

Liquid Vibrations Project Report:  
St. Nicholas School, Canterbury  
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## Liquid Vibrations Report

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## **Introduction**

### *Liquid Vibrations*

Liquid Vibrations is a charity that uses underwater listening as a tool to enhance the well being of individuals with special needs. The organisation is currently working alongside specialists in Watsu and aquatic bodywork (discussed below), in order to further enhance the experience that the individuals have. Sessions are run in a hydrotherapy pool, and specialist speakers are installed to enable the music and sounds to be heard underwater. The quality of sound underwater is altered, in comparison to the air, particularly through the vibrations that are caused within the water. The organisation view these vibrations as beneficial due to the fact that they are not only perceived by the ears but also the skeletal system. In addition, floating enables movement (e.g. through weightlessness) that may not be possible for these individuals on land (Liquid Vibrations: nd a). Liquid Vibrations also perceives the following areas to be possible outcomes and benefits for disabled children and adults:

Education – the sessions are occurring in “interactive listening environments which provide a basis for [an] understanding of the environment” (ibid).

Physical – the fact that there is an increase in freedom in the body working within water, in comparison to in the air (ibid).

Emotional – the response that individuals may have can be that of emotional resonance because of the sound, but also the feeling that experiences of the vibrations have in the skeletal system (ibid).

### *Music*

The music that is used within the work that Liquid Vibrations carry out is based around three concepts:

1. Familiar music (e.g. pop music) which serves as a relaxation and opportunity to increase interaction, as well as for individual pleasure.
2. Abstract music (e.g. electro-acoustic sounds) which is used to evoke imagination and encourage the individual into an introspective state.
3. Narrative sounds (e.g. animal noises) as recognition and to heighten awareness

(Liquid Vibrations: nd b).

There is research into the benefits of music with individuals with special needs. In regards to autism, benefits were found when comparing improvisational music play and toy play (Kim, Wigram and Gold: 2009 and Kim, Wigram and Gold: 2008). Some autistic individuals are able to learn graphic symbols better through the use of interactive songs (Simpson and Keen: 2009). There is less research into music and profound and multiple learning disabilities (PMLD).

However a framework has been developed, *Sounds of Intent* (SoI), which analyses the musical development of individuals with special needs, from children who have PMLD to those on the autistic spectrum (with or without savant skills) (Sounds of Intent nd). The framework was developed from extensive observational data of children, psychological research into 'typical' music development and underpinned by the zygonic theory "which seeks to explain how music makes sense to us all" (ibid). The framework consists of three domains: reactive, proactive and interactive, which each have six levels of development. This is a popular tool for assessing musical development (Vogiatzoglou, A. et al, 2011; Welch, G. and Ockelford, A. 2010; Welch et al 2009).

There is very limited research into music underwater but one study looking into diver's and sound underwater, found that the sensitivity of the hearing process is slightly lower underwater which mean that a "higher level of noise is permissible underwater than is permissible in air" (Parvin and Nedwell 1995: 12).

### *Watsu*

This is a therapeutic technique that is carried out within the water. It incorporates “static passive stretches and a structured sequence” that is highly individualised (Chon, Oh and Shim 2009: 129). This has been used in a variety of settings and there is limited research that has been carried out on it. Chon, Oh and Shim found there was an improvement in spasticity and ambulatory function in hemiplegic patients after a stroke (2009). General improvement was also found in flexibility, stability and joint articulation (Stan 2013).

### *Aquatic Bodywork*

This is based on Watsu although develops it further to incorporate a wider range of techniques: underwater dance, the Alexander Technique, Osteopathy-based Craniosacral Therapy, integrating also breath and sound work (Poetry in Water: nd).

There has been other research in aquatic leisure which found higher levels of engagement in a session in a hydrotherapy pool using aquability (a form of aquatic leisure) in comparison to a control condition for patients at a residential home with neuropalliative conditions (e.g. Huntington’s disease, advance stage Parkinson’s or MS) (Fenech 2011).

### *Previous Liquid Vibration Research*

The organization have carried out previous research into the benefits of music underwater to children with special needs. The reports from the previous research can be downloaded via their website: [www.liquidvibrations.org.uk](http://www.liquidvibrations.org.uk). The most recent research carried out in 2014 found positive impacts on the children but pointed to areas which could be further developed to help “tease out the various elements” such as the incorporation of silence into the work, which has been added in for this phase of research (Vogiatzoglou 2014: 16)

## **Current Research**

The aim of the research was to see whether individuals with PMLD could benefit from listening to music underwater, whilst engaging in aquatic bodywork. A secondary aim was to see if an evaluative tool could be developed that could effectively analyse reactions from individuals with PMLD to the experience.

The research took place at a special school in Kent, St Nicholas', which provides education for pupils aged 4 - 19 who have profound severe and complex learning difficulties ([www.st-nicholas.kent.sch.uk](http://www.st-nicholas.kent.sch.uk)). Sessions were run between January and March 2015, on a weekly basis for 9 weeks (with a week break to coincide with the school's half term). There were a combination of individual and group sessions. The group sessions were run for children who were diagnosed on the autism spectrum. For the purpose of this research only the individual sessions were closely analysed. A similar project was run simultaneously at the Redway School in Milton Keynes, but this project will not be analysed in this report (see Liquid Vibrations website for this – once published).

Individual sessions were run for three students who all had PMLD. Participants were under the age of 16 and coincidentally all female. These children had been selected by the school because they had PMLD and were happy to be in the water.

The participants attended a weekly session in the schools own hydrotherapy pool, in which they experienced the same original 10-minute piece of music<sup>1</sup> played through underwater speakers. This music started with a two minute silence, and then incorporated sounds and moments of silence throughout. In addition to this, aquatic bodywork was carried out by Steve Karle (a qualified Watsu therapist), teaching assistants and a teacher from within

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<sup>1</sup> The music was composed by Joel Cohen (Co-Founder and Artistic Director of Liquid Vibrations). The piece of music is divided into three sections: silence, melodic bars and relaxing mix, all of which are intended to achieve different experiences for the individuals (see appendix for more details).

the school who had a relationship with the child participating (the teaching assistants had all had a taster session of Watsu during an inset day in which Steve Karle worked with them for four hours). There was a maximum of three adults in the water (including one person filming) per participant<sup>2</sup>. There were two weeks when Steve Karle was not present but it was felt by that point the Teaching Assistants (TAs) and teacher could carry out the work needed for the purpose of the research. The participant was introduced into the water (some entered via hoist and others aided down the steps) and either Steve Karle or the TA would settle them into the water. Once it was felt the participant had settled, the ten minute piece of music was played. Once the piece was finished, if there was time, participants were able to stay in the water for a short period. They either engaged further with the Watsu technique, experienced different sounds or were allowed some free play. The footage of this was not analysed closely.

The participants were filmed via two cameras: one in the water, capable of going underwater, and one from the poolside.<sup>3</sup> Footage was analysed every week via an observation form which documented any reactions to the music, silence and questions about mood and behaviour. This was a novel form that was created for the purpose of the research. The observation forms were complemented by forms given to the teaching assistants and teacher who worked with the participant, and parent/carer forms which were sent home. Unfortunately return of forms was not always high (particularly for the parent/carer forms). As well as this analysis of documentation was used to obtain the participants level within the SoI framework.

In addition to the pool sessions, dry sessions were run at three points (within the first couple of weeks, at the halfway point and just after the last session) in which the participant (accompanied by a TA) sat in a quiet room within the school, whilst the music was played. These

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<sup>2</sup> Outside of the pool would be several people including Adele Drake (Founder of Liquid Vibrations)

<sup>3</sup> The filming was carried out in water by Hannah Newman (author of this and research assistant) and outside of the pool by Artemis Evlogimenou.

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sessions were also filmed and analysed. One child attended all three sessions, another attended two sessions and the final child was only able to attend one session.

At the same time as these dry sessions, interviews were also carried out with the TA's and teacher in which similar questions to the observation form were asked, as well as typical behavioural cues for each individual and an overall perspective on the experience. This was carried out in the second and third dry session. An interview was also conducted towards the end of the project with the Head Teacher of the school, Dr. Daniel Lewis.

Unfortunately there were difficulties in attendance with the participants, as due to the complex natures of the conditions of each participant, medical issues often meant that they were unable to go into the pool or were not in school.



***Child One - A***

A. has global learning difficulties, epilepsy and uses a gait trainer to help her move around. Information obtained from the school indicated that she likes listening to any type of music and enjoys being in the water. She has no hearing difficulties but she has delayed receptive skills. She was present for seven out of the nine sessions (missing weeks 2 and 5). She was present for all of the dry sessions. She either worked with a TA, Jo, or with her class teacher, David. 4 of the TA forms were filled out (3 by Jo and 1 by David). Only one parent/carer form was returned.

Pool Sessions

*Physical and Verbal Reactions to Music*

She displayed no clear physical reactions to the music during the first two sessions she attended. On the third session she attended there was a very clear physical reaction to the start of the first bit of music, where she suddenly starting wiggling and opened her mouth wide, then smiling. This physical reaction continued onto the following week, where she smiled and swayed at various points to the music, even holding her weight on the side of the pool and moving her feet from side to side. The physical reaction to the music then reduced in subsequent weeks, with only very small indicators of reaction e.g. smiling.

Although she made vocalisations at various points throughout the sessions, there was no clear link to the music throughout the course. Neither was there any clear indication of reaction to silence.

*Reaction to Hydrotherapy Pool*

Overall she was very happy and content being in the hydrotherapy pool and showed little change in her reaction to it.

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### *Reaction to Watsu*

She did relax into the Watsu as she progressed through the project, although she had a tendency to want to be held closely to the body – almost being cradled. This reduced, and later on she spent time standing independently, supported by the water. She was not very comfortable with her head in the water, although in later weeks did spend some shorter periods of time with her ear under the water.

### *Mood and Behaviour*

Her behaviours remained relatively consistent once she was in the pool. Her mood on occasions did change, where she displayed her happy sounds, which become more common in later weeks (weeks 4, 6, 7 and 9).

### SoI Analysis

The majority of reaction that can clearly be attributed to the music was a physical reaction. However she did make vocalisations throughout the weeks that we worked with her. There were moments that this had clear intentions e.g. her happy sounds, and therefore overall she would be placed in the P2 bracket, in regards to her vocalisations.

Week	Session	Video Name	Time Code	Description	Domain	Level
1	1 <sup>st</sup>	GOPRO021 MVI_9013	N/A	Vocalisations and movement throughout – unclear of links	R	1
2	ABSENT					
3	2 <sup>nd</sup>	GOPROA. 4 Feb 10min A. 4 Feb 10min	N/A	Vocalisations and movement throughout – unclear of links	R	1
4	3 <sup>rd</sup>	GoPro A. 10min080	2:05	Music starts and she opens her mouth wide, smiles and suddenly wiggles.	R	2
		MVI_9077 A. 10min	2:02	As above.	R	2
		GoPro A. 10min080	2:32	Smiles as music comes on.	R	2
		MVI_9077 A. 10min	2:32	As above.	R	2
5	ABSENT					
6	4 <sup>th</sup>	GOPROa.	4:28	Swaying from side to side and	R	2

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6	4 <sup>th</sup>	10min	4:28	moving her feet underwater as music is playing.	R	2
			5:07	As above.	R	2
			5:58	As above.	R	2
		MVI_A. 10 min	4:23	Smiling and swaying from side to side as music is playing.	R	2
			4:58	As above.	R	2
		5:55	As above.	R	2	
7	5 <sup>th</sup>	GOPRO a. 10min	2:06	Looks around when music starts and stops what she has previously been doing.	R	2
		MVI_9173 A. 10min	2:02	As above.	R	2
8	6 <sup>th</sup>	GOPRO161 10min A.	8:51	Smiles during bird song.	R	2
9	7 <sup>th</sup>	MVI_9809 a. 10min	2:46	Splashing during music.	R	2
			2:58	As above.	R	2
			7:36	As above.	R	2

### Dry Sessions

In all of her dry sessions (she attended all three), a TA who had not worked in the pool accompanied her.

She was very vocal in the first dry sessions, making noises sporadically throughout. She also moved a lot and there were very few moments of stillness. She displayed her happy signifiers - blowing raspberries - from the offset and continued throughout, mainly occurring to the music. There were lots of smiles and swaying from side to side, and back and forth throughout. On several occasions throughout she either opened her mouth and put her head back whilst holding her breathe (suspected to be mini-fits) or chewed her tongue.

The second dry session was carried out in a different room. Before we started the TA accompanying her mentioned that A. had been in a very bad mood and she was unsure if the session could occur. The TA was persuaded to try and reassured that she could stop it at any point. The session ran as normal and A. even blew some raspberries on two occasions and smiled on three. There was some swaying from side to side too. Afterwards the TA commented on her surprise at A. being able to stay and making her happy sounds, considering her mood

beforehand. A. still chewed her tongue and put her head back with her mouth open at various points. She displayed some self-injurious behaviour hitting her head, at which point the TA intervened.

The third session occurred in the same room as the second. Again there were displays of happy sounds throughout, lots of smiling and swaying. The majority of these occurred during the music. Tongue chewing and the head back with mouth open were still present on several occasions.

### TA Forms

Three out of four weeks a slight positive change in mood after the session was noted (one week was not filled out). The behaviour changes were ranked after the session as having a significant positive change one week, and a slight positive change for two weeks (one week was not filled out). According to the forms, no intention to listen to the music underwater was displayed. Various comments were made about the positive effect that they felt the water had in regards to her relaxation, with in the final week Jo noting that she was “really relaxed half way through the session. Let legs float up for the first time”. It was noted that in two sessions there was a change to her vocalisations (the blowing of raspberries which is her happy sound). It was found in three out of four session her physical state changed to be more relaxed

From the TA forms we can conclude that there were no negative alterations to her mood and behaviour whilst working with us. The sessions increased her relaxation and in half of the sessions recorded caused her to make her happy sounds.

### TA Interview

The first interview was carried out on a TA, Sue, who had not been working with her in the pool. She did however comment on the fact that when A. had come in for the dry session she was agitated and now she was happy, having expressed her happy sounds.

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The second interview (on the same day) was with David, her class teacher. He emphasised several times throughout that she was enjoying the session but he could not say what aspect of it:

we know previously she has enjoyed hydrotherapy um and she does enjoy music very much so um in its individual states but collectively because she's not quite putting her head under the water or feels confident enough to put her head, her ear under the water rather that she's - it's difficult to tell what she is enjoying about it

He also observed that he believes that she has become less "grabby" and less anxious as the sessions have continued.

David expanded on these points in the second interview we conducted at the end of the research. He again emphasised that she has enjoyed the session but has not quite got to the point where she feels comfortable to really put her head in the water, again expressing he believes she was less "clingy". However he did notice some unique behaviour:

It's very difficult because she fluctuates a bit...she's enjoyed herself in the water, it's hard to say whether it's because of these sessions because she's always enjoyed being in the water....however I did see her a couple of weeks back seemingly dance within the water listening to the sounds and that was the first time I have ever seen that happen in all the hydrotherapy sessions that she's ever happened before...I've never seen her sway to the music like she did that time.

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David also said that although he has seen some difference in her but that it is too short a period for solid progression to be made.

### Parent/Carer Forms

Unfortunately not much can be taken from the one carer form that was given back to us. It also coincided with a week in which A. was unable to come into the pool due to a medical condition. It does, however give us clear indications of behaviour she displays when happy.

***Child Two - C***

C. has Congenital HHV6 and is able to walk, but needs help getting in and out of the pool. The school informed us that she enjoys listening to music and water play. She has no hearing problems. She was present for six out of the nine sessions (missing weeks 4, 6 and 7). She was only present for the final dry session. She worked with her TA, Catherine. Catherine filled in and returned 5 of the teaching assistant forms. Unfortunately no parent/carer form was returned.

Pool Sessions

*Physical and Verbal Reactions to the Music*

Her main physical reaction to the music is through smiling or dancing. Her dancing, as described by her TA, is when she flaps her hands and moves her head from side to side. She is generally a smiley person so at times it was difficult to differentiate between causes of smiling. Weeks 1 and 2 there were clear links to music and her smiling. Her dancing behaviour clearly linked to the music is displayed in weeks 1, 3 and 5.

She vocalised a fair amount during each week. The vocalisations occurred during silence and music, so it is too difficult to differentiate between whether it is a reaction to the music or not.

She did react to the silence in a couple of the sessions. In week 1 she stopped her dancing when the music stopped and in week 2 she suddenly made vocalisations, whereas previously she had been quiet.

She displayed the only instance we saw of a child actively putting their head in the water to listen to the music. This occurred in week 5.

*Reaction to Hydrotherapy Pool*

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Her response to the pool overall was very good and remained consistent. She did on two occasions when asked by TA's if she wanted "more" or to "finish" working in the pool, she requested "more". This was after the music piece used for the research was played, and the formal part of the Watsu stopped. However sounds were still being played.

### *Reaction to Watsu*

She was content working in various Watsu positions. She worked with both Steve Karle and Catherine and seemed happy to work with both. There was a noticeable difference when she was passed to Catherine, as she would often engage in more eye contact and smiles aimed at Catherine (this was reciprocated by Catherine).

### *Mood and Behaviour*

Her mood was good throughout, with lots of indications of happiness. The only variation was when she left the pool. In week 2 once she had left the pool she made a lot of noise, which the TA indicated was due to her not being happy at leaving. In week 5 when she was taken by Steve Karle to the edge of the pool to leave, she suddenly became more vocal. She was smiling and then pushed him away and went back into the pool. Her behaviour remained relatively consistent throughout the sessions. If there were changes these were displayed by a reduction in movement.

### SoI Analysis

Again with her most of the reaction to the music she made was physical. She did make vocalisations throughout sessions and in talking to her TA and from the observations she would be allocated to P2.

Week	Session	Video Name	Time Code	Description	Domain	Level
1	1 <sup>st</sup>	GOPRO019	2:46	Smiling whilst head is in the water and music playing.	R	2
			3:57	As above.	R	2
			7:18	Smiling whilst head out of water and music playing.	R	2



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			8:55	As above.	R	2
		MVI_9010	1:56	Laughter as music comes on for the first time.	R	2
			4:15	Smiling whilst head in water and music playing.	R	2
			5:20	Smiling whilst head out of water.	R	2
			7:18	Smiling whilst head out of water and music playing.	R	2
			8:52	As above.	R	2
		GOPRO019	4:37	Head and hand movement (dancing).	R	2
		MVI_9010	4:35	As above.	R	2
2	2 <sup>nd</sup>	10min c. 28jan	2:36	Splashing as music starts.	R	2
			4:06	Splashing with music on.	R	2
			5:10	Head shaking with music.	R	2
			8:34	Smiles.	R	2
			8:59	Laughter.	R	2
		GoPro010min c. 28jan	10:50	Smiles.	R	2
			11:15	Smiles.	R	2
3	3 <sup>rd</sup>	C. 4 feb 10min	6:37	Head and hand movement (dancing).	R	2
		GOPRO048	5:10	Hand flapping underwater and smiling on top.	R	2
4	ABSENT					
5	4 <sup>th</sup>	MVI_C. 10min	8:25	Head and hand movement (dancing).	R	2
6	ABSENT					
7	ABSENT					
8	5 <sup>th</sup>	GOPRO157 10min c.	2:21	Music first comes on she stops what she is doing suddenly.	R	2
		MVI_9777 10min c.	2:06	As above.	R	2
9	6 <sup>th</sup>	MVI_9806 c. 10min		Vocalisations and movement throughout – unclear of links	R	1

### Dry Sessions

She was only able to attend one dry session at the end of the project. Throughout the session she moved a lot, even getting off of the chair and going to sit on the floor. She smiled on a couple of occasions (although much less than was seen in the pool sessions). She spent some time hitting a plastic bean bag that was on the floor. She also on two occasions put her fingers in her ear.

### TA Forms

The TA indicated that in two weeks there was no change in mood, two weeks there was a slight positive change and one week there was a significant positive change. The behaviour however was consistently rated as having a slight positive effect. No negative changes to mood or behaviour were indicated.

The TA conveyed that in all sessions she believed that she showed an intention to listen in the water.

In four out of the five weeks there was a change in vocalisations (the other session was ticked in between yes and no and so therefore cannot be determined.) There was a change in her physical behaviour reported in three sessions, no change in one, and one week left without an answer.

In addition to this it was indicated across the weeks that she was happy or enjoyed being in the water. The TA also noted most occasions that there was a change in C.'s interaction with her, often giving her good eye contact and smiles.

The TA forms therefore indicate that there was no negative effect on her mood or behaviour, with the majority of sessions having at least a slight positive effect. The majority of sessions also caused a change in vocalisations and her physical state. It enhanced the TA's interaction with C., and had a positive effect in regards to C. being happy and/or enjoying the experience.

### TA Interviews

Her TA who worked with her in the pool the whole time was interviewed on both occasions.

In the first interview Catherine commented on the changes she had witnessed:

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I think she really enjoys them, she, I meant the first week we went, she was a bit, like not interested as much and then as the weeks have gone on she's become more and more happy with it like the second week in or the third week in I think she went in and as soon as I got her out she started screaming, like did not want to get out the pool at all.

When asked if she would like to add anything to the questions asked she commented:

I do think she, as the weeks have gone on, she's definitely got more into it because at the beginning week like I said she was a bit pushy away and then as the weeks have gone on she has just kinda gone with it, listening to the music, now dancing, so she's obviously getting a lot out of it.

Catherine did indicate that she has not noticed a difference in her mood or behaviour, other than being happier, which she thinks she is generally experiencing more.

In the second interview she again reiterated that C. has been very happy within the project. When asked which aspect she believed C. enjoyed the most (the hydrotherapy pool, Watsu or music) she said music, although she had got a lot of enjoyment from the Watsu.

### Parents/Carers Form

Unfortunately despite the forms being sent out, they were not returned by the parent. Catherine indicated this might be the case when we started out.

***Child Three - S***

S. has epilepsy, Rett syndrome, dystonia and scoliosis. She is confined to a wheelchair. The school did not indicate to us whether she enjoyed music or the hydrotherapy pool, however they did think that she has good hearing and listens well to everything around her. She was present for five out of the nine sessions (missing weeks 3, 6, 8 and 9). She was present for the first and second dry session. She worked with two TA's. At the time of writing this report, we are still awaiting return of forms from the TA's.

Pool Sessions

*Physical and Verbal Reactions to the Music*

No vocalisations were made at any point during her work with us. There were alterations in her hand movements, in which they opened up (an indication of happiness, enjoyment and/or relaxation as stated by her TA). In three of the weeks she displayed a physical reaction to the first time she heard the music (weeks 2, 4 and 5). In the final week she worked with us (week 7) there was a very clear reaction to the music as her hands started moving rapidly, her eyes became active and she turned her head towards the speakers. The TA thought this might be a sign of anxiety so moved her away from the speakers (this had been the closest she had been).

*Reaction to Hydrotherapy Pool*

Overall she seemed calm and still in the water (there are restrictions on her movement because of her conditions).

*Reaction to Watsu*

Again overall she seemed to enjoy this and was on the whole calm. The level of work that was given to her was quite still, but with a gentle rocking from side to side. Within the first

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week when she was moved slightly out of the water she became panicked and her TA had to reassure her.

### *Mood and Behaviour*

Her mood remained relatively consistent as she was happy and calm. Although there were some variations when she became anxious, mainly due to there being a change in what was happening. Her behaviour remained consistent throughout the sessions, other than week 7 where she had a sudden reaction to the music.

### SoI Analysis

She only reacted physically to the music. Her TA commented that she does occasionally make sounds but the main reason for this would be if she did not like something.

Week	Session	Video Name	Time Code	Description	Domain	Level
1	1 <sup>st</sup>	GOPRO020	6:50	Hands come up and away from her body.	R	2
			7:17	As above.	R	2
			7:59	As above.	R	2
			9:00	As above.	R	2
		MVI_9012	4:09	As above.	R	2
			5:08	As above.	R	2
			6:02	As above.	R	2
			6:24	As above.	R	2
			7:10	As above.	R	2
2	2 <sup>nd</sup>	10min S. 28 Jan	2:12	Hands open for the first part of music.	R	2
		GOPRO10min S.	3:19	As above.	R	2
3	ABSENT					
4	3 <sup>rd</sup>	GOPRO S. 10min083	2:05	Head moves and eyes suddenly become active.	R	2
		MVI_9078 S. 10min	2:06	As above	R	2
5	4 <sup>th</sup>	GOPRO S. 10min	2:16	Eyes lift up away from TA on first instance of music playing.	R	2
6	ABSENT					
7	5 <sup>th</sup>	MVI_9174 10min S. (same time and action for GOPRO s. 10min)	3:15	Hand movements.	R	2
			3:40	Sudden change in movements. Hands starting moving, eyes become active	R	2

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				and she turns head towards speaker.		
			6:43	Hand movements.	R	2
8	ABSENT					
9	ABSENT					

### Dry Sessions

She attended the first and second dry session.

In the first session she showed no clear reaction to the music. She had (as described by her TA) her “face on” which is her unhappy face that she tends to put on when being filmed for the purposes of testing (this occurs on a fairly regular basis to monitor progress). She played with some gold material that was attached to her wheelchair for some time. One noticeable difference was that her arms were not held up to her chest and only rarely came together.

In the second session before the music started S. suddenly became anxious with her face going red, and her torso thrusting. The TA lent forward to check on her. However once the music started she settled down and on several instances then began smiling to herself and then towards others.

### TA Forms

Two forms were returned. Both of these indicated that there was a slight positive change in her mood. With her behaviour in one week there was no change noted and the other a significant positive change.

In both weeks the TA believed that she intended to listen to the music in the water.

There was no changes in her verbalisations. However on one week there was a change in her physicality: “S. clearly lifted and held (supported) her own head out of the water during the second sound”.

TA Interviews

Her TA, Amy, was only able to be interviewed in the first session. She shared working with S. in the pool with her other TA Lisa, although Lisa carried out more sessions.

When asked how she thought that S. reacted to the experience she said:

I think she reacts really well like I think the last session she had, she'd had a really um uncomfortable day. She was thrusting forward quite a lot in her chair and she just really wasn't generally happy... so I didn't think the session was going to go very well but in the water she was still. There was still a lot of um quick movements, and she didn't seem as relaxed as prior sessions but um she did, you could really see her starting to relax towards the end.

On summing up the experience she and S. had to date she commented:

I was a bit apprehensive at first. I didn't quite know how it would work but from watching her I can see a difference in this short amount of time and I think it's quite positive.

Both TA were not there for the final interview, however provided feedback on a questionnaire (which were similar questions to what would have been asked). They said S. was anxious with the sessions at first but as these went on became more relaxed and began to anticipate what was going to happen. They noted that there was some change to her mood or behaviour but this was her going through her "teenage phase" and so is unlikely to be linked to her work in the pool. They believe she enjoyed being in the pool and particularly having Watsu carried out by Steve Karle.

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Within that dry and interview session we were also able to interview S. asking about her experiences. She communicated via eye pointing which was interpreted to us by Amy. On discussion with Amy about the best way to communicate, she suggested that we give two options in response to a question. Unfortunately “no” and “yes” were not on the board, so the questions were asked twice, once with the response “happy” or “sad”, and the second with “good” or “bad”. She had positive responses to whether the music, hydrotherapy pool and listening to the music made her happy/sad or good/bad. When asked about the movement in the water she responded with “surprised” and then “good” the second time around. When asked overall if she thought the sessions with us were good or bad, she chose good.

### Parent/Carer Forms

At the time of writing we are still awaiting the forms.

### ***Discussion and Conclusions***

We can conclude from the observation document (and also supported by the forms and interviews from the TA’s and teacher) that all of the children enjoyed the sessions. There were many instances of happiness and enjoyment which occurred in both the pool and dry sessions. The fact that these occurred in the dry sessions, indicates that the children are responding positively to the music that was created, aside from the hydrotherapy pool and Watsu. There was also indications across the board of the experience being very relaxing, and calming for some of the children (again present in the documentation and TA support) which is another positive outcome of the project. When interviewing the head teacher of the school, Dr. Daniel Lewis, he noted that music is quite commonly used within the school in the form of songs and rhymes, as a learning tool, description of activity or command. He mentioned that they have



several musicians who come to perform concerts at the school. When music is used within the hydrotherapy pool it is used above water and as a mood setting, so different to the way music was used in this project.

With regards to the observation document that was produced for the research, this was not always helpful, as the expectation of reactions were higher than they actually appeared. Also due to the complex and highly individualised nature of the participants' conditions, it was at times difficult to interpret behaviour displayed. However we could deduce that all children reacted at least once across the sessions physically and/or vocally to the music, which indicates that they were listening to it at times. Problems occurred also with isolating what triggered a particular reaction as there were so many variables.

With regards to the grading on the Sol framework one participant remained at the same level, R2 throughout her experience. Another one increased after her third session, moving from R1 to R2. The final participant remained at R2 throughout, reducing to R1 in the final session. These results are not unexpected. Due to the short time period in which the children experienced these sessions, as well as the highly complex nature of their conditions, only very small changes – if at all seen – would be demonstrated in regards to this framework. The Sol is a tool to be used over a longer period of time.

Having said this there was an indication of change and development with all the participants, albeit relatively small. With individuals with PMLD the targets that are set for them, in this school at least, can be very small with a longer period of time to achieve them. It is unlikely that a nine week experience (approximately ten minutes per week) would have a profound affect. However the fact that there was some change, indicates this to be a positive tool to use.

This research has had a positive impact on the school. They have purchased their own floats, similar to the ones that were used with Watsu, and the staff are very positive and enthusiastic about continuing and developing the training of Watsu that they experienced.

There are also discussions about purchasing underwater speakers. Daniel commented in his interview:

so far I've got really positive messages back from how the project is working.

There is a lot of enthusiasm from the staff because of the impact they're seeing and although, it's, you know, as its happening as it were, they're saying it is having a very positive impact on those young people's enjoyment of the hydrotherapy pool.

This research project provides evidence to warrant further investigation into the role of underwater sound and Watsu on children with PMLD. This was an overview analysis of the work. The results that we can see from this, warrant further investigation into this material to more closely analyse the effects (if any) that the music may be having over the period of time.

For future research projects, the research could continue for a longer period to enable any changes to individuals to be further explored, and to support the slow development that can be seen in children with PMLD. At this point in the research the benefits that each individual element (music, hydrotherapy pool and Watsu) has on the child cannot be ascertained. It is unclear as to which one has the most impact, or whether it is the accumulation of all three. Again this is an area which could be further explored. Some of the tools for evaluation were not optimum but can act as a learning tool for the researchers involved in how to successfully evaluate children with PMLD in this specific context.

One strand to this research which was not fully explored was the effect that this experience had on the group of ASD students. Some of them showed clear changes in experience outside of the pool and then inside the pool, e.g. one child would wear headphones and did not like noise, however once in the pool he would spend most of the time underwater near a

speaker, actively seeking the noise and vibrations. Close analysis could occur of the footage that was taken to see if there were any significant differences but from the surface analysis that occurred, these children could benefit from such an experience.

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### Appendix 1 – Music Notes

00:00 - 02:00 - silence

02:00 - 05:23 - melodic bars on a keyboard 15s - 20s each dispersed by decreasing silent intervals of 15s - 6s

05:23 - 09:10 - relaxing mix

09:10 - 10:00 - silence

The Silence is intended to observe the participant as they behave in water without sound played back underwater before and after the sonified section.

The Melodic Bars have been composed on a keyboard, they use classical harmonic scales and are chosen in order to introduce underwater sound in a pleasant and positive way

The Relaxing Mix has two sections.

The first section introduces various sound textures such as a slow melodic sustained vibraphone with incidental high frequency flutters and rings, the latter are particularly accented underwater as high frequencies tend to conduct better through the body in this size pool.

Following this there are also low frequency ship horns and mid to high frequency sawtooth wave modulated sinewaves. The low frequencies are physically felt as vibrations on the body

and extend the sonic sensation beyond the aural. These varied uses of the frequency spectrum is intended to invoke an interest in sound resulting from attention to textural sonic aesthetics rather than particular melodies, song or rhythm based sound structures, which most likely compose a large majority of the recorded sound content the participants are usually exposed to (assessed according to market share of mainstream music, or music that is composed of particular melodies, song or rhythm based sound structures, commonly found in most genres and mainstream music.)

The second section has bird song and cicadas mixing in with slow and sustained harp sound on a synth playing a somewhat Japanese scale which fades out leaving just the nature sounds playing until they fade out. The Japanese scale is there to provide a melodic bar that sounds harmonious yet somewhat unfamiliar and exotic. The nature sounds in the end are there as a sonic signifier to shift the listening reference from the internal world which the sonic textures are intended to immerse the listener in, to the external world, evoking the imagination to the familiar external environment that is nameable and identifiable.

The movement of the sound 1. melodic > 2. abstract > 3. narrative - follows a sequence of 1. invitation > 2. introspection > 3. identification - or a sequence of different kinds of listening: 1. following a melodic song progression > 2. deep listening that does not employ rationality and auto-composition based in familiarity of harmonic chord sequences > 3. listening as a sonic signifier to an event or agency of activity or environment. The latter is ultimately the majority of sound content which arrives at the participants ears on a regular basis and as it follows a section that heightens awareness to the aesthetic of sonic textures, it is intended to be listened to aesthetically as well.

The aim here is to increase the aesthetic appreciation of this sound content in order to create a level of observational separation from that is based in aesthetic appreciation. This would benefit

in two ways:

1. An exercise in concentrated listening that does not demand any response as expected in many musical activities in their lives (sing-along, play-along, dance-along for example). Deep listening allows for introspection whether as a result of a daydream or as a result of assessment of the sounds heard and activation of the imagination as a result.
2. This could expand and empower the participant's musicality and tolerance of various environments as they have other tools by which to assess sounds by rather than just as signifiers of action to which they submit.