SWIM ODYSSEY

AN INDEPENDENT REPORT

BY

THE ALLIED HEALTH RESEARCH UNIT

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Innovation Partnership

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REMIT OF THIS REPORT

This report recognises the agreement established in the contract between Swim Odyssey and the University of Central Lancashire (Allied Health Research Unit). This report discusses all the main outcome measures of this study and meets the full contractual obligation between the parties.

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Does musical hydrotherapy facilitate learning for children struggling in classroom settings? A Case Study

1. Introduction

Musical Hydrotherapy represents a distinctive therapeutic method that integrates underwater auditory experiences with aquatic body therapy techniques. Its primary objective is to promote both physical and mental relaxation, fostering a harmonious relationship between movement and stillness to enhance the connection between the body and sound. Underwater speakers are used to play specially designed music during the sessions; as sound travels faster in water (Etter, 2013). The sound is perceived through bone conduction of the skeletal system, in addition to the eardrum, which provides a unique, womb-like experience for the listener, perceiving the sound as if heard from inside their own head (Deliege and Sloboda, 1996; Dewhurst-Maddock, 1993; Papousek, 2007; Cahen, 2010). This practice is primarily used in an educational or artistic context for children with complex needs (Cahen, 2010). The reasons why this practice may be beneficial for this population is that the pool creates a playful, fun social space for learning, additionally it may increase attentiveness and a sense of individuality and self for the listener, increasing confidence and awareness (Cahen, 2010). The evidence base supporting musical hydrotherapy is sparse (Vogiatzoglou, 2014). Previous evaluations including children with complex needs showed improved physical movement, reduced levels of anxiety and stress, with children being more relaxed during the hydrotherapy sessions (Rinta, 2011). Notably, a greater amount of enjoyment and happiness has previously been noted during the musical hydrotherapy sessions compared to the classroom (Rinta, 2011). The positive reinforcing elements associated with music listening have been shown to be influenced by elevated dopamine levels in the nucleus accumbens, as well as the cerebellum's role in emotional regulation through its links to the frontal lobe and the limbic system (Peretz and Coltheart, 2003; Zatorre, 1994).

It has been suggested that Musical Hydrotherapy has educational, physical and emotional benefits for children with Special Educational Needs (SEN). A Cochrane review of music therapy with children with SEN highlighted that Music therapy could enhance social interaction, verbal communication, initiating behaviours and social-emotional reciprocity amongst children with Autism Spectrum Disorders (ASD) (Skinner et al., 2020). However, studies of adequate sample size remain lacking, to emphasise the true benefits to be gained (Geretsegger et al., 2014; Gold et al., 2006). For musical hydrotherapy, positive responses have been noted from children with autism and learning difficulties with improved confidence in the water, responses of relaxation and creative use of movement all reported (Vogiatzoglou, 2014). Certain individuals with autism may enhance their understanding of graphic symbols through music therapy (Simpson and Keen, 2009). The sensitivity of hearing may be somewhat diminished underwater, indicating that a greater level of noise is acceptable in aquatic environments compared to that in air (Parvin and Nedwell, 1995). Therefore whilst musical hydrotherapy is an innovative approach and may promote many benefits in children who struggle with learning, adapting the learning environment may influence the ability of a child to learn a task.

Mechanisms of learning

The process by which a child acquires a new task can be understood through the lens of the organismic constraints model (Newell, 1986). This model emphasizes the interplay between the child's inherent characteristics, the task requirements, and the environmental context, highlighting how these factors collectively influence learning (Figure 1). By considering the biological, psychological, and social constraints that shape a child's development, one can gain insights into the mechanisms of skill acquisition and adaptation in various learning scenarios.

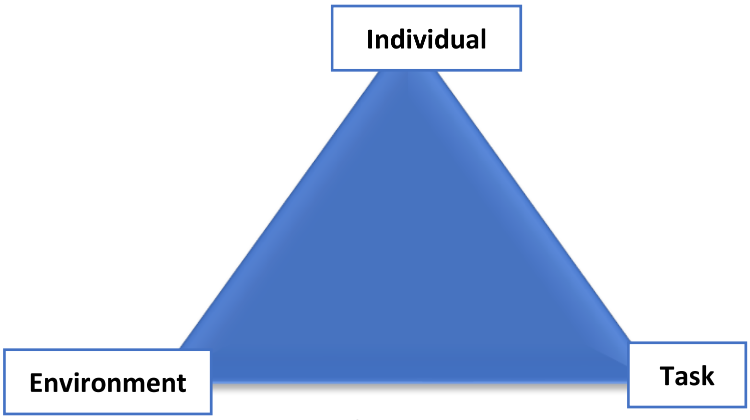


Figure 1: Constraints Model (Adapted from Newell, 1986)

In order to successfully adapt to learning, it is important to consider, not only the task and environment in which a child learns, but also the other influencing factors within an individuals' developmental context. Bronfenbrenner's ecological theory provides a framework for understanding the various environmental systems that influence child learning (Bronfenbrenner, 1979). It emphasizes the interconnectedness of different contexts, such as family, school, and community, and how these systems interact to shape a child's development and educational experiences (Figure 2). By examining these layers of influence, the theory highlights the importance of considering not only the immediate but broader social environments that influence effective learning outcomes for children. This study will focus on the Mesosystem of a child, by exploring the interaction between the child and their microsystem when participating in Musical Hydrotherapy. This study will explore not on the individuals' perspectives, but also that of the Parent/caregiver and schoolteacher, in order to explore the impact of a water based learning activity on the core influencing factors on a child's development and learning.

Figure 1: Constraints Model (Adapted from Newell, 1986)

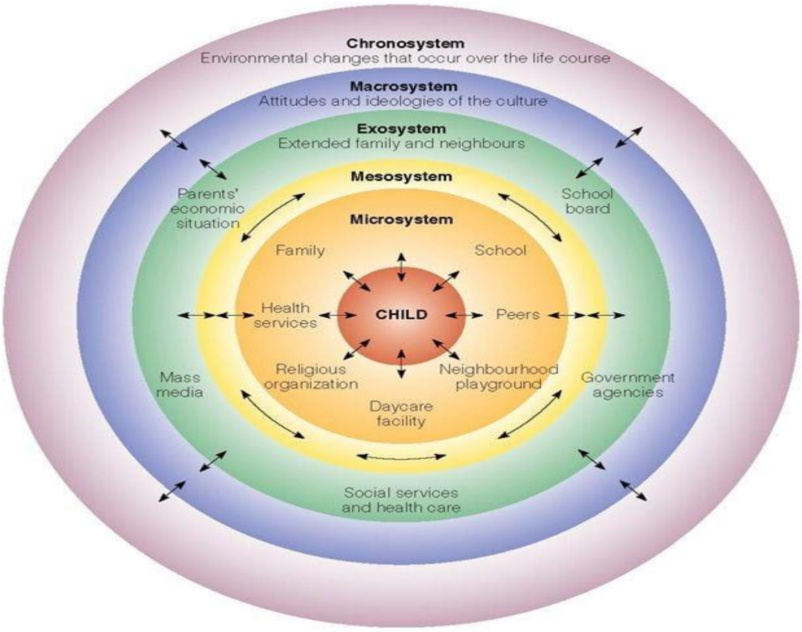


Figure 2: Ecological System's theory (Bronfenbrenner, 1979; Guy, 2024)

2. Aims and Objectives

The aim of this case study was to explore how a musical hydrotherapy intervention impacted focus and ability to learn for a child struggling in the traditional classroom setting.

3. Methods

3.1 Ethical considerations

Ethical approval was granted from the University ethics Committee (ref: Health 01193). The study conformed to the Declaration of Helsinki (World Medical Association, 2013). All data was collected, managed, and stored in line with General Data Protection Regulations. Electronic consent was gathered, confirming participation in the study at each data collection point.

3.2 Design

A single pre-post intervention case study design was used to explore how a musical hydrotherapy intervention affects focus and learning, gathering data from three involved parties: teacher, parent, and pupil, using an online questionnaire-based approach.

3.3 Participants

A participant was recruited using existing links between Swim Odyssey and a local primary school. A primary school facilitated the study through use of their swimming pool facilities. Children were considered potentially suitable if they met the following criteria:

- Aged 8-11years old.
- An Education, Health, and Care Plan (EHCP) in place.
- The childs teacher identified that the child struggled to focus in a traditional classroom environment.
- Capacity to complete the questions included in this study, with support from a parent/caregiver as needed.

Participants were not excluded from the study based upon their ability to swim or not, as the intervention was adapted accordingly. Suitable volunteers were identified by the classroom teacher, and an invitational letter and information sheet was sent home on behalf of Swim Odyssey and the research team, providing details about the musical hydrotherapy intervention, and the research study. Interest in participation was indicated through a completed return slip to the child's school, and Swim Odyssey contacted the parents to arrange dates for the intervention. No basic swimming knowledge was required to take part, and the intervention was adapted according to the participant's needs.

3.4 Procedure

Once a participant had been recruited for the study, a representative from Swim Odyssey met with the classroom teacher to understand the specific learning and behavioural needs of the participant prior to the start of the intervention. A classroom observation was carried out to see how the participant behaved in the classroom and was used to plan the tailored intervention.

The parent, teacher and child completed a pre-intervention (T1) questionnaire before the start of the intervention. These questionnaires covered the same domains, but were adapted accordingly for each participant (parent, child, teacher). The domains included:

- Child's focus at home or at school

- Child's happiness
- Child's response to the intervention (post-intervention only, [T2]).

Following the preparation work and completion of the Pre-intervention [T1] questionnaires, the intervention commenced. Upon immediate completion of the intervention, an online questionnaire (T2) was completed by the teacher, the child, and the parent to understand the immediate effects of the musical hydrotherapy intervention.

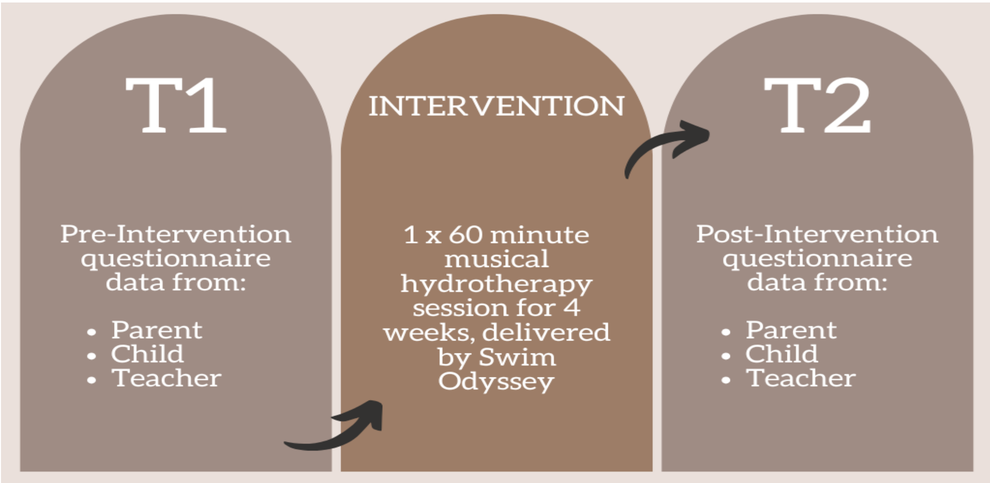


Figure 1: Study Design

3.5 Intervention (Musical Hydrotherapy)

The intervention comprised up to four weeks of musical hydrotherapy sessions (one 60-minute session per week from January to February 2025). Each session focused specifically on a topic that the pupil was struggling with in school at that point in time, informed by the preparation stages, e.g. times tables. Each session was based in the swimming pool and appropriate music was played through underwater speakers during every session. The music choice was guided by the preparation stage, e.g. if the participant found learning and concentrating stressful then calming and relaxing music was selected. Sounds were also used to help the individual to regulate. During each session the participant moved through the water (walking/swimming) or remained stationary (standing up/floating using aids), which was directed by the participant, depending on how they felt and what enabled them to focus. The school topic was then taught in the swimming pool environment.

3.6 Data processing

Although a single case-study research design requires only one participant to participate in the intervention, data was collected from 3 involved parties (child, teacher, parent). The data set comprised quantitative and qualitative components. The quantitative components were analysed using descriptive and repeated measures statistical tests. The qualitative components were analysed using thematic analysis with key findings presented descriptively (Braun & Clarke, 2006). Due to the case study nature of the study, no statistical tests were included.

4. RESULTS

A single primary school participant with Special Education Needs participated in the study alongside the individual's parent/caregiver and teacher. Key outcome measures explored the three perspectives at 2 timepoints within the intervention (baseline and 4 weeks) around

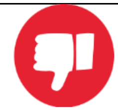
- The child's focus/concentration at home and school
- The child's response to change or new situations
- The child's happiness
- Intervention specific feedback

The child attended 3 out of 4 sessions within this period.

4.1 THE CHILD'S FOCUS AND CONCENTRATION AT HOME AND SCHOOL

When asked to rate their own level of concentration in the classroom, **the child** reported an increase by 3 points (50%) from their own perspective. This could indicate an increase of confidence in the child within the classroom environment (Table 1). From the **parents' perspective,** the ability of the child to focus on an activity for 5 minutes at home decreased. However, improved focus in the afternoon was noted following the intervention (figure 2). From the **teacher's perspective**, improved focus was found for 5-minute tasks. At T1, the teacher reported that the pupil's focus was better in the morning. However, following the intervention, no noticeable differences in focus were reported by the teacher based on the time of day. This differs to the parent's perspective in that the child's focus had become more effective in the afternoon at T2. Overall, this could suggest an improvement on overall focus through the day, where previously effective focus was only reported in the morning.

Table 1: Outcomes on the child's focus and concentration from the perspectives of the child, parent/caregiver and teacher: The traffic light system for change indicates either a positive (green), negative (red) or no change (orange).

PERSPECTIVE	QUESTION	PRE (T1)	POST (T2)	POSITIVE / NEGATIVE CHANGE
Child	*How good is your concentration in the classroom?*	 (3)	 (6)	
Parent/Caregiver	*My child is able to focus on an activity for 5 minutes (select most appropriate answer)*	"Able to focus for the full 5 minutes"	"Able to focus for a short period of time, have a break, and then focus again	
	What time of day do you notice your child is able to focus more effectively at home?	"No noticeable differences"	"Afternoon (12 - 5pm)"	
Teacher	*The student is able to focus on an activity for 5 minutes (select most appropriate answer).*	"Able to focus for a short period of time, have a break, and then focus again".	"Able to focus for the full 5 minutes"	
	What time of day do you notice your student is able to focus more effectively at school?	"Morning"	"No noticeable differences"	
	To what extent have you noticed an improvement in the student's ability to focus in the classroom over the last four weeks?		"Not at all	

4.2 RESPONSE TO CHANGES / ADAPTATION TO NEW SITUATIONS

In terms of the child's response to change and new situations, **the child** reported that they felt sad (2 out of 6) when changes occurred in their life (Table 2). Following the intervention (T2), the child reported that they felt worse (1 out of 6), in comparison to T1. Data from the parents and teacher provided further insight into how the child was feeling. In the home environment, **the parent** found that the child responded worse to change within their normal routine at T2 in comparison to T1, however when learning within the classroom environment, **the teacher** reported an improvement in the child's ability to cope with routine changes, stating an increase from "not able to cope" to "somewhat able to cope". Perhaps this represents an increase in confidence in the classroom; the specific nature of the intervention being cantered around aspects of learning may be key in improving their ability to cope with routine changes in the classroom.

When specifically asked about the child' ability to adapt to new situations (such as being a part of the musical hydrotherapy intervention), the parents and teacher both stated that the child was "somewhat able to cope" at T1, and this was maintained over to T2.

Table 2: Outcomes relating to the child's response to changes and new situations from all individuals involved (child, parent, teacher).

PERSPECTIVE	QUESTION	PRE (T1)	POST (T2)	POSITIVE / NEGATIVE CHANGE
Child	*How do you feel when changes happen in your life?*	 (2)	 (1)	
Parent/Caregiver	*Is your child able to adapt their behaviour to a new situation, for example, starting a new class such as Musical Hydrotherapy?*	"Sometimes able to adapt"	"Sometimes able to adapt"	
	Is your child able to cope with changes, for example, something changing within their normal routine?	"Somewhat able to cope"	"Not able to cope"	
Teacher	*Is the student able to adapt their behaviour to a new situation, for example, starting a new class such as Musical Hydrotherapy?*	"Sometimes able to adapt"	"Sometimes able to adapt"	
	Is the student able to cope with changes, for example, a change within their normal routine?	"Not able to cope"	"Somewhat able to cope"	

4.3 THE CHILD'S HAPPINESS

With regards to happiness, **the child** reported they were very happy at T1 (6 out of 6) whilst they reported a slight decrease in happiness at T2 (5 out of 6). However, the child reported that they were happy before and after the intervention (Table 3).

In the classroom, the child reported that they neutral feelings (felt neither happy nor sad) when learning something new at school (4 out of 6). Following the intervention (T2), the child self-reported that they felt very happy when learning something new in the swimming pool (6 out of 6), showing a positive impact of this change of environment during the learning process. Similar to the child, **the teacher** reported that the child had shown increased signs of happiness when within the classroom environment following the intervention (T2), compared to T1. In contrast, from the **parents' perspective**, the child was showing slightly less signs of being happy at home, yet they were still showing signs of being happy "often". In addition a notable difference from the parents' perspective was that the child adapted from more individually focussed happiness to connecting with others.

The signs of the child being happy reported by the parent and teacher were consistent when in the home or classroom environment, with themes identified such as laughing, talkative, actively engaging in play. This result concurred with the data on the child's ability to cope with change in routine or new situations, where the increased ability to cope in the classroom had resulted in more signs of being happy in that environment and perhaps less of being overwhelmed.

Table 3: Outcomes relating to the child's happiness from all individuals involved (child, parent, teacher)

PERSPECTIVE	QUESTION	PRE (T1)	POST (T2)	CHANGE / THEME
Child	*How happy are you right now?*	 (6)	 (5)	
	How do you feel when you start to learn something new at school? (T1)	 (4)		
	How did you feel when you started to learn something new in the swimming pool sessions? (T2)		 (6)	
Parent/Caregiver	*My child shows signs of being happy*	"Always"	"Often"	
	If your child shows signs of being happy, please describe what signs these are.	"Laughing, smiling, physical play and touch, making noises and sounds to himself, moving around lots. Being loud and bubbly".	"Laughing, running around, wanting to play together",	Laughing, actively engaging in play, talkative.
Teacher	*The student shows signs of being happy*	"Sometimes"	"Often"	
	If the student shows signs of being happy, please describe what signs these are.	"happy, laughing, smiling, asks to do activities, plays games."	"laughing, smiling, talkative"	Laughing, actively engaging in play, talkative.

4.4 Intervention Specific Feedback

Overall, **the child** enjoyed the programme a lot, rating it the maximum score on the scale used (6 out of 6). From the child's perspective, the most enjoyable parts of the intervention were the calmness experienced, their improved ability to learn their spellings, and being able to recall that information learnt from the previous week without practicing (Table 4). Moreover, both the **parent and the teacher** both felt that the child had benefitted from the Musical Hydrotherapy intervention, with both reporting an increased ability of the child to learn specific task. In agreement with the child, the parent specifically mentioned the increased ability of the child to learn their spellings following the intervention, whereas the teacher reported an increase in the child's confidence around the classroom.

Considerations for improvement: One area the child did not enjoy about the intervention was "seeing other people finishing their lesson or getting changed". Whilst not always avoidable, perhaps scheduling a gap between lessons where crossover is less likely to occur may be beneficial for some children who may find this problematic.

Table 4: Perspectives on the intervention from the child, parent and teacher.

PERSPECTIVE	QUESTION	RESPONSE AT T2	NOTABLE CHANGE / THEME
Child	***How much did you enjoy the swimming pool sessions?***	 (6)	
	What did you like about the swimming pool sessions?	That it was calm and the water was warm. I liked the music in the water because it was calming. I think it did help me learn my spellings better. I remembered how to spell the words from the last session without practicing in between. **Themes:** Calmness, Improved ability to learn and recall information learnt. Self-reported improvement in spelling.	
	What did you not like about the swimming pool sessions?	"I didn't like seeing other people finishing their lesson or getting changed."	
Parent/Caregiver	***To what extent have you noticed an improvement in your child's ability to learn a specific task* over the last four weeks?***	"Very"	
	Do you think your child has benefitted from the musical hydrotherapy intervention?	"Yes"	
	Please can you describe what benefits you have noticed?	"He felt he was able to learn the spellings better through doing it. Thank you for the experience, he loved it. We will consider doing it again in the future." **Themes:** Improved ability to learn.	
Teacher	***"To what extent have you noticed an improvement in the student's ability to learn a specific task* over the last four weeks"***	"Slightly"	
	"Do you think the student has benefitted from the musical hydrotherapy intervention? "	"Yes	
	Please can you explain what benefits you have noticed?	"He has benefitted as he has shown more confidence around the classroom, but due to a prolonged period of absence with being ill (for over a week) and having half-term off school, the benefits have not been as noticeable in school as of yet." **Theme:** Improvement in confidence	

5. Summary

Concentration:

- The child reported improved concentration in the classroom following the Musical Hydrotherapy intervention. The parent noticed an increased concentration of the child specifically in the afternoon, and the teacher reported an increased ability of the child to focus on a 5-minute task.
- The results from the parents and teacher indicate that the child's overall concentration throughout the day may have improved; at T1 the teacher reported increased focus in the morning and found "no noticeable differences" at T2. Moreover, the parent reported increased focus in the afternoon at T2.
- Whilst this suggests the intervention may be effective at increasing the child's concentration in the classroom, this intervention was short and as such findings should be interpreted with caution.

Ability to cope with changes:

- The child reported that they feel sad (2 out of 6) when changes happen in their life. This reduced further to "very sad" (1 out of 6) following the intervention. Furthermore, the parent noticed the child's reduced ability to cope with changes at home following the intervention.
- In contrast, the child's ability to cope with routine change from the teacher's perspective suggests an improvement in the classroom environment following the intervention, with the child being "somewhat able to cope" when previously they were "not able to cope".
- This suggests the Musical Hydrotherapy intervention may be effective for helping children who struggle to cope with routine changes specifically in the classroom environment. However, a longer term follow up would be recommended.

Happiness:

- The child's level of happiness was generally high at T1 and T2, however it did reduce slightly after taking part in the intervention.
- There was a contrast in happiness between how the child felt about learning in the classroom (T1) versus learning in the pool (T2). The child reported that they felt very happy when learning something new in the pool.
- The teacher reported that the child was showing more signs of happiness in the classroom following the intervention.
- Whilst the parent noted that the child showed less signs of being happy at home,

they noticed that happiness shifted from focussed on the child to interpersonal connection.

- This suggests that whilst Musical Hydrotherapy sessions may provide a more enjoyable learning environment for children who do struggle with certain tasks at school, further benefits may be seen in the traditional learning environment. However, a longer term follow up would help to understand this further.

The Intervention:

- The child enjoyed the Musical Hydrotherapy intervention, rating it the maximum score on a 1-6 scale.
- The sense of calmness and their improved ability to learn their spellings and recall that information in subsequent weeks was what they found most enjoyable. This indicates that the child was happy learning in this environment and found the lessons valuable and memorable.
- The parent reported a great improvement in the child's ability to learn the specific task (spellings), whilst the teacher reported a slight improvement.
- Overall, the child enjoyed learning in the swimming pool, and it improved their ability to learn from the parent's perspective and increased their confidence in the classroom environment.

Limitations

- A further evaluation was planned to take place 4-weeks after the conclusion of the intervention to understand the longer lasting effects of the intervention. Unfortunately, due to time constraints, this was not possible. It would be valuable to know if the child's improved concentration, increased confidence and improved ability to learn in were maintained long-term. Further work in this area may inform the company on how long the intervention should be to provide find a meaningful long-term effect.
- Whilst numerous positive effects of the intervention were found, the results were only assessed in a case-study design (one participant). Further research with more participants and a control group may inform the company of further benefits of the intervention and provide further context of the benefits in the classroom or home environment.
- This study explored the Meso and microsystem influences of this intervention on the child's development through this intervention (Bronfenbrenner 1979, Guy 2024).

There are a multitude of factors that may influence the development and learning of a child. Further case studies should look to adopt a more comprehensive approach to understand the wider influencing factors that may impact a child's learning behaviour and wellbeing when participating in Musical hydrotherapy interventions.

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