which present a clear and	
	adjusted goal. During the execution of each task we should use strategies that	
	autusieu goai, Duffig ule execution of each lask we should use strategies that	

	 support learning, such as visual aids, positive reinforcement, trial without error, active work and repetition. Apart from using these strategies, during the session we must control and dose what kind of sensory inputs we give to the child to enable an optimal state of alertness. It makes normal development possible during the session, and in turn facilitates the acquisition of new social skills and behavioural change. 4. In the last phase (exit ritual) our aim is that the child calms down and connect with his/her transfer out of the water. Creating a routine that informs them of the time of the exit and the activities that will take place afterwards contributes to a better performance of the activity we are asking them to do (saying goodbye to the water). We can do this through songs or imitation games, or simply by putting the toys away, accompanied by the use of pictures which is often effective in reducing anger and tantrums at the end of the session. We never deny the emotional states of the child (any emotion is welcomed and it is important to name it and collaborate to ensure that the child acquires skills for self-regulation).
4. What	
procedures	1. Ritual of entry. Routine phase. Structure the entry:
	• Songs, stories, tales, rules, visual agenda.
	2. Mental adjustment + control of WST-Halliwick rotations. Perceptual phase.
	Explore water by themselves. Link with therapist who respects and follows
	• 1-1/group Therapoutic exercises/games Mental motor independence:
	Fincourage regulation at all times Exaggerate emotions and gestures to
	maintain interaction. Little by little give structure (rhythm)
	 Safety exercises: Balance falls turns etc
	 Presymbolic play: Splashing, Cause-effect, Go-come, Throwing and
	picking up games. Space permanence, Appearance-disappearance, Object
	permanence, Sinking-out, hiding and finding.
	• Functional/symbolic play: "As if" with real objects, Threading more actions
	into the "as if" play and suspending the real use of objects, Using invisible
	objects and characters.
	3. Learning + WST control rotations. Conceptual phase. Goal setting:
	Begin to change behaviour and transfer.
	• 1-1/group play.
	• Select a Halliwick point to do the rehearsal-learning. Use necessary
	supports, modelling, chaining. Structure sensory inputs and sequenced
	tasks. Add learning aids (reinforcers, visual aids, etc.).
	4. Exit ritual. Routine phase.
	• Calming down. Structure the exit with activities that organise or regulate.
	• Songs, picking up toys or elements. Use goodbye songs, songs to say
	goodbye. Use farewell songs, pictograms diary, songs, collecting toys or
	material.
5. Who	In water, ideation (mental desire) and motor control go together. Play is the perfect
provided	opportunity to link the two within the aquatic intervention process, as a source of
	run, motivation and learning. A great advantage for the quality of the intervention
	is that the family can be included in the session. It can result repetition and
	generalisation of the games and therapeutic goals in their natural environments,
	The MET games were developed by 2 physical therewise with more than 10 meres
	of expertise. Two evaluators (physical therapists) with more than 10 years
	or expertise new evaluators (physical therapists) with more than 10 years of expertise performed the initial and post treatment accossments. AT Sessions were
	experiese performed the initial and post-freatment assessments. At Sessions were

	carried out by one physical therapist who were with the patients throughout all the rehabilitation process.	
6. How	Group sessions. Attended by the 6 children, the physical therapist and the childrens' father/mother who participated in WST activities.	
7. Where	The intervention took place in a therapeutic pool:	
	- 1.10 m depth	
	- Water temperature 31.5 °C	
	- Access to therapeutic area via a ramp or staircase	
	- Water quality: pH and chlorine measurements were performed twice a day. The rest of the parameters were checked daily by the maintenance personnel. The pool water was constantly filtered (overflow) and all the water was renewed daily.	
8. When and how much	Patients attended AT twice a week over seven months. Sessions lasted 60 minutes, including a change of clothes, physiotherapy session and free time with parents. The day of therapy and the schedule was agreed on with the parents depending on the best availability to attend other therapies, medical consultations and adapted to school hours. Moreover, we tried to schedule therapy in time slots when the pool occupancy is less than 25% to avoid noise and crowds.	
9. Tailoring	During the sessions different play strategies based on circular play models were used, in which the child is helped to move towards higher levels of complexity with strategies to facilitate social interaction. The child's interests are respected and noted, as internal motivation helps to improve the quantity and quality of joint attention. This facilitates the establishment of WST games in which the child has to overcome challenges (making requests, taking turns or playing in a team).	
	One recommendation when starting a play stimulation program in the aquatic environment is to let the child lead at first, with us intervening in a gradual and orderly manner. The aim is to connect their actions within a pedagogical approach that will help us to attract their attention, to get them to accept us within their space and to engage them emotionally. A good tip at the beginning is the use of counter- mimicry, observing the child's intentional actions. Other strategies include setting some kind of problem to solve, hiding a toy, making a funny mistake or to using elements in unconventional ways.	
10. Modifications	There were no modifications of the initial protocol. All patients were able to perform all the proposed activities.	
11. How well planned	Intervention was delivered as planned and no adverse side-effects were observed. Physical therapist registered children attendance to sessions through a name check sheet.	
12. How well actual	Intervention was delivered as planned and no adverse side-effects were observed.	

Table 2. Trustworthiness qualitative design criteria applied.

Criteria	Techniques performed and application procedures
Credibility	Investigator triangulation: each interview was analyzed by two researchers. Thereafter, team meetings were performed in which the analyses were compared and themes were identified. Triangulation of data collection methods: semi-structured interviews were conducted and researcher field notes were kept.
	Participant validation: this consisted of asking the participants to confirm the data obtained during the data collection and analysis stages.
Transferability	In-depth descriptions of the study were performed, providing details of the characteristics of researchers, participants, contexts, sampling strategies, and the data collection and analysis procedures.
Dependability	Audit by an external researcher: an external researcher assessed the study research protocol, focusing on aspects concerning the methods applied and study design.
Confirmability	Investigator triangulation, data collection triangulation. Researcher reflexivity was encouraged via the completion of reflexive reports and by describing the rationale for the study.

 Table 3. Semi-structured question guide.

Research topics	Questions asked
Opening questions	What does aquatic therapy mean to you? What is your treatment
	expectation?
	What is your experience with the aquatic therapy received by your child?
Adaptation to the new	How was your child's adjustment to the new treatment
aquatic environment for	environment? Were there any activities that were very difficult to
WST treatment	perform?
Effects of WST	How do you think the aquatic therapy has influenced your child?
treatment	What do you think has been the benefit of participating in these
	sessions?
	Have the recommendations provided by the aquatic therapists been useful for the management of your child outside the pool?
Influence of aquatic	In what aspects of daily care and management of the child have you
therapy on the daily	noticed changes? If these were negative, what were they?
care and	
management of the	
child	
Factors of the disorder	How do you feel aquatic therapy can affect your child in the long
for which aquatic	term?
therapy is most useful	
	WST: water specific therapy

Table S4. Polarity analysis

Formula and dictionaries used to calculate pola	rity
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- The analysis was carried out using the Bing dictionary [54]. The Bing dictionary determines the positivity (acceptance) or negativity (rejection) of each word used. Also, the amplifiers and de-amplifiers of Semantic Orientation Dictionaries Version 1.11 Spanish dictionary [56-58] were used, and the negators proposed by Vilares et al. [59].
- To calculate the polarity (δ), a contex cluster of words (x^{T_i}) was formed around each polarized word using the Bing dictionary [54], taking by default 4 words before and two words after it (if there is any comma in the cluster, it will only include the words that are after the comma) and that will be treated as valence shifters.
- The words in this cluster are labeled as neutral (x⁰_i), negators (x^N_i), amplifiers (x^a_i) or deamplifiers (x^d_i) using the dictionary SODictionariesV1.11Spa2 [56-58] and the negators proposed by Vilares et al. [59]. Neutral words do not add to the equation but affect the word count (n).
- Each polarized word (negative or positive) is weighted (w) based on the context cluster weights (x^{T_i}) and further weighted by the number and position of the valence shifters directly surrounding it. A weight (c) can be added and applied to both amplifiers and deamplifiers (with a default value of 0.8 and a lower limit for the de-amplifiers of -1).
- Finally, the context cluster (x^T_i) is added and divided by the square root of the number of words (√n) to generate a polarity score (δ) that by default is not limited in value.

The end result is the formula:

 $\delta = \mathbf{x}^{T_i} / \sqrt{n}$

Where:

$$\begin{split} x^{T_i} &= \sum \left((1 + c(x^{A_i} - x^{A_i})) \cdot w(\text{-}1)^{\sum x Ni} \right) \\ x^{A_i} &= \sum \left(w_{neg} \cdot x^{a_i} \right) \\ x^{D_i} &= max \; (x^{D'_i} - 1) \\ x^{D'_i} &= \sum \left(\text{-}w_{neg} \cdot x^{a_i} + x^{d_i} \right) \\ w_{neg} &= \left(\sum x^{N_i} \right) \end{split}$$