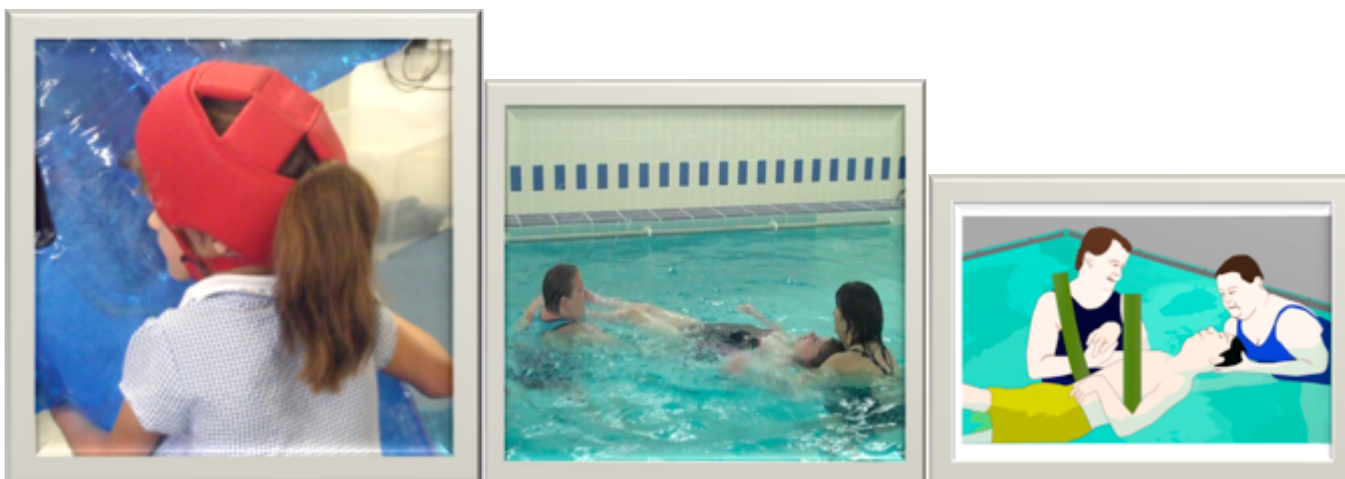


## ***An evaluation for 'Good Vibrations, a sound experience, promoting sounds and music in water for children with complex needs'***

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*'There is no existing data on whether sound is particularly beneficial in a hydrotherapy context. The intention is to generate some robust evidence of possible and actual benefit that can then be applied elsewhere across the sector (given there are at least 30,000 children and young people in England with complex needs)'. Graham Welch, Professor of Music, Institute of Education.*

*'It was evident that the children greatly enjoyed the hydrotherapy sessions with the sound and music, in particular feeling the vibration of sound in water. The sensory story used in the classroom was particularly successful. The children also listened attentively throughout the sessions.'* Daniel Lewis, Head teacher, St Nicholas Special School, Kent.

*'Many of the students love being in the hydrotherapy pool and we often find this is when they are at their most relaxed. Deputy Head, Primary school, Islington.*

*'The children listened attentively, both in the classroom and in the pool, and they wanted to remain in the water throughout the sessions. Each of the children seemed to enjoy the feeling of the vibration of sound in the water.'* Class teacher, Special School, Kent.

## Abstract

*Good Vibrations* (a sound experience, promoting sounds and music in water for children with complex needs) is a new innovative project that combines music, sound and technology in the context of a hydrotherapy pool. The concept underlying *Good Vibrations* is that vibration of sound in water can potentially facilitate individuals' awareness of the world around them (Drake, 2011). The concept is supported by the fact that sound travels 4.5 times faster in water than in air, with bass sounds in particular vibrating through the skeletal system (including the ribcage, the sternum and the spine) (Ruocco et al., 1996). Such sensations can potentially encourage and stimulate children with profound, multiple and complex needs in order for them to become increasingly curious about their outside world. Therefore, the project aims to facilitate awareness of such children's environment through the use of sound and music in a hydrotherapy pool where the children can sense vibrations in water. The project builds on previous research work on the therapeutic and healing effects of music and sound (Boyce-Tillman, 2000; Bunt, 1994; Ockelford, 2010).

The current research study was undertaken due to the fact that there is no existing data on whether sound and music are particularly beneficial in a hydrotherapy context (Welch, 2011). The intention of the project has been to investigate the development of sound art practice to create an interactive environment for increased sensory stimulation, deep listening, environmental awareness and enhancement of cognition and learning, by exploring the potential of underwater sound art (including natural sounds and the songs of humpback whales). The aim has been to conduct an investigation with children who possess complex needs and to assess how such sound-focused art practice might be used beneficially with such clients.

The project work was evaluated at a special school in Canterbury, Kent, with the help of a sound engineer who also works with sound art ([www.wetsounds.org](http://www.wetsounds.org)). An action research and case study approach was adapted for this exploratory study. Four children from the school participated in the project sessions over a period of three weeks. Each child exhibited a unique profile of complex needs. Each therapy day consisted of two types of sessions: 'dry sessions' and 'wet sessions'. The 'dry session' in the classroom prepared the participants for 'the wet sessions' in the pool by introducing them to the focus sounds and music through an interactive story. 'The wet sessions' were the main therapy sessions in the hydrotherapy pool.

Several benefits were perceived to arise from the sessions. There was more physical movement recorded in the hydrotherapy pool than in the classroom. The water in the pool provided essential support for the physical movement of the children, being further reflected in perceptions of increased feelings of self-confidence and efficacy. Enhanced feelings of relaxation and joy were recorded during the pool sessions. The sessions also seemed to have acted as a form of stress release for the participants. Such feelings of joy, excitement and happiness are likely to have further facilitated the children's general feelings of well-being and so positively influenced their behaviour in the classroom. Furthermore, the participant children interacted with their peers, carers and the teacher significantly more during the pool sessions than during in the classroom. Moreover, the children were observed to display greater awareness of their environment during the pool sessions. As the sessions progressed, the children became increasingly aware of the sounds played during the sessions and they were perceived to be significantly more focussed on listening. This was evident in their ability to remain quiet and sit still during the sessions. In addition, the children appeared to enjoy musical activities much more as the sessions progressed, evidenced in increased movement to music.

The Head teacher, class teacher and carers of the participant children stated that the sessions had been very beneficial to the children and, as a result, the school had purchased under-water speakers as a legacy from the project in order to be able to continue with the sessions.

## **Introduction**

Accessing musical opportunities through technology has developed rapidly over the past decade (Drake and Robinson, 1990; Ockelford, 2010). In educational settings, music technology has been gradually benefitted from, with new technology and software programmes for music teaching being continuously introduced to such settings (Drake and Grant, 1987; Ockelford, op.cit.). Increasingly, technology in mainstream schools has been advocated and the benefits associated with working with music technology with children who possess special education needs are being acknowledged (Ockelford, 2010).

Due to the evident benefits emerging from research and practice, the Drake Music Project was first initiated in the 80s. The project addressed issues of how music technology could be used beneficially with children with complex needs (Drake and Grant, 1987; Drake and Robinson, 1990). The current project, *Good Vibrations*, builds on the work of the Drake Music Project. *Good Vibrations* combines music, sound and technology in the context of a hydrotherapy pool. The concept underlying *Good Vibrations* is that vibration of sound in water can potentially facilitate individuals' awareness of the world around them (Drake, 2011). The concept is supported by the fact that sound travels 4.5 times faster in water than in air, with bass sounds in particular vibrating through the skeletal system (including the ribcage, the sternum and the spine) (Ruocco et al., 1996). Such sensations can potentially encourage and stimulate children with profound, multiple and complex needs in order for them to become increasingly curious about their outside world. Thus, the project aims to facilitate awareness of such children's environment through the use of sound and music in a hydrotherapy pool where the children can sense vibrations in water.

## ***Music, sound and their therapeutic effects***

A considerable amount of research has been conducted on music and its therapeutic effect. Yet, not much of such research has been conducted with reference to sound per se, despite the fact that music and sound are intimately connected (Osborne, 2008; Salamon et al., 2002). In fact, music has been regarded as organized sound, where one pitched note is followed by another (Paynter, 1992). Particularly significant connections have been drawn between music and sounds from the natural world (Paynter, op.cit.).

Music and sound are further connected by the fact that both types of stimuli rely on the act of listening (Salamon et al., 2002). When sound vibrates the skeletal system (such as in the context of a hydrotherapy pool), listening takes a new dimension and can be of even greater benefit to the individual (Drake, 2011; Welch, 2011). Additionally, gaining confidence through developing or refining one's ability to listen can assist children in hearing and paying attention to shared activities and socialising with others, potentially resulting in greater self-confidence and enhanced learning in the classroom (Gold et al. 2004; Kipper, 1988).

Furthermore, human-beings are able to recognize sound already as foetuses in their mother's womb, with each one developing an ability to react to sound at approximately 20 weeks (Deliege and Sloboda, 1996; Dewhurst-Maddock, 1993; Papousek, 2007). Research in the field has highlighted how musical expression, similar to verbal language, is based on communication between the mother and the child. Such communication is prosodic in nature (Mang, 2001; Papousek, op.cit.). As a continuation to this basic start in human vocalisation, the structures of sound and emotional elements create a musical language that can be used in communicating emotion through sound (Mang, op.cit.; Rinta and Welch, 2008; Robertson, 1997). In addition, the first sounds heard by an infant trigger consciousness and memory that can help them in constructing knowledge (Donaldson, 1978).

The research above, therefore, indicates that sessions combining sound and music in a hydrotherapy pool may assist children in becoming increasingly aware of the world around them. For example, as a result of the sessions, the participant children may start recognizing and paying greater attention to sounds made in the natural world by animals or birds.

### ***Musical behaviour and healing***

Musical behaviour has been a natural part of human culture for centuries (Osborne, 2008; Storr, 1992; Welch, 2005). Humans possess direct knowledge of music within their body, which is unlike any other human perception (Bunt, 2004; Storr, op.cit.). Through such an intimate contact, music can affect humans deeply and lead them to experience emotion, in particular through the physicality of movement (Papousek, 2007; Storr, 1992). This is, in turn, directly applicable to the act of moving in water whilst listening to music and sounds (Drake, 2011).

Musical behaviour and healing are intimately connected in a therapeutic context. Due to the fact that musical behaviours are natural to humans, it can be argued that music and sound therapy can be seen as a healing sanctuary: a place where individuals can stop in order to be still enough to hear and listen to other aspects of their lives (Pavlicevic, 1997). In fact, Boyce-Tillman (2000) claimed that healing is concerned with the physical, psychological and spiritual aspects of humans that are further linked to creative activity. Thus, a holistic model for healing that considers all aspects of human beings is regarded as essential in any therapy context (Pavlicevic, op.cit.).

Furthermore, case-study examples have highlighted how music can act as a motivator for movement. The *Sounds of Intent* Project, which offers musical opportunities for children with complex needs, has reported several examples of such cases (Ockelford, 2010). For instance, a disabled adult in a wheelchair who was hunched into himself opened up and stretched out in order to make a sound with an electronic musical instrument that he perceived to be in the air (Drake, 2011). Another example is a girl who was paralyzed and blind, yet responded well to the experience of listening to sounds in a hydrotherapy pool, trusting herself to be held in water and, finally, being able to move her legs independently (Drake, op.cit.). Although it could be said that simply being in water was sufficient motivation for the girl, listening was likely to have been an additional motivating factor, with the different therapeutic context taking away the pressure of instructions normally found in a physio-therapeutic context.

### ***Physiological processing of music***

There is a considerable amount of literary evidence concerning physiological responses to music, particularly with regard to ambulant rhythm and the ways in which music can be used to encourage restricted movement (Ockelford, 2010). For example, Bunt (1994, p.20) has described how a child with cerebral palsy achieved an improved sense of balance through training herself to walk in time to a remembered rhythm.

Moreover, large brain areas are involved in the processing of music (Peretz and Coltheart, 2003; Zatorre, 1994). Levitin and colleagues (2009) have described the processes activated in the brain when listening to classical music. Initially, the auditory cortex is activated for the processing of the components of the sound, then the frontal regions are activated in the processing of musical structure and expectations and, finally, a network of regions are activated covering nearly the entire brain (Levitin et al., 2009). The cerebellum and basal ganglia are active throughout, presumably supporting the processing of rhythm and meter (Peretz and Coltheart, op.cit.).

In addition, the rewarding and reinforcing aspects of listening to music seem to be mediated by increasing dopamine levels in the nucleus accumbens and by the cerebellum's contribution to regulating emotion through its connections to the frontal lobe and the limbic system (Peretz and

Coltheart, 2003; Zatorre, 1994). Furthermore, specific neurotransmitters (i.e. chemicals) are recorded throughout the nervous system when one is engaged in musical activities (Levitin et al., 2009; Welch, 2005). In relation to this, serotonin, a hormone produced in the brain stem that is associated with the regulation of mood and sleep, and cortisol that is a steroid hormone released as a response to stress, play a role due to the fact that music can have a physically calming effect by reducing the production of cortisol and by facilitating the production of serotonin (Salamon et al., 2002; Thurman, 2000).

### ***Implication for the current project***

On the basis of the existing evidence, it was thought that a number of possible benefits could arise from sound and music sessions in a hydrotherapy pool for children and adults who possess complex needs:

#### ***Educational***

- Listening to music and sounds is the first stage of improvisation. In the pre-pilot studies, the project team found evidence of improvement in listening and in paying attention, as well as increased curiosity, even with children who had difficulty in vocalisation.
- The primary aim of the project was to facilitate children's awareness of the world outside, in particular the sounds of the natural world (including the sound of recorded songs of humpback whales).

#### ***Physical***

- Freedom in the water for children who are restricted in their movements is already appreciated by special schools.
- Movement while listening (in particular for those individuals who are wheel-chair bound) is no longer a conscious effort, but rather manifests itself more easily as a secondary aim when listening exercises are applied in the hydrotherapy pool.

#### ***Emotional***

- There is tremendous excitement and pleasure in hearing sounds that can be felt in one's body in the hydrotherapy pool context.

### ***Research questions***

There is no existing data on whether sound and music are particularly beneficial in a hydrotherapy context (Welch, 2011). The intention of the exploratory evaluative study has been to generate some robust evidence of possible and actual benefits that can then be applied elsewhere across the sector, given that there are at least 30,000 children and young people in England with complex needs (Ockelford, 2010). The goal has been to discover the possible benefits for disabled children with complex needs of listening to sounds and music whilst floating in water in a hydrotherapy pool.

The intention of the project has been to investigate the development of sound art practice to create an interactive environment for increased sensory stimulation, deep listening, environmental awareness and enhancement of cognition and learning, by exploring the potential of underwater sound art (including natural sounds such as the songs of humpback whales). The aim has been to conduct the investigation with children who possess complex needs and to assess how such sound art practice could be used beneficially with such clients.

## **Methods**

The project work has been evaluated at a special school in Canterbury, Kent, with the help of a sound engineer who also works with sound art ([www.wetsounds.org](http://www.wetsounds.org)). The methods used in the project has been designed on the basis of previous work with sound and music in a hydrotherapy pool context with adults, as well as on the basis of an extensive literature review and pre-piloting of possible sessions with children who possess complex needs.

An action research approach was adapted to this exploratory study. Such an approach enabled the researcher to engage in a reflective research process in order to generate a comprehensive and reliable picture of the therapy sessions and their potential benefits. At this initial stage of the research study, a case study method was adapted, as this enabled the researcher to gather in-depth data on the phenomenon and to establish a framework for subsequent research.

## **Participants**

The participating school, St Nicholas Special School (identified with permission) and located in Canterbury, Kent, is a community day special school providing education for 187 children and young people who have special educational needs and are aged between 4 and 19. The school caters for a wide range of learning disabilities including: severe learning difficulties; profound learning difficulties; complex learning difficulties; autism; and sensory impairment.

Four children from the school participated in the project sessions over a period of three weeks. Three of the participants were girls and one was a boy. The first girl was 16 years of age, blind with physical disabilities and wheel-chair bound. The second girl was 12 years of age, physically disabled and diagnosed with profound and multiple learning difficulties (including emotional needs, visual impairment and Rett's syndrome). The third girl was 10 years of age and possessed multiple physical disabilities with a growth impairment, resulting in difficulties with speech and communication. The participant boy was 12 years old and possessed cerebral palsy with additional physical disabilities. He also lived in care.

All the participant children generally enjoyed musical activities and moving to music. They all also liked being in water and swimming.

## **Music and sound used during therapy session**

The intention behind the hydrotherapy pool sessions was to provide the participant children with a space for sharing stories, music and meditative relaxation away from the constant flux of information that they have to process on a daily basis. In the therapy sessions, the intention is for the children to just let go.

The music and sound chosen for the hydrotherapy sessions were centered around three different concepts: a) familiar music (i.e. pop, 'social' music, thematic music and rhythms); b) abstract music (i.e. musical themes, electro-acoustic sounds and composition); and c) narrative sounds (i.e. animals, environments, field recordings, sound effects, text and dialogue).

Familiar music was included in the session since it can be used to relax the participants by immersing them in a familiar environment that enables them to form associations to moments that they had heard when the music was being played. Such music is believed to assist an individual to connect with a core personal identity within their cultural background. Such music also has the power to lighten up mood and to relax the listeners into their environment.

Abstract music was chosen for the sessions since it is likely to have a psychoacoustic effect on the participants. Abstract music and sound can be used to evoke imagination and to tap into a core identity that is not related to a public cultural environment, but rather to a personal introspective space. Abstract sounds are intrinsically site-specific. Sounds and frequencies for the sessions were chosen on the basis that they were regarded to resonate with the space, the pool and water medium. Such an approach further placed the participants within, and as part of, the listening space.

Narrative sounds were chosen since they were dislocated from their source (e.g. there is no real lion in the water making neither the roar, nor was it really raining) and, thus, they were to be heard isolated. Sonic qualities can then be assessed by the participants as musical sounds and they can further heighten the listener's attention to details. They can also heighten awareness. In the case of individuals with complex needs, it is proposed that this can further educate and inform them of a narrative, as well as help them to make connections between events. Narrative sound informs the listener of a space and an action from all around the listener. While visual input is directional, sound input is omni-directional. Awareness and attention to the location of the listener in a space and to the space itself can, therefore, heighten tolerance and increase confidence in a space.

The sessions were based on using a sound collage that consisted of elements from the different musical concepts described above by playing them back simultaneously. Such an approach is intended to create an immersive effect since the ear is used to hearing sound collages on a regular basis in real life. At times, individual sound elements were also played back on their own (such as a song by the pop band called 'Queen', or bird sounds). Specific musical elements were also played according to what the participant children talked about during the sessions. For example, one of the girls loved 'Queen' and so their song was played, whereas the boy loved airplanes, which is why the sound of airplanes was played.

The following pieces of music were played during the sessions:

- \* 'Aquarium' from 'Carnival of the Animals' by Camille Saint-Saens
- \* 'Killer Queen' by Queen
- \* 'Sex Magick', the percussion track from John Zorn's album 'IAO'
- \* A loop from 'Oops' by Britney Spears
- \* 'Farewell to Tarwaithie' by Judy Collins
- \* 'Module 1' by Alva Noto
- \* Sound mix that included natural sounds from: whales; dolphins; birds; dogs; crickets; seagulls; grandfather clock; chimes; fog horn (prominent throughout); rain; and spoken word by Lennie Lee.

## **Ethical issues**

A letter of permission was sent home to the parents and carers of the children who were to participate in the sessions. Approval was asked for allowing the children to participate in the sessions and consent was asked for photographs, video images and sound recordings of the sessions to be used within the evaluation of the project.

The participants were assured that the images would only be shown to appropriate professional staff. They were informed that the materials collected during the sessions could be used in educational publications, journals, textbooks and used in any form or medium, including all forms of electronic publication, storage or distribution anywhere in the world. It was made clear to the participants that, as a result, with explicit permission the images may be seen by the general public and that all or part of the material may be used in conjunction with other photographs, drawings, videotape images, sound recordings or other forms of illustration. The participants were also informed that they may request to conceal their identity both visually and by removing any name/s that associated them with the media, but full confidentiality could not be guaranteed.

Furthermore, they were informed that they may view the material by arrangement and can rescind their consent at any time (this must be requested in writing), although the recovery of the material may not be possible once released. It was also made clear that no fee was payable to any participants in respect of the material either now or at any time in the future.

All participants were assured that the data would be treated with confidentiality and stored in locked cupboards, as well as in password protected computers. The participants and the school were informed that the data would not be used for any other purpose than the current study and that they would not be passed onto any third parties. The teachers and the participants were assured that the ethical guidelines of the British Education Research Association would be followed throughout the study.

### **Data collection methods**

An in-depth ethnographic approach was adopted to evaluating the sessions in order to gather detailed data on the project sessions and outcomes. All of the sessions were observed by a member of a research team. An observation sheet was used for recording notes during the sessions. The sheet was adopted from the *Sound of Intent* project that had gathered a vast amount of data from studies with children who have complex needs (see Appendices for the full observation sheet).

Additional video footage was recorded during the sessions. The video footage was subsequently analyzed according to the categories used in the live observation.

### **Content of sessions**

Each therapy day consisted of two types of sessions: 'dry sessions' and 'wet sessions'. 'The dry sessions' took place in a classroom normally used for art classes and 'the wet sessions' took place in the hydrotherapy pool. The 'dry sessions' took place in the morning of a school day (11.30-12.15) and the 'wet sessions' in the afternoon (13.45-14.15). The 'dry sessions' were 45 minutes long and the 'wet sessions' were 30 minutes long. This was the structure for all the therapy days that included the project sessions.

The idea behind having two types of sessions was that the 'dry sessions' would enable the children to start listening to different sounds in the context of their classroom. This was preparatory work for the subsequent 'wet sessions'. The sessions took place in the classroom with a member of school staff (the art teacher). During 'the dry sessions', the teacher and the carers of the participating children prompted the children to listen and attend to the music and sound by asking them questions about the sounds and by getting them to listen to different types of sounds. The music and sounds used in these sessions included familiar sounds and music (such as music that the children are likely to hear at home, at school or in the nature). The children were also asked about their favourite types of music in order to include such music in the sessions.

In the 'wet session', the sounds and music were played through underwater speakers. As a result, the sound and music played could only be heard and felt by the participants in the water. The 'wet sessions' in the hydrotherapy pool were reserved for sounds that the children were not likely to hear in places other than these linked dry/wet sessions. 'The wet sessions' were less structured in nature, with teachers and carers interfering less with the children's experience and rather leaving them to explore the soundscape for themselves. Such an approach was believed to influence the children's listening mode, with the water space subsequently being regarded as a listening space, in which something new could be discovered. The carers and teacher assisted the children in their movements by guiding them to allow for maximum relaxation and receptivity (e.g. they showed the children how they can put their heads in water and properly hear the sounds and music).



Consequently, the intention was that the participants were both stimulated by the sound and by their freedom of movement through the assisted floatation.

### **Procedure**

Both 'the dry' and 'the wet sessions' were delivered once a week over a period of three weeks. 'The dry sessions' consisted of the art teacher reading and acting out a story about a whale. A range of sounds and music were played in the background while she was telling the story. The sound artist and the teacher had designed the sessions in order for the story and the sound track to complement one another. The sessions consisted of a story about a whale, with the sounds of whales playing in the background mixed with additional sounds from a beach, as well as instrumental music and vocal music. The story with the background music was used as tool to introduce different sounds to the children and, as a result, to begin enhancing their awareness of the environment.

For 'the dry sessions', the children entered the classroom with their carers. Each child had one carer present. They were seated in a circle and the art teacher led the session from the middle of the circle. The sound artist was seated in a corner of the room. The teacher and the sound artist communicated effectively throughout the session and enabled a sense of natural progression to the session. The art teacher acted out the story and made it interactive by asking the children questions, as well as by asking them to act out small parts of the story. She also asked questions about the background sounds and prompted the children to identify specific sounds.

'The wet sessions' were less structured. The children came to the hydrotherapy pool with their carers. They were instructed to float in water with their heads in the water in order for them to feel the full effect of the vibration and sound in the water. The same pieces of sound and music were played in 'the wet sessions' as in 'the dry sessions'. Underwater speakers had been installed in the pool in order for the participants to feel the vibration from the sound. Towards the end of the sessions, the teacher asked the children to identify the sounds that were played in the water and a discussion on the music and sound was initiated.



## Data analyses

The observational and other data were input into Excel and NVivo software. Due to the small number of participants, qualitative data analyses methods were used in the data analysis.

## Results

### *Physical movement*

Observation conducted during the sessions and analyses of the video footage indicated that there was more physical movement recorded in the hydrotherapy pool than in the classroom. The water in the pool provided essential support for the physical movements of the children and, therefore, the children found it easier to move their bodies when in the pool than on dry land. Some of the participants were not able to engage in any physical movement in the classroom, yet they were freer to move themselves around in the hydrotherapy pool. Moreover, a greater amount of physical movement was observed as the sessions proceeded and as the children became more confident to move in water.

The water provided essential support for the children. In particular, the water seemed to support the children's co-ordination of different body parts, assist them in holding their bodies erect when they tried to walk in water and provide support when moving from one place to another. In particular, a greater amount of movement of the arms and legs was observed in the pool. General moving around in the pool was also a significant improvement.

The greater amount of physical movement in the water was likely to have enhanced the children's feelings of self-confidence and related self-efficacy, potentially further being reflected in greater attempts to move on dry land. The positive and encouraging experiences accumulated when moving in water were reported to be likely to have encouraged the children to move after the pool sessions, as a result of realisations of their own ability to use their bodies for their own benefit. For instance, one of the girls was not able to walk on her own due to an under-developed sense of balance, yet in the hydrotherapy pool, she was able to move without assistance from others. This was observed to be a great self-confidence booster for the girl and also brought much happiness to her. Another example was the girl who was wheelchair-bound and unable to walk on dry land, yet enjoyed splashing in the water with her arms whilst being swum around the pool by her carer. This appeared to provide her with a sense of being able to use her arms and move around other than when sitting on a wheelchair.

Movement to music and sound was observed during both 'dry' and 'wet' sessions. The combination of sounds and music used during the sessions encouraged the children to listen and to move their bodies to the auditory stimuli. This, in turn, was likely to have facilitated the children's ability to acknowledge and become increasingly aware of their environments.

### *Psychological aspects*

Enhanced feelings of relaxation and joy were recorded as a result of the hydrotherapy pool sessions. The sessions also seemed to have acted as a form of stress release for the participants. The children who had appeared to be tired and stressed out during the classroom sessions appeared to be significantly more relaxed and energetic during the pool sessions. For example, the participant boy was irritated and rather angry during some of the classroom sessions, yet in the pool sessions, he was noticeably more relaxed without displaying any signs of stress. In fact, all of the participant children at one point or another appeared to be annoyed or stressed out during the classroom sessions, but none of them showed such signs during the pool sessions. For

instance, two of the children appeared to be completely different in terms of their general behaviour and way-of-being during the pool sessions where they were laughing with joy, compared to their behaviour during the classroom sessions when they had displayed aggressive and irritable behaviour.

A greater deal of enjoyment and expressions of happiness was observed during the pool sessions than during the classroom sessions. Shrieks of joy, laughter and jumping or splashing in water were observed throughout 'the wet sessions'. Such evident signs of enjoyment, excitement and happiness were much less frequent in the classroom sessions. For instance, one of the girls repeatedly kept on yawning and was disengaged in the classroom sessions, yet she was thoroughly enjoying the pool sessions by jumping around excitedly and smiling throughout the sessions. Genuine pleasure and excitement was observed throughout the pool sessions.

The feelings of joy, excitement, happiness and relaxation that were perceived in the pool sessions are likely to have enhanced the children's general feelings of well-being and positively influenced their behaviour in the classroom during the rest of the school day. Such an effect is also likely to have enhanced their ability to concentrate and learn in the classroom.

### *Social skills and awareness of the environment*

The participant children interacted with their peers, carers and the teacher a greater deal during the pool sessions than during the classroom sessions. For example, significantly more talking was recorded between the carers and the children, as well as amongst the children themselves in the pool than in the classroom. Even the children who were not able to express themselves verbally tried to communicate with others through the use of sign language or by swimming close to their peers. The environment in the swimming pool appeared to open the children up to communication and to make them more aware of others around them.

Moreover, the children displayed greater awareness of their environment during the pool sessions. For instance, the boy participant kept on pointing at others around the pool, as well as on the lights in the corridor and posters on the walls, where as in the classroom setting, he had primarily focussed on talking with his carer. Similarly, one of the girls repeatedly attempted to communicate with her peers in the pool, which she has not done during the classroom sessions. Another one of the girls was increasingly aware of the lights and sounds around her and she kept on swimming towards them.

As the sessions progressed, the children became increasingly aware of the sounds played during the sessions. They started recognising them and were able to name them. For instance, they could identify the whale sound or the sounds of the birds. During the third session, the children were much more able to name the different sounds than during any of the previous sessions. They were also more concentrated on listening to the sounds during the final session, indicating that there had been a gradual improvement in their awareness of the sonic environment. For example, during the final session, the girl who was wheelchair-bound was able to name the whale sound and the sounds from the beach (such as the sound of the waves and the wind), which she had not been able to do in the previous sessions.

### *Musical development and listening skills*

The children's listening skills developed from one session to another. As the sessions progressed, the children were perceived to be significantly more focussed on listening. This was evident in their ability to remain quiet and sit still during the sessions. For instance, there were moments during the second and the third sessions when all of the children were quiet and simply listened to

the sounds being played in the background. Significant improvement was recorded in the children's skills to recognise sounds as the sessions progressed. The children were more able to recognise and name the background sounds during the third session than during the first two sessions. Becoming more aware and familiar with different sounds is likely to have facilitated the children's ability to become increasingly aware of their environment and sounds surrounding them.

In addition, the children appeared to enjoy musical activities much more as the sessions progressed. Additional movement to music and singing (and/or other vocalisation) was recorded during the final session than during the first two sessions. The children appeared to have grown in confidence to move to music and were more willing to try this out. For example, the girl who had a poor sense of balance was static during the first two sessions, yet she swayed to the music during the final session.

### *Perceptions of teachers and carers*

The carers and the classroom teacher of the participant children were interviewed in the end of the project. They regarded the sessions as of great benefit for the participants. They stated that all of the children had very much enjoyed the sessions, in particular the freedom that the sessions offered. They also stated that the children had been intrigued by the sounds during the sessions.

The personal carers for each individual participant were interviewed about their child. The carer of the first participant girl reported that the girl had responded to the sound by putting her head in the water through her own initiative. She had also laughed throughout the sessions and independently vocalised in response to questions regarding the sounds. The carer of the second girl stated that the girl had responded by signing several of the sounds heard during the session and that she had thoroughly enjoyed the sessions. The carer of the third girl reported that the girl had enjoyed the story in 'the dry session and being in water in 'the wet session'. She had also been able to recognise the sounds and music heard during 'the wet sessions'. The carer of the boy reported that he had greatly enjoyed participating in the sessions. In particular, he had enjoyed listening to the sounds of the birds.

Nevertheless, the carers and the teacher strongly stated that their expectation was that the sessions would need to run for at least 8 consecutive weeks in order to observe any significant conclusive positive outcomes from them.

### *Perceptions of the Head teacher*

The Head teacher of the school was interviewed on his perceptions of the project. He stated that the children had greatly enjoyed the sessions, in particular feeling the vibration of sound in water. In his opinion, the sensory story used in the classroom had been particularly successful. He understood that the children had listened attentively throughout the sessions.

Although the participant children receive swimming lessons once a week, the Head teacher felt that there was a need for more lead-in time to prepare the children in order for them to be more relaxed and fully benefit from their lessons in water. This project enabled them to do that. The Head teacher also strongly stated that listening to sounds is extremely beneficial for children who possess complex needs, as this can assist them in understanding their own surroundings more clearly and, thus, they can be led to an appreciation of the outside world.

Moreover, the Head teacher said that the Parent-Teacher Association of the school had raised funds in order for the school to be able to purchase under-water speakers as a legacy from the project. This would enable the school to continue deliver such sessions in the pool in the future.

### **Conclusion and implications for practice**

During the sessions provided under the *Good Vibrations* project, several benefits were observed as arising from the sound and music sessions in the hydrotherapy pool with children who have complex needs. The benefits could be divided into four categories: physical movement; psychological aspects; social behaviours; and musical behaviours. Significant improvement and development were recorded in all the different areas in the participants as the sessions progressed. This was believed to be due to the fact that the sessions were of holistic nature that influenced the children's overall wellbeing and behaviours.

In particular, an increasingly greater amount of physical movement and interaction with carers and peers on the children's part was observed as the sessions progressed. An enhanced awareness of their environment, as well as enhanced feelings of wellbeing, was evident subsequent to the sessions. All of such changes further resulted in significant improvements in the children's behaviour in and out of the sessions. For instance, the children behaved better in the classroom after the sessions, which is likely to have resulted in enhanced abilities to concentrate and to learn. On the basis of the current evaluation, there is evidence concerning how the sessions can be of benefit for children with complex needs. Each participant child exhibited a range of different needs, yet they all appeared to gain benefits from participating in the sessions, implying that the sessions could be of advantage for a wide range of special needs. In fact, the participating school noticed such significant benefits and, as a result, the Parent-Teacher Association decided to buy underwater speakers in order for the teachers to be able to continue running such sessions in the future.

It should be noted that the project was of short duration and, therefore, a longer-term programme is needed in order to draw any firm connections between the sessions and the project outcomes. The initial indications of the positive impact evident in this evaluation should be further investigated over a longer period of time and with a more comprehensive research approach. It should also be noted that it is essential to deliver preparatory sessions to the teachers and carers prior to starting the hydrotherapy pool sessions in order for them to know how to hold the children properly in water and, thus, maximize the potential for positive outcomes from the project.

### **References**

- Boyce-Tillman, J. (2000). *Constructing musical healing: the wounds that sing*. London: Jessica Kingsley
- Bunt, L. (1994). *Music therapy: an art beyond words*. London: Routledge
- Deliege, I. and Sloboda, J. A. (1996). *Musical beginning: origins and development of musical origin*. Oxford: Oxford University Press
- Dewhurst-Maddock, O. (1993). *The book of sound therapy: Heal yourself with music and voice*. New York: Simon & Schuster
- Donaldson, M. (1978). *Children's minds*. New York: Fontana Press
- Drake, A. (2011). *Good Vibrations, a sound experience, promoting sounds and music in water for children with complex needs*. Unpublished report

- Drake, A. and Grant, J. (1987). Music gives disability a byte. *New Scientist*, 22. January 1987
- Drake, A. and Robinson, J. (1990). Music, microtechnology and handicapped people, *British Journal of Music Education*, 7(2), 149-159
- Gold, C., Voracek, M. and Wigram, T. (2004). Effects of music therapy for children and adolescents with psychopathology: a meta-analysis. *The Journal of Child Psychology and Psychiatry*, 45 (6), 1054-1063
- Kipper, A.-I. (1988). The influence of group singing on trust and cooperation. *Journal of Music Therapy*, 3, 145-155
- Levitin, D. J. and Tirovolas, A. K. (2009). Current advances in the cognitive neuroscience of music. *Annals of the New York Academy of Sciences*, 1156, 211-231
- Mang, E. (2001). A cross-language comparison of preschool children's vocal fundamental frequency in speech and song production. *Research Studies in Music Education*, 16 (1), 4-14
- Ockelford, A. (2010). Using education in music, and education through music to promote well-being in children and young people with complex needs. In: R. MacDonald, G. Kreutz and L. Mitchell (eds.). *Music, Health and Well-Being*. London: Open University Press
- Osborne, N. (2008). The Riddle of Rocks - What can a load of giant boulders in Uganda tell us about music? In: M. Bunting, *Madeleine Bunting on a UK concert series inspired by the pure sound of ancient gong*, *The Guardian*, 1 October
- Papousek, M. (2007). Communication in early infancy: an arena of inter-subjective learning. *Infant behaviour and development*, 30 (2), 258-266
- Pavlicevic, M. (1997). *Music therapy in context: music, meaning and relationship*. London: Jessica Kingsley Publishers
- Paynter, J. (1992). *Sound & Structure*. Cambridge: Cambridge University Press
- Peretz, I. and Coltheart, M. (2003). Modularity of music processing'. *Nature*, 6 (7): 688-690
- Rinta, T. and Welch, G.F. (2008). Should singing activities be included in speech and voice therapy for prepubertal children?. *Journal of Voice*, 22 (1), 100-112
- Robertson, J. (1997). Real-Time Music Generation for a Virtual Environment. *Report from the University of Edinburgh, Department of Artificial Intelligence, published online, retrieved on 4th of October 2011, [www.doc.gold.ac.uk/~mas02gw/papers/ECAI98b.pdf](http://www.doc.gold.ac.uk/~mas02gw/papers/ECAI98b.pdf)*
- Ruocco, G., Sette, F., Bergmann, U., Krisch, M., Masciovecchio, C., Mazzacurati, V., Signorelli, G. and Verbeni, R. (1996). Equivalence of the sound velocity in water and ice at mesoscopic wavelengths. *Nature*, 379, 521-523
- Salamon, E., Kim, M., Beaulieu, J. and Stefano, G. B. (2002). Sound therapy induced relaxation: down regulating stress processes and pathologies. *Report published online, retrieved on the 4th October 2011, <http://www.biosonics.com/downloads/pdfs/SoundTherapyInducedRelaxation.pdf>*
- Storr, A. (1992). *Music and the Mind*. New York: Free Press
- Thurman, L. (2000). Bodyminds, human selves, and communicative human interaction. In: L. Thurman and G.F. Welch. (eds.). (pp.134-189). *Bodymind and voice - foundations of voice education*. Iowa: National Centre for Voice and Speech
- Welch, G.F. (2005). We are musical. *International Journal of Music Education*, 23 (2), 117-120

Welch, G.F. (2011). Unpublished interview at the Institute of Education, University of London, London, UK, September 6, 2011

Zatorre, R. L., Evans, A.C. and Meyer, E. (1994). Neural mechanisms underlying melodic perception and melody for pitch. *Journal of Neuroscience*, 14 (4), 1908-1919