

# Exploring the multi-sensory environment as a leisure resource for people with complex neurological disabilities

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**Abstract.** The problems experienced by people with neurological disabilities create barriers to participation in leisure activities. Particular common features include cognitive deficits (attention, executive functioning, language and memory), functional difficulties (in activities of daily living), psychomotor impairment (dyspraxia and poor co-ordination), and behavioural difficulties (aggression, agitation, and wandering). The Multi-sensory environment (MSE) has the potential to accommodate some of these problems experienced by people with neurological disabilities and, as such, is a valuable leisure resource. Multi-sensory activity can address individual sensory needs, such as offering a stronger stimulus if initial attempts are unnoticed, and be offered alongside familiar activities and routines to enhance sensory awareness. If the complexity of the activity, individual needs, and MSE demands are matched, engagement in this activity may be achieved. The Pool Activity Level Occupational Profiling Tool can provide a protocol from which MSE activity may be facilitated. By using this tool the MSE fits well within the World Health Organisation International Classification of functioning, Disability and Health by facilitating participation and reducing environmental barriers.

**Keywords:** Multi-sensory environment, Snoezelen, leisure activity, participation, recreation, relaxation

## 1. Background

The concept of multi-sensory environments (MSE) is one that was developed in the 1980's at the Haarendael Institute, Holland [30]. Multi-sensory environments (MSE) utilise advanced sensory stimulating equipment that targets the five senses of sight, hearing, touch, taste and smell. Visual (sight) stimulation is achieved using a solar projector that casts themed images. For example, an underwater scene with fish; coloured optic fibres and a bubble tube. Auditory (sound) stimulation is achieved by playing music or environmental themes such as bird song. Tactile (touch) stimulation is accomplished using optic fibres to stroke and plait, and textured fabrics.

Gustatory (taste) stimulation is achieved by offering small amounts of citrus fruits, sherbert and textured foods such as popcorn, jelly and so forth. Olfactory (smell) stimulation is achieved by using aromatherapy scents and smell pots (small pots containing everyday aromatic items such as cloves or peppermint).

The original MSE concept was bound within a framework of leisure and failure free activity [22]. However, with its development into other clinical areas (pain management, people with dementia etc.) therapists have started to use MSEs as an intervention with therapeutic goals. Whilst MSEs have continued to be used as a leisure resource primarily in the area of learning disability, little consideration has been given to the potential of MSE as a leisure resource for people with more general neurological impairment. Despite the term leisure being commonly used, it is one that remains loosely defined [26]. It has often been referred to as time remaining after other obligations have been met, engagement in freely chosen activities that are viewed

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as being for entertainment or own personal goals but not for material gain [26,36]. As such, defining the MSE as a leisure resource has always been problematic.

Studies exploring the emotion-oriented aspects of MSEs suggest that this activity has the potential to meet many of the components of a leisure activity as described above. In particular, individuals find them enjoyable and are able to make independent choices about which piece of equipment they wish to use [11,16,20]. Research with older people with severe dementia has built on these findings, as this population is known to find conventional leisure activities difficult to access. After spending time in a MSE, people with dementia are reported to show positive changes in mood and behaviour, and also an increase in attention to their surroundings [4,10,39,52]. MSEs are also reported to influence the interpersonal interactions and levels of engagement amongst this group [5,50] and staff feel that these improvements directly impact on the quality of their relationship with the individual [27]. These findings are also supported by Hotz et al [29] in their study using MSEs with children recovering from severe brain injury.

Conceivably, the problems experienced by many people with brain injury are similar to those with dementia and they too experience problems which can create barriers to participation in many leisure activities. In particular, participation may be limited by the individual's reliance on others to take part. Given the range of different cognitive deficits experienced and reliance on others to participate, the MSE may be one activity that might accommodate some of the problems presented. Problems may include cognitive deficits (attention, executive functioning, language and memory), functional difficulties (in activities of daily living), psychomotor impairment (dyspraxia and poor coordination), and behavioural difficulties (aggression, agitation, and wandering). These will be considered in relation to using the MSE as a possible leisure activity for people with brain injury.

## 2. Problems encountered by people with neurological problems

### 2.1. Attention deficits

Attention refers to a number of cognitive abilities including maintaining an alert state and orienting to sensory stimuli in order to engage in everyday tasks [19]. Particular attention deficits include poor selective atten-

tion, the inability to shift attention, poor sustained attention, and difficulty dividing attention [15,42]. People with neurological problems may find it difficult to filter out irrelevant sensory stimulation due to these attention deficits and, therefore, experience difficulty in participating in conventional activity. This may not be entirely due to distractibility but rather a problem with sensory gating [1]. As many leisure activities are too complex for people with severe neurological problems, arousal can decline rapidly over time leading to distractibility [42]. If the activity requires divided attention there may be a catastrophic rate of decline in task accuracy often leading to higher levels of performance error [2,3]. Simplifying the level and presentation of sensory stimulation may help them focus and engage without the challenge of having to filter out irrelevant stimuli. Using a MSE, environmental stimulation can be reduced and specific stimulation can be presented in a more controlled manner. For example, lights in the room can be dimmed to reduce conflicting stimulation and a single strand optic fibre can be presented to gain attention. This reduces competition from environmental stimuli and attention can be drawn to the one visual stimuli. Whilst this may not constitute leisure in its purest form it may offer a break from routine and some level of enjoyment. If the individual is able to attend to that single strand optic fibre a more complex visual stimulus may be presented, for example, a bubble tube. Thus, the environment can be adapted to accommodate the sensory processing ability of the individual to take into account their ability to sustain attention.

### 2.2. Executive function

Executive function controls higher order cognitive capabilities such as problem solving, self monitoring, sequencing and awareness [35] and overlaps with the functions described in attention. Stuss and Benson [53] have suggested that executive functioning can be divided into two facilities. The first involves sequencing of behaviours, whilst the second is concerned with drive and motivation. Studies exploring participation in leisure and social activity report that significantly more people have problems accessing leisure activities if they have problems in executive functioning [8,18].

Examples of executive function deficits that hinder participation in activities include manipulation of information and problem solving. For example, following instructions to a game requires using new information which may need to be modified as the activity progresses, as well as holding the details of the task instruc-

tions in working memory. The individual also has to remember what has been completed and what is left to be done in order to complete the game [33,34]. If the activity requires complex manipulation of information, these resources may be exceeded and the activity may fail. The MSE offers an activity that does not rely on the manipulation of information. Equipment may be engaged with without the expectation of an outcome and as such is considered to be failure free [22]. As drive and motivation may also be compromised in brain injury the use of switched and interactive systems may encourage the individual to participate. These systems also allow a more active participation for those who are more able, enhancing a sense of mastery [57]. By adapting the activity to match executive functioning, motivation and drive may be encouraged. This may create a state of Flow. Flow is described as a state of total engrossment that emerges as a result of engagement [13]. This is another key feature of leisure which is achieved if the activity is accurately matched with the ability of the individual [48].

### *2.3. Language deficits: Expressive and receptive dysphasia*

Problems with language expression include loss of fluency, perseveration and non-verbal utterances, for example, muttering and groaning [7]. Receptive dysphasia (difficulty in understanding what has been said) may include problems with phonology (loss of accent and intonation). Leisure activities which require verbal communication skills may be compromised for people with neurological deficits, due to problems with verbal expression and comprehension [40]. The MSE does not rely on verbal communication. Indeed much of the interaction relies on non-verbal behaviour and the interaction between the user and the facilitator. Unaided communication can be encouraged through non-verbal communication, body language and signing. For those with limited communication switches and themed projections using novel equipment give the opportunity for listening, recognising symbols and indicating personal preferences. This use of novel equipment is described in Roelofs definition of leisure in which he states that activities that possess and engender idiosyncratic meaning are capable of creating a leisure experience [45].

### *2.4. Memory*

The term memory includes registration, retention and retrieval of information through a series of com-

plex inter-connecting systems [38]. Failure in one area has consequences for the functioning of another [51]. Memory dysfunction may be a critical feature in many neurological conditions and has a direct impact on the individual's ability to participate in activity [12,14]. For example, impairment in short term and long term memory coupled with language comprehension difficulties makes the understanding of instructions problematic for the person with neurological deficits. Therefore, activities requiring retention of new information such as a new game or craft may fail as the individual is unable to remember the steps required to achieve a successful outcome.

The MSE does not rely on memory in order for the individual to participate. Interaction with multi-sensory equipment provides a novel experience and, as such, does not require a set of rules in order to participate. Although the equipment may be accessed by those with severe memory problems individuals may associate a response from a switching system with a visual response, for example, switching on a bubble tube may reinforce its visual and vibratory nature. Also, being in a MSE may provoke reminiscent responses, such as the memory of Christmas on viewing the optic fibre spray or Guy Fawkes Night when infinity panels are used.

### *2.5. Dyspraxia*

Studies with people who have cerebrovascular accidents have described two types of dyspraxia which are also evident in other forms of neurological impairment [9,58]. Ideational dyspraxia is a disorder of the conceptual system which contains knowledge of actions and functional performance. Ideomotor dyspraxia is a disorder in the generation and control of specific movement. Both these forms of dyspraxia make activity difficult for people with neurological problems as they may start an activity and then not know how to progress. Alternatively, they may find it difficult to initiate movement to start the activity. Many social activities rely heavily on movement, such as baking or gardening. Therefore, people may find it more challenging to complete such activities independently. The MSE can be adapted to accommodate different movement patterns. Those with more co-ordinated patterns of movement can use switching systems whilst others with more limited movement can achieve a sense of movement through swings, hammocks or water beds. As there is no end point to the MSE activity the individual may take part and leave at any time. This ability to engage in activity during discretionary time for as long as you wish is an essential component of leisure.

## 2.6. Agitation and anxiety

Agitation is often seen as a behavioural sign of anxiety and, therefore, these two features will be discussed together. Key features may include inappropriate motor or vocal activity that is not explained by need, such as excessive checking and fiddling [6,24,28]. This can impede the progress of activity in terms of attention to the details and task completion. Because agitation is thought to indicate distress, potential antecedents of behaviour should be addressed [7,49].

A diagnosis of anxiety is equally problematic and is often related to episodes of depression. Anxiety impacts on an individual's ability to participate in activity due to restless movement and poor attention. Activities which involve sequential events, such as painting a picture, may serve to exacerbate the problem rather than reduce the level of anxiety [41]. However, activity is an essential part of life's purpose; therefore, removing activities may enhance the presenting level of anxiety rather than reduce it. The MSE may reduce levels of anxiety by presenting a calming environment with an appropriate level of challenge. By reducing the level of sensory stimulation levels of anxiety and agitation have been found to reduce in many client groups [29,44]. Use of music that reflects personal taste and is meaningful to the individual has been found to reduce anxiety and help induce a sense of belonging [46,47,56]. Relaxation is seemed to be achieved by the reduction of pressure to concentrate, distraction from stressful situations and gentle stimulation.

## 3. Assessment and construction of a MSE session

MSE activity most commonly fails when little or no consideration is given to an individual's abilities or of how the session should be facilitated. Assessment is essential in order to identify personal abilities, likes and choices. Assessment tools most suitable for structuring a MSE activity may include functional assessments such as the Assessment of Motor and Process Skills (AMPS) [21] and the Functional Independence Measure and Functional Assessment Measure (FIM+FAM) [23]; Cognitive and behavioural assessments such as the Neurobehavioural Rating Scale (NRS) [37]; and activity assessment such as the Pool Activity Level (PAL) Instrument for Occupational Profiling [43].

The PAL instrument was intended as a practical guide designed to give advice on how to engage people in

meaningful activities [43]. It assists the facilitator in structuring a protocol which recommends the length of time in which to run the session, presentation of the equipment and the format of the session given the individual's level of functioning. The instrument identifies at which level an individual is operating. These levels include the Planned activity level (the individual can work towards completing a task), the Exploratory level (the individual can access familiar activities but is more concerned with the effect of doing the activity than completion), the Sensory level (the individual responds primarily to the sensory components of the task), and the Reflex level (the individual is not aware of their environment, movement is a reflex response to stimuli). This protocol, using the PAL framework, encompasses the essential requirements for successful activity for people with cognitive impairment as identified by Jones [32,43] and Hellen [25]. They suggest that activity should be: 1. simple – short tasks presented one step at a time with a limited chance for failure; 2. repetitive – being routine and familiar; 3. multi-sensory – including stimulation of sight, sound, touch, taste, smell and movement; 4. safe – with little element of risk; 5. adaptable – spontaneous versus planned and group work versus one to one depending on individual need; and 6. respectful – offering compatibility with age using remaining abilities and skills, incorporating old interests. An example of a protocol designed for the MSE for an individual operating at a reflex level is included in Table 1.

Therefore, the MSE should include an appropriate level of stimulation that challenges the individual to reach their maximum potential (sensory stimulation versus sensory deprivation). The activity should be designed to address individual sensory needs, such as offering a stronger stimulus if initial attempts are unnoticed, and be offered alongside familiar activities and routines to enhance sensory awareness. The activity should occur on a regular basis and offer a 'just right challenge' as the person with brain injury will find it easier to cope with the demands of the environment if adequate stimulation is provided. The levels or intensity of the activity may need to be adjusted depending on individual needs. Finally, if the complexity of the activity, individual needs, and MSE demands are matched, engagement in this activity may be achieved.

With improvements in neurointensive care the number of people with moderate disabilities has increased but rehabilitation often precludes leisure activities [17, 54]. Many leisure activities offered to people with brain injury fail to offer the level of flexibility that is a fea-

Table 1  
Pool Activity Level Guidelines for Multi-Sensory Environment group Reflex activity level

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*Activity objectives:* To arouse conscious awareness of self and the immediate environment.

*Position of the equipment:* Make available to the participant equipment that stimulates all of the senses. Directly stimulate the area of the body to be targeted i.e. touching the palm of the hand / arms / feet, shining visual stimuli into the line of vision, placing aromas directly under the nose for olfactory stimulation. Ensure all the senses are stimulated equally. Look for signs that the person is aware of the equipment such as eye / head / hand movement, verbal responses, moving parts of their body.

*Verbal directions:* Help the person to settle and explore the equipment. Guide all movements and reinforce with simple one word verbal directions. If the person is new to the MSE ensure they are settled with each piece of equipment before exploring its sensory components. Maintain eye contact and reinforce the activity with appropriate body language and gestures.

*Communication and activity characteristics:* Bring the person into the room and settle them in a comfortable chair. If they are in a wheelchair transfer them to an easy chair. Start with main room lights on and slowly dim the room. The session may last for up to 10 minutes but end the session if the person is no longer able to concentrate on the task or if they fall asleep (this approach is designed to stimulate rather than relax). The session should be 1:1.

Break each activity down into 1 step at a time and limit the stimulus to one piece of equipment operating at any one time. Repeat the activity for as long as the person is able to tolerate it. The activity is in direct response to the level of stimulation needed to arouse.

Guide the person by touch to explore and handle the equipment. Do not enforce any instructions on how to use or handle the equipment unless the person is placing himself or herself in danger. Ensure that the person is able to access the sensory qualities of each piece of equipment, and use your body language and tone of voice to enhance the level of stimulation.

*Ending the session:* Slowly brighten the room and allow the person to become accustom to the everyday environment. Adapt tone of voice and body language to the new environment.

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ture of MSEs. Consequently, studies report that people with brain injury have an abnormal dependence on carers and relatives in order to participate in social and leisure activities [17,18,31]. Given the World Health Organisation International Classification of Functioning, Disability and Health (ICF:World Health Organisation) shifts the focus of service delivery from disability to the more positive concept of participation, more novel activities such as MSE may provide a leisure outlet that is more adaptable for the needs of those with brain injury [18,55]. However, the MSE is not be an activity that is exclusive to those with disabilities but is also an activity that can be shared with friends and carers. Currently the concept is that of a fixed location MSE within healthcare settings, but slowly the use of multi-sensory stimulation is being widened to mainstream settings with more portable features to meet the leisure requirements of people with many different needs.

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