OCCUPATIONAL THERAPISTS' EXPERIENCES OF SOUND-BASED THERAPY ON OCCUPATIONAL PERFORMANCE OUTCOMES IN CHILDREN WITH SENSORY PROCESSING DIFFICULTIES

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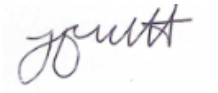
A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Occupational Therapy (Paediatric Perception).

Johannesburg, 2021

DECLARATION

I, Taryn Maree van der Westhuizen, declare that this research report is my own unaided work. It is being submitted for the degree of Master of Science in Occupational Therapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.



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PLAGIARISM DECLARATION

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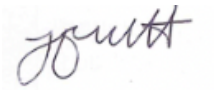
Signature: 

Date: 24 September 2021

This research report is dedicated to my husband, **Wiaan van der Westhuizen**, who supported me throughout the process of writing this research report, and to my parents, **Graham and Rose Everett**, who have always encouraged me to study further.

ABSTRACT

Occupational therapists consider the role the auditory system, based on the theory of sensory integration, could play in the treatment of children with sensory processing disorder presenting with occupational performance challenges. Occupational therapists have been incorporating sound-based therapies into their occupational therapy practice in treating children with sensory processing disorder. However, within the occupational therapy context, there is minimal research on the use and benefits of sound-based therapies on occupational performance, particularly in the South African context. A qualitative study was conducted using individual interviews to explore occupational therapists' use and perceived effectiveness of sound-based therapies. The data collected through the individual interviews was analysed using thematic content analysis with the use of MaxQDA. Therapist related factors including exposure and mentoring, research evidence, therapist philosophy and the valuable role of auditory input cause occupational therapists to include sound-based therapies. These factors influence which sound-based therapies are included in occupational therapy practice. Sound-based therapies are improving underlying client factors specifically: sensory modulation and emotional regulation which result in improvements in occupational performance outcomes. However, further research is needed. Occupational therapists must be cautious when using sound-based therapies and must consider evidence-based practice and good clinical reasoning to ensure individualised and effective treatment.

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TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS

ADLs	-	Activities of Daily Living
ASHA	-	American Speech and Hearing Association
CNS	-	Central Nervous System
EBP	-	Evidence-Based Practice
iLs	-	Integrated Listening Systems
iADLs	-	Instrumental Activities of Daily Living
OTASA	-	Occupational Therapy Association of South Africa
REDCap	-	Research Electronic Data Capture
SAISI	-	South African Institute for Sensory Integration
SI	-	Sensory Integration
SMD	-	Sensory Modulation Disorder
SPD	-	Sensory Processing Disorder
SSP	-	Safe and Sound Protocol
USA	-	United States of America

OPERATIONAL DEFINITIONS

Auditory system	The auditory system involves locating, identifying and filtering auditory input, which are precursors to the development of speech and language skills[1–5].
Bilateral coordination	Bilateral coordination is the ability to use both sides of the body in a smooth and controlled manner[1–5].
Bottom-up approach	This approach refers to the therapist assessing and treating the underlying skills to affect change in occupational performance[1, 10–12].
Client-centredness	Client-centredness is a core foundation of occupational therapy practice, which states that the therapist is concerned with the client and involves the client throughout the occupational therapy process[6–9].
Clinical reasoning	Clinical reasoning is an essential feature of occupational therapy practice and highlights the decision-making process during the occupational therapy process to ensure improved occupational performance outcomes[1, 10–12].
Evidence-based practice	The use of knowledge gained from clinical experience, unique circumstances and best research evidence that will influence one's occupational therapy practice[13–16].
Emotional regulation	A person's ability to effectively manage and respond to emotional experiences[1–5].
Family-centred practice	Creating partnerships with families, treating families with respect and dignity, honouring their choices and decisions and providing support to improve their functioning as a family[17, 18].
Occupation	Goal-directed and meaningful activities in which humans engage[19–22].
Occupational performance	An individual's ability to successfully perform meaningful activities that are needed to care for themself, enjoy life and be productive[19–22].
Occupational performance areas	Categories of activities performed by people to fulfil their occupational roles, which include rest and sleep, education and/or work, activities of daily living, play, leisure, instrumental activities of daily living and social participation[19–22].
Postural control	Postural control is a sensorimotor system that allows an individual to maintain an upright posture and successfully move and transition within the environment with ease[1–5, 23].

Praxis	Praxis is a learnt skill inherent to humans that allows them to effectively interact with the environment and adapt to any environmental changes[1–5, 24].
Proprioceptive system	Proprioceptive system is an unconscious process that provides the individual with an awareness of their body in space and the grading and timing of their movements[1–5].
Self-regulation	The child's ability to monitor and manage their arousal, thoughts, behaviours and emotions that are appropriate and acceptable and promote well-being, learning and relationships[1-5].
Sensory craving	Sensory craving occurs when an individual craves an unusual amount or type of sensory input, resulting in disorganised behaviour[1–5, 25].
Sensory discrimination	Sensory discrimination is the ability to interpret sensory information details, such as spatial and temporal qualities[1–5].
Sensory integration or sensory processing	Sensory integration or sensory processing is the central nervous system's ability to detect, process and organise sensory information to produce adaptive responses for the successful performance of daily occupations[1–5, 25, 26].
Sensory modulation	Sensory modulation is the central nervous system's ability to regulate incoming sensory information to generate appropriate behavioural and emotional responses[1–5, 25–27].
Sensory over-responsivity	Sensory over-responsivity is when an individual responds to sensation quickly with more intensity and for a longer duration due to a low neurological threshold, resulting in inappropriate behavioural and emotional responses[1–5, 25–27].
Sensory processing disorder	Sensory processing disorder is a disorder where sensory information is not processed and integrated appropriately, causing the individual to present with maladaptive behavioural and emotional responses or poor movement execution[1–5, 25–27].
Sensory registration	Sensory registration is the fundamental stage in sensory processing and is the ability to register and detect sensory information from the body and in the environment[1–5, 25–27].

Sensory under-responsivity	Sensory under-responsivity is when an individual responds to sensation slowly with less intensity and for a short duration due to a high neurological threshold, resulting in inappropriate behavioural and emotional responses[1–5, 25–27].
Top-down approach	This approach refers to the therapist assessing and treating the occupational performance areas that have been identified as an area of difficulty for the child[1, 10–12].
Vestibular system	The vestibular system is an unconscious process that provides awareness of the head's position and movement in space[1–5].

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Sensory processing disorder (SPD) is a neurological condition whereby sensory information from the internal and external environment is not processed and integrated efficiently[1, 5, 25]. Children who have SPD perceive and/or respond to sensory information differently compared to most other people; therefore, their emotional and behavioural responses are inappropriate in that specific context[1, 5, 25]. Occupational therapists treating children with SPD have started incorporating sound-based therapies as a complementary technique to their traditional occupational therapy process based on the Sensory Integration (SI) frame of reference[4, 28–30]. The rationale for incorporating sound-based therapy is based on research by Dr A. Jean Ayres, who noted that auditory input contributes to optimal self-regulation, arousal and emotional expression [4, 31]. She further noted that well-organised sensory input allows a child to be ready for action and thus improve their participation in their daily occupations[4].

There are various sound-based therapies used by occupational therapists in South Africa; however, there is very little research on the benefit of sound-based therapy within the occupational therapy context. Studies on the inclusion of sound-based therapy in a child's traditional occupational therapy process have mainly focused on children with neurological disorders (such as autism spectrum disorder and learning disabilities), with a specific focus on identifying changes in behaviour and underlying performance skills and client factors, rather than the influence of sound-based therapy on their occupational performance outcomes[28, 30, 32–39].

1.2 STATEMENT OF THE PROBLEM

Efficient processing and integration of sensory information result in improved occupational performance[4, 28–30]. Auditory input forms part of a person's sensory systems and should be considered in SI therapy as it plays a role in calming and alerting the nervous system and coordinating rhythmical movements. Occupational therapists incorporate sound-based therapies as a complementary tool to SI therapy to ensure the auditory system is included in the therapy process. However, there is minimal current discussion and a lack of empirical evidence regarding the effectiveness of sound-based therapies on children with SPD within

the occupational therapy context[30, 32–36, 40]. The lack of empirical evidence has made it difficult for occupational therapists to determine which sound-based therapy would be beneficial for a specific child, when the sound-based therapies should be incorporated into a child's traditional occupational therapy process and what occupational therapy outcomes a child should be referred for sound-based therapy. This is a cause for concern as the profession aims to ensure that occupational therapy practice is evidence-based and occupation-centred[13–16, 41]—specifically as evidence-based practice (EBP) is important in occupational therapy practice, as occupational therapists must justify their choice of interventions aimed at improving occupational performance[13–16].

Speech therapists who specifically address the auditory system do not endorse sound-based therapies due to the lack of evidence as stipulated in the position statement by the American Speech and Hearing Association (ASHA)[42]. This causes one to question why occupational therapists incorporate sound-based therapies or why occupational therapy associations have not released a position statement on the use of sound-based therapy within the occupational therapy context.

It is, therefore, unclear why occupational therapists incorporate sound-based therapies as a complementary tool in the treatment of children with SPD and whether sound-based therapy affects change in children's occupational performance—the ultimate goal of occupational therapy.

1.3 PURPOSE OF THE STUDY

The purpose of this study was to explore occupational therapists' perspectives on the use and perceived effectiveness of sound-based therapy in the treatment of children with SPD.

1.4 RESEARCH QUESTION

Do occupational therapists perceive sound-based therapy as effective in treating the occupational performance of children with SPD?

1.5 AIM OF THE RESEARCH

To explore occupational therapists' experiences of the nature of sound-based therapy intervention and whether occupational therapists perceive sound-based therapy as effective

in improving the occupational performance outcomes of occupational therapy intervention for children with SPD.

1.6 RESEARCH OBJECTIVES

1. To explore occupational therapists' experiences of the use of sound-based therapy intervention for children with SPD in Gauteng.
2. To explore occupational therapists' experiences of the perceived effectiveness of using sound-based therapies on occupational performance outcomes in children with SPD.

1.7 JUSTIFICATION AND USE OF THE RESULTS

Currently, there are uncertainties around the use of sound-based therapies as a complementary technique in treating children with SPD and the effectiveness on occupational performance outcomes[28, 30, 32–39]. Clinicians' knowledge and experience around which sound-based therapies can be used for specific children, when sound-based therapies should be incorporated during the occupational therapy process and how sound-based therapies are implemented are provided through the study outcomes. This will allow occupational therapists to start using evidence to justify their clinical reasoning or assist them with their clinical reasoning in incorporating sound-based therapies in the treatment of children with SPD. Factors affecting the implementation of sound-based therapies were also explored, which will allow occupational therapists to consider these factors in their clinical reasoning process before determining whether a sound-based therapy would be suitable for the child and family.

Occupational therapists aim to improve occupational performance through the occupational therapy process: evaluation including occupational profile and analysis of occupational performance, intervention (plan, implementation and review) and outcomes[20, 43]. Thus, occupational therapy treatment should ensure that children with SPD can become productive and independent in their daily tasks and improve the quality of life and well-being for both the families and the child with SPD[8, 19, 21, 44]. This study explored how sound-based therapies influence the occupational performance outcomes of children with SPD and whether this has a sustainable and long-lasting effect on occupational performance. This information can be provided to parents to allow for informed consent regarding the use of sound-based therapy in the treatment of their child. Medical aids and insurers would also benefit from this research

on whether sound-based therapy falls within the scope of occupational therapy and, therefore, should be financially covered.

No position statement has been made by any occupational therapy association. This study could, therefore, allow for the development of a position statement regarding the use of sound-based therapy in the treatment of children with SPD and its influence on occupational performance outcomes.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Sensory processing disorder (SPD) is a disorder treated by occupational therapists within the paediatric field of practice. It affects children's participation in their occupational performance areas, namely education, play, leisure, rest and sleep, activities of daily living (ADLs), instrumental activities of daily living (iADLs) and social participation[20, 43]. Occupational therapists treating children with SPD seek to incorporate best practice to allow these children to become independent and productive in all areas of daily life[8, 19–21, 43, 44]. Best practice is ensured by incorporating client and family-centred practice, evidence-based practice (EBP) and good clinical reasoning throughout the occupational therapy process[1, 10–18]. Currently, there is concern around the incorporation of sound-based therapies in the occupational therapy process and the effectiveness of improving the occupational performance of children with SPD[28, 30, 32–39].

This literature review describes the occupational therapy process and the clinical skills and processes occupational therapists use when treating children with SPD to ensure best practice. The review defines SPD, outlines the different SPD patterns and describes the impact it has on a child's occupational performance. The emergence of sound-based therapy and the types of sound-based therapy are explored. Existing evidence is reviewed to understand how sound-based therapy could influence a child's occupational performance outcomes based on SI theory.

2.2 OCCUPATIONAL THERAPY PROCESS

Occupational therapy seeks to ensure that everyone is able to participate independently and successfully in their daily activities[8, 19–21, 43, 44]. Within the paediatric field, occupational therapists focus on improving a child's underlying skills or adapting the task and/or environment to allow for optimal occupational performance[20]. Occupational performance is the child's ability to successfully perform and execute occupations, such as social participation, rest and sleep, play, leisure, education, ADLs, and iADLs, due to an optimal fit between the child's abilities, task

demands and environment[19–22]. The occupational therapist can determine the optimal fit through the occupational therapy process[20].

The occupational therapy process consists of a thorough and holistic evaluation and an individualised intervention plan to promote each child's success in their daily occupations. The evaluation can be subdivided into two steps: the occupational profile and the analysis of occupational performance[20]. The occupational profile is the first step and is conducted to understand the child's occupational history, interests, values, reasons for referral, strengths, challenges and priorities[20]. This guides the therapist in tailoring the assessment to the child's reason for referral[20]. The second step is the analysis of occupational performance, which is conducted through an individualised assessment. An individualised assessment allows the occupational therapist to efficiently interpret the child's strengths and weaknesses and identify the barriers and supports to the child's successful participation in daily tasks. The occupational therapist will assess the child's abilities, the environmental supports and barriers, and performance and participation in occupations. An individualised assessment is the foundation for implementing effective occupational therapy intervention and guiding the occupational therapist's clinical reasoning[8, 20, 43]. Based on the assessment findings, the occupational therapist develops a treatment plan that addresses the areas of weakness to ensure successful participation in daily tasks. The treatment plan is implemented by the occupational therapist, and the therapist constantly evaluates and adapts the intervention based on the child's response and the family and child's needs[10, 45].

Within the paediatric field, the child is the client, but the family is important to consider when making clinical decisions around the intervention to be provided. Family-centred practice is essential in the occupational therapy process as each family is unique and different[18, 46]. Families vary based on the following factors: size, configuration, socioeconomic status, parenting styles, values, culture and resources[47]. Occupational therapists need to understand each child's family and ensure the intervention chosen for that family is suitable based on their priorities and needs [17, 18, 46]. Family-centred practice leads to an improved sense of control, goal

attainment and family satisfaction with occupational therapy services for children [17, 18, 46].

Evidence based practice (EBP) is a core element that is considered in developing and implementing an intervention suitable to each child and family. Occupational therapists are encouraged to ensure that their occupational therapy process is guided by EBP. EBP is a priority in the health care profession to justify the services provided, as clients expect and deserve services guided by the best available evidence[13–16]. Traditionally, evidence referred to in EBP was the use of best available research; however, occupational therapists are encouraged to integrate information from research, clinical experience, knowledge on client circumstances and values, and the practice context to inform their clinical reasoning[13–16]. Challenges, such as limited time and resources and lack of skills to critically appraise research, influences the incorporation of EBP into their occupational therapy practice[13–16]. Occupational therapists using sound-based therapy should use EBP to become aware of the evidence and rationale behind the interventions being used. Occupational therapists must remain true to the scope of the occupational therapy profession addressing occupational performance challenges. Treatment tools and frames of reference suitable to the child and family need to be occupation-centred and informed by EBP[41]. Of concern, however, is Copley et al.'s[45] research which identified that rather than choosing tools based on EBP, therapists choose tools based on familiarity, the extent of use in the workplace, early exposure to the tool and personal experience with the successful use of particular interventions.

Occupational therapists strive to provide best practice to their clients. Best practice is not only based on following the steps of the occupational therapy process and using EBP but also relies on clinical reasoning, where the occupational therapist draws and reflects on information and knowledge simultaneously[1, 10–12]. Clinical reasoning is an important skill for an occupational therapist and develops and progresses with clinical experience[12]. Clinical reasoning is a complex set of cognitive processes that makes the occupational therapy process unique to each child, as it is how the therapist puts the science and art of occupational therapy practice together. Six types of clinical reasoning influence an occupational therapist's decision-making and choice of frame

of reference and treatment tools during the occupational therapy process. There are: scientific, procedural, interactive, narrative, pragmatic and ethical reasoning [1, 10–12]. These types of clinical reasoning guide the therapy process. The factors that influence an occupational therapist's clinical reasoning include the therapist's philosophy about occupational therapy, therapy skills and motivation influenced by stress, tiredness, interest and rapport with client, and attitude to disability[10, 11].

Paediatric occupational therapists treat SPD within their scope of practice using a SI frame of reference. This disorder's intervention management requires a carefully tailored and individualised assessment and treatment plan that is heavily reliant on the occupational therapist's clinical reasoning and knowledge of EBP. SPD influences the child's ability to successfully participate in occupations and can hinder development and affect the child's health and well-being.

2.3 SENSORY INTEGRATION THEORY

The theory of SI was developed by Dr A. Jean Ayres[4]. SI is the process of registering, processing and integrating sensory input received from outside the body and within the body to produce purposeful, adaptive behaviours in response to the environment[4, 60, 61]. SI is an automatic and unconscious process that occurs in the subcortical areas of the brain and is well integrated by eight to ten years of age[4, 60, 61]. Ayres hypothesised that SI develops over time and is refined throughout life. Children are born with an immature and malleable brain but have an inner drive and motivation to explore and master their environment. Development occurs when there is a just-right challenge between the child's abilities and the environment that elicits an adaptive response. This adaptive response causes the CNS to adapt, modify and/or change, through neuroplasticity, in function and/or structure in response to the experience. The child can then move onto the next developmental area as development is seen as building blocks[4]. According to Ayres, efficient SI is important for the development of social and emotional skills, motor skills and participation in occupations[1, 4].

Sensory integration (SI) requires all sensory systems to process and integrate interdependently to allow for successful participation in occupations. The auditory system was initially hypothesised by Ayres to play an important role in the regulation

of arousal, speech and language skills, social skills, rhythmicity of movements and successful execution of movements within the environment. She did not, however, investigate this area in depth[4]. Since then, other scholars have identified the functional roles of auditory input within the SI frame of reference[28–30, 40, 60, 62].

One of the avenues through which auditory input is processed is via the reticular activating system, which influences our arousal level[4, 63]. The auditory system is subconsciously alerting us to ongoing changes in the environment, and any unexpected sounds elicit an orienting response. The orienting response to sound impacts arousal, alertness and attention[62]. Therefore, auditory input can be alerting or calming and allow a child to achieve an optimal level of arousal for learning and participation in daily activities[4, 5, 61]. The orienting response due to the integration with the visual and vestibular system facilitates the activation of postural muscles, promoting deeper respiration which could influence the child's posture and ability to be upright and be ready for action (fight/flight response)[62].

The auditory system is important for the detection and interpretation of sound, which are vital to the development of speech and language skills[4, 5, 64]. The detection, location and distance of auditory input integrated with the visual system provide humans with a spatiotemporal orientation in the world[62, 64]. Therefore, auditory input can be used to assist children with understanding the relationship between the external world and themselves and is critical for efficient and successful movement within the environment[65, 66].

Auditory input is closely linked with the motor system because the vestibular system is within the inner area of the ear and therefore works closely with the auditory system[62]. Ayres[4] noted that as the auditory system evolved out of the vestibular system resulting in the two systems sharing the membranes and bony labyrinths of the inner ears and both responding to vibrations in the perilymph and endolymph that they are closely related. Furthermore, even though the auditory and vestibular system each have a branch of the eighth cranial nerve there is crossover from one to the other. Ayres[4] stated that the vestibular system plays the major role of being the reference point between the body and the external world through the use of gravity. In

a similar manner, the auditory system gives us information about three-dimensional space and provides us with a basic orientation to space surrounding us. Both systems work together to provide us with spatiotemporal orientation that is critical to function and move in the world[4] . Furthermore, Ayres[4] hypothesised as the vestibular system is closely linked to the auditory system this could indirectly influence the child's posture and bilateral integration and sequencing. Furthermore, the rhythmicity of auditory input can improve the timing and execution of movements important for the development of bilateral integration and praxis[62].

Based on this frame of reference and the underlying assumptions, sensory processing disorder was identified as a disorder along with patterns and subtypes of the disorder.

2.4 SENSORY PROCESSING DISORDER

Sensory processing disorder (SPD) is defined by Miller et al.[25] as a neurological disorder in which the sensory information that the individual perceives results in abnormal responses. SPD is multisensorial, impacting some or all of the sensory systems, including auditory, visual, proprioceptive, tactile, vestibular, gustatory and olfactory[2, 31]. Children with SPD can detect the sensory information, but it is not processed and integrated efficiently at a subcortical level. Therefore, their emotional and behavioural responses may be inappropriate, and their occupational performance presents as atypical or delayed[25].

There is limited research on the prevalence of SPD in children within South Africa and in South Africa the studies have focused more on the patterns of SPD[4, 48–50]. SPD can exist in isolation but also presents as comorbid to attention deficit hyperactivity disorder and autism[51]. Estimates indicate SPD in children without comorbidities range between 5% and 10%, but this was based on Ayres' clinical experience in 1989 rather than prevalence studies[4, 48]. Later research by Ben-Sasson et al.[49] and Miller et al.[50] indicated that between 5% and 16% of children in the United States of America (USA) exhibit SPD symptoms. While many studies on the assessment and treatment of SPD have been conducted in South Africa, Van Jaarsveld et al.[52] confirmed the patterns of SPD found in South African children are consistent with the patterns of dysfunction evident in the USA population. The preliminary research suggests that SPD can be

inherited or can be due to environmental factors[1, 4, 5]. Prenatal and birth complications, including low birth weight and prematurity, are also implicated[50, 53].

2.5 PATTERNS OF SENSORY PROCESSING DISORDER

Sensory processing disorder (SPD) presents as patterns of dysfunction based on a factor analysis of assessment indicators used since Ayres' original research on the Southern California Sensory Integration Test in 1972 on children aged five to 12 years[4]. Miller et al.[25] developed a nosology for SPD, which describes the following three SPD patterns: sensory modulation disorder (SMD), sensory discrimination disorder and sensory-based motor disorders and includes several subtypes in each of these SPD patterns. Patterns of SPD based on Miller et al.'s proposed nosology emerged from empirical analysis and, thus, forms the foundation theory for this study[25].

2.5.1 Sensory modulation disorders

Sensory modulation is the central nervous system's (CNS) ability to modulate sensory input to generate an appropriate response that matches the environmental demands and expectations[3–5, 25]. This process provides the foundation to perform adaptively in day-to-day occupations.

A SMD occurs when the CNS cannot regulate and generate graded and appropriate responses to meet environmental and task demands, resulting in the child over or under-responding to incoming sensory input[3–5, 25]. This mismatch causes the child to display behaviours and emotions inappropriate for the nature and/or intensity of the sensory input. Three subtypes of SMDs have been identified[25] below:

2.5.1.1 Sensory over-responsivity

Sensory over-responsivity refers to a child who has a low neurological threshold for sensory input and responds to sensory input quickly and with greater intensity. This can occur in a single sensory system or across multiple sensory systems[3–5, 25]. Symptoms of sensory over-responsivity include sensitivity to light touch, particular sound frequencies, bright lights, tastes and food textures, smells, and movement[3–5, 25]. The responses to sensory input tend to be automatic due to sympathetic nervous

system activation, which elicits the fight, fright, flight or freeze response. Sensory input also has a summative effect: a sudden exaggerated response to a seemingly trivial event may occur because of the accumulated events of the day[3–5, 25]. Children with sensory over-responsivity can be irritable and aggressive, and when over-stimulated, can easily become anxious and clingy[49]. They will often be rigid and controlling, and their attention may fluctuate from distracted to over-focused in an attempt to screen out noxious stimuli. This subtype is often detected in infants and the early years due to the significant effect on sleep and feeding[3–5, 25].

Sensory over-responsivity can cause occupational performance challenges[32, 54, 55]. Children with sensory over-responsivity tend to be picky eaters and enjoy sticking to bland foods due to sensitivity to food textures, tastes and smells[56, 57]. They may become distressed during grooming and bothered by labels and certain clothing textures and prefer to wear shoes due to tactile over-responsivity[25]. Children with sensory over-responsivity may have difficulty falling and staying asleep—as they are in sensory overload—and may have difficulty achieving an optimal state of arousal for falling asleep[25, 31]. Within the school environment, children with sensory over-responsivity may appear to have difficulty paying attention as they are easily distracted by irrelevant sensory stimuli[3–5, 25]. Children with sensory over-responsivity may avoid play activities involving movement such as swinging or climbing and may avoid activities such as birthday parties or restaurants because of the noise level[25].

2.5.1.2 Sensory under-responsivity

Sensory under-responsivity refers to a child who has a high neurological threshold for sensory input and takes longer to respond to sensory input with less intensity or may not even respond to the sensory stimuli in their environment[3–5, 25]. Children with sensory under-responsivity are often not aware of being touched, are oblivious to the pain of minor scrapes/bruises, fail to notice or ignore noxious odours, appear oblivious to certain sounds, constantly put objects in their mouths and may seek opportunities for movement, jumping and crashing[3–5, 25]. Children with sensory under-responsivity generally tend to present as passive, withdrawn, difficult to engage, inattentive or self-absorbed[25, 58, 59]. They often miss out on opportunities afforded to them within the environment. This may affect their ability to learn and master the environment and

tasks, which may hinder their development[3–5, 25]. Sensory under-responsivity in children is often detected late, as the children are generally well-behaved and easy-going. It is, rather, identified during school years when the children are struggling to keep up with school demands[32, 54, 55].

2.5.1.3 Sensory craving

Sensory craving refers to a child who craves an unusual amount of sensory input [3–5, 25]. Symptoms of sensory craving consist of the child engaging in activities that add more intense sensations to their bodies, such as loud noises, spicy food, constant moving and visually stimulating objects. Some degree of sensory-seeking behaviour is typical for children as they learn, explore and master new challenges. However, sensory craving results in more disorganised behaviour[3–5, 25]. Children with sensory craving are constantly moving, being impulsive, careless and reckless. This can have a significant influence on social interactions with peers as they tend to be rough and rowdy[3–5, 25, 58, 59]. Children with sensory craving behaviours are often interpreted as demanding or having attention-seeking behaviour, which could influence the ability of the child to focus and complete school tasks and ADLs[32, 54, 55].

2.5.2 Sensory discrimination disorders

Sensory discrimination is the ability to interpret and compare information[3–5, 25]. A disorder of sensory discrimination means the child has difficulty interpreting the sensory input. Each of the eight senses has its own discrimination disorder, and a child can have any combination of the eight discrimination disorders[3–5, 25]. Children with tactile discrimination disorder struggle to process things they touch without seeing what they touch. This may result in poor fine-motor skills needed for scholastic tasks, dressing and using utensils, and poor body awareness[3–5, 25]. A child with auditory discrimination disorder may have difficulty following instructions and discriminating between sounds and words, which are vital in developing speech and language skills, reading and spelling, and participating in school tasks[3–5, 25]. A child with visual discrimination disorder has difficulty distinguishing objects within a background, observing similarities and differences in pictures and completing incomplete pictures, and has poor depth and spatial perception. This affects the child's ability to line up numbers in a maths problem and write letters in the correct direction[3–5, 25]. Children

with vestibular discrimination disorder may not feel when they are falling, are unable to catch themselves before they get hurt and tend to get disoriented easily[3–5, 25]. Children with proprioceptive discrimination disorder lack body awareness, tend to be clumsy and struggle to grade force appropriately. This may result in a child using too much force when throwing and catching a ball and during play, resulting in someone getting hurt[3–5, 25].

2.5.3 Sensory-based motor disorders

Sensory-based motor disorders are motor challenges with an underlying sensory basis and have two subtypes: postural disorder and dyspraxia[25].

2.5.3.1 Postural disorder

A postural disorder occurs due to inefficient vestibular and proprioceptive processing[3–5, 25]. Children with postural disorder have poor core strength, decreased endurance and poor balance, and experience difficulty using both sides of the body simultaneously. Children with a postural disorder are slow and cautious, with a clear preference for sedentary tasks. They also fatigue quickly, slump over and prop their head on their hand when at a desk[3–5, 25]. Children with a postural disorder may exhibit poor self-esteem and self-confidence[58, 59]. They may play alone because they cannot physically keep up with their peers[32, 54, 55].

2.5.3.2 Dyspraxia

Dyspraxia is the difficulty a child with SPD has in performing the three processes of completing a motor action: ideation, sequencing and motor execution to complete non-habitual motor skills[24, 32, 54, 55]. Children with dyspraxia experience difficulties with knowing how to relate to their environment and how to use objects. As a result, these children often feel incompetent, frustrated and powerless as they know what they want to do but cannot do it[24, 32, 54, 55]. Children with dyspraxia lack the skills to interact effectively with people and objects, leading to decreased self-efficacy. They are often teased by peers and excluded from sports and games, resulting in increased isolation and low self-esteem[58, 59]. Dyspraxic children are often aware of what they cannot do and, therefore, avoid difficult situations. They can be described as being uncooperative and having a negative attitude toward participating in motor activities.

Children with dyspraxia are often only identified during the school years when they are required to perform non-habitual tasks independently[24, 32, 54, 55].

Sensory processing difficulties negatively affect occupational performance[32, 54, 55]. Occupational therapists have unique expertise to understand the transactional nature of occupation and SPD's effect on occupational performance[41]. Therefore, occupational therapy is considered an effective treatment to address SPD, allowing children to become independent and participate to the best of their ability—the ultimate goal of the profession[41]. One of the main frames of reference used by occupational therapists to treat children with SPD is SI. Ayres developed the theory of SI to explain children's learning and behaviours, as she believed that the processing of sensory information in the CNS influenced development[4].

The functions of the sensory systems suggest that incorporating 'controlled and enhanced' sound input may play an important role in SI and the treatment of children with SPD[62]. As a result, sound-based therapies are starting to be incorporated into the SI approach as a complementary tool based on the therapists' clinical reasoning to enhance progress towards successful participation in occupations[38, 62].

2.6 SOUND-BASED THERAPY

Sound-based therapy was pioneered by the French physician Dr Alfred Tomatis in the mid-1900s[67]. Currently, there are several sound-based therapies used as a complementary tool within the SI frame of reference for a child's occupational therapy process. Occupational therapists who have used sound-based therapy within a SI context have commonly reported improvements in sensory modulation[28, 37, 68–70], behaviour[37, 68, 69], posture and movement[71], and engagement in activities[28], which have all led to changes in praxis and communication[37, 68, 69, 71–73]. Improvements in these client factors and performance skills may enhance a child's ability to participate in all occupational performance areas. There are various sound-based therapies available in South Africa.

2.6.1 Types of sound-based therapies

The work of Dr Tomatis was seminal in the emergence of the following four sound-based therapies.

2.6.1.1 Tomatis® Method

The Tomatis® Method was developed as the first sound-based therapy to treat autism[33]. The Tomatis® Method is expected to positively affect: attention, arousal, behaviour, social participation, balance, muscle tone and coordination, visual perception, visual-motor functioning and speech and processing of language when reading[68, 71–73].

A case study by Nicoloff[71] indicated that when following the Tomatis® Method, children were able to produce sounds and words with less emotional and physical frustration and displayed improved fine and gross-motor skills and overall improved confidence in their physical abilities. Neysmith-Roy[69] conducted an experimental study on six boys with severe autism as measured by the Children's Autism Rating Scale. The study noted that three of the boys experienced improvements in behaviour and five of the boys were observed to show improvements in pre-linguistic areas including: activity level, non-verbal communication, listening response and adaptation to change[69]. Following the Tomatis® Method it was observed that one of the boys no longer met the criteria for a diagnosis of autism, two showed behaviours indicative of mild autism and three boys continued to exhibit behaviours consistent with a severe autism category[69]. Kershner et al.[37] compared a group of children with learning disabilities who received the Tomatis® Method in school and a control group of children who only received direct instruction. There were no differences noted at a 1 year follow up[37]. Tomatis Listening Centres around the world have accumulated clinical evidence suggesting that the Tomatis® Method positively influences development in children in general and children with learning, sensory-motor integration, attention and concentration, and communication challenges in particular[73].

Although a few peer-reviewed studies confirm these positive effects on children, research data are scarce and focuses either on a few case studies or does not

sufficiently satisfy the requirements for rigorous scientific investigation. Not only is the existing research on the Tomatis® Method of sound stimulation minimal, but all previous studies on the Tomatis® Method have focused exclusively on children with language difficulties and autism spectrum disorder. Therefore, the Tomatis® Method lacks research to clearly identify its effects on the brain's physiology, language, cognition, behaviour and sensory-motor processing in children with SPD[37, 68, 69].

2.6.1.2 Therapeutic Listening®

Therapeutic Listening® was developed by Sheila Frick, an occupational therapist, on the foundation of the Tomatis® Method and the principles and assumptions of SI theory—specifically to focus on occupational therapy outcomes in children with SPD[2]. Therapeutic Listening® was developed to allow for an affordable and less intense way to provide this treatment in the practice, home or school setting[33].

Numerous case studies published in Sheila Frick's book which indicate improvements in occupational therapy outcomes; however, this is a low level of evidence as these children were still receiving occupational therapy and the case studies did not receive the same degree of peer review as would if they were submitted to a journal for publication. A research study on the effectiveness of Therapeutic Listening® was conducted by Hall & Case-Smith[30] . The study examined 10 participants between the ages of 5 to 11 years with visual-motor delays and SPD. Following four weeks of a sensory diet and eight weeks of Therapeutic Listening®, parents and the children completed four assessments: Draw-A-Person test, Sensory Profile, visual perceptual part of the Beery-Buktenika Developmental Test of Visual Motor Integration and the Evaluation Tool of Children's Handwriting[30]. The results indicated, along with the sensory diet, improvements in the children's behaviour related to sensory processing, improved attention, sleeping patterns, consistency in following directions and visual motor skills[30]. Furthermore, parents also reported developments in their children's behaviour related to sensory processing. The limitations to this study is the small population size, lack of control group and parent-report measures for behaviour[30]. Chiu and Li[70] investigated the use of Therapeutic Listening® with children with SPD in Taiwan. A qualitative study was conducted to explore three mothers' experiences of Therapeutic Listening® through semi-structured interviews. The mothers reported

changes in the following four areas: emotional regulation, self-control, time management and parent-child interaction[70] . Improvements were noted in motor control and the ability to execute their daily activities in a more timely manner[70].

Another study conducted by Bazyk et. al.[38] examined the effects of Therapeutic Listening® on enhancing school performance in pre-schoolers with developmental disabilities. The children aged 3-6 years old listened to the programme for 20 minutes twice a day during their typical classroom routine. The treatment duration ranged from 6 weeks to 5 months determined according to both the therapist's clinical observations and the child's needs. The assessments used included the Peabody Developmental Scale-2, Preschool Language Scale-3, Sensory Profile, Draw-A-Person, Social Skills Rating System and the Beery-Buktenika Developmental Test of Visual-Motor Integration. The results from this research study indicated statistically significant improvements in all the areas[38].

Therapeutic Listening®, in conjunction with occupational therapy using an SI approach, has been identified as influencing a child's arousal level, enhancing spatial-temporal organisation and improving attention, social and language skills, sleeping patterns and visual-motor skills[30, 38, 62, 74, 75]. Therefore, Therapeutic Listening® is one of the most researched sound-based therapies used on children with SPD.

2.6.1.3 Integrated Listening System

The Integrated Listening System (iLs) was developed to influence sensory processing, attention and regulation, learning skills, handwriting, emotional regulation, completion of daily tasks, reading skills, speech and auditory processing[28]. The programme is based on Dr Tomatis' work, in which he stated that emotional regulation and processing is optimised alongside one's ability to think, focus and engage in social situations[28]. Only one pilot study by Schoen et al.[28] exists on the use of iLs in occupational therapy. The study provides preliminary research evidence that this sound-based therapy may influence children with SPD's participation in occupations, behaviour and emotions. Parents reported better sleep due to a reduction in auditory over-responsivity, while two parents reported having less difficulty filtering out background noise during daily interactions at home and school[28]. The results

identified that this is a feasible home programme and can be used within the practice. It appears to address occupational challenges specifically communication and education-related abilities such as schoolwork, handwriting and reading comprehension[28]. This programme has been identified to be a cost effective and time efficient application for occupational therapy practice[28]. However, the limitations in this study including a small sample size and short-term study suggests that this is not generalisable to the larger population and that one cannot conclude the sustainability of these results[28]. Therefore, minimal research exists for the use of iLs in occupational therapy practice.

2.6.1.4 Safe and Sound Protocol

The Safe and Sound Protocol (SSP), designed by Dr Stephen Porges, offers possibilities for reducing hypersensitivities in autistic people[76]. SSP has been identified as reducing auditory, visual and tactile over-responsivity in children with autism and assisting with state regulation and auditory processing deficits[76, 77]. The two studies on the SSP have mainly been conducted within the autistic population with improvements noted in state regulation, social participation and auditory modulation[76, 77]. However, these studies have lacked control groups and the long term effects of the intervention has not been monitored[76, 77]. No studies have been conducted on the effect of the SSP on children with SPD within occupational therapy literature.

Table 2.1: Summary of sound-based therapies

	Target population	Equipment	Intervention method	Perceived benefits	Evidence	Training
Tomatis® Method	First developed for children with autism but now for children with and without disabilities[78, 79].	TalksUp device and a special headphone, including bone and air conduction [78, 79].	Initial phase of 14 days, with 1½ hours' listening each day. Then a four-week break, and then another cycle may be recommended. The break allows for the integration of the changes in the brain and body and at the emotional level[78, 79].	• Attention[37, 68, 69, 71–73, 78–80]. • Academic skills[33, 79, 80]. • Behaviour[37, 68, 69, 71–73, 78–80]. • Speech and language [37, 68, 69, 71–73, 78–80]. • Postural control[33, 79, 80]. • Balance[33, 79, 80]. • Motor coordination [37, 68, 69, 71–73]. • Social participation [37, 68, 69, 71–73, 78–80]. • Visual perception and visual-motor functioning [37, 68, 69, 71–73]. • Emotional regulation [37, 68, 69, 71–73, 78–80].	Few peer-reviewed studies, case studies and studies that do not satisfy the requirements of scientific investigation [37, 68, 69, 71–73].	Must be a health or education professional. Involves undergoing different levels of training[33, 79, 80].
Therapeutic Listening®	Children with SPD who are two years and older[30, 62].	Specific headphones and a device to play music, such as an iPod, chip player or cell phone[30, 62].	The child listens to requested music two times per day for 30 minutes, seven days per week. The music selection is individualised based on the child's specific needs and goals of intervention. The programme lasts from eight weeks to several months based on the child's response and need [30, 33, 62].	• Attention[30, 38, 70, 74, 75]. • Transitions and changes in routine[30, 38, 70, 74, 75]. • Verbal and non-verbal communication[30, 38, 70, 74, 75]. • Play skills[30, 38, 70, 74, 75]. • Sleep[30, 38, 70, 74, 75]. • Bowel and bladder control[62, 81]. • Timing and sequencing of motor skills[62, 81]. • Following directions[62, 81]. • Perceiving and navigating space (spatial-temporal organisation)[62, 81].	Case studies published in Sheila Frick's book[62] and five low-level evidence studies [30, 38, 70, 74, 75].	Therapists with a background in SI working at schools, hospitals and private clinics. This includes occupational therapists, speech therapists, physiotherapists and mental health practitioners. Involves a three-day training course with the option of doing advanced courses[62, 81].

				• Arousal regulation [30, 38, 70, 74, 75]. • Motor planning[62, 81]. • Visual-motor skills[62, 81]. • Emotional regulation[62, 81]. • Time management[62, 81]. • Parent-child interaction [30, 38, 70, 74, 75].		
iLs	Children with learning difficulties, developmental difficulties and SPD[28].	Headphones and the Focus System[28].	The child listens to one of the four prescribed music programmes, three to five times a week for 30 sessions[28].	• Coordination and balance[82]. • Attention and focus[82]. • Learning and memory[82]. • Reading and auditory processing[82]. • Auditory sensitivities[28]. • Speech and language[28]. • Anxiety[28]. • Executive functioning[82]. • Sleep[28]. • Arousal regulation[28]. • Handwriting[82]. • Emotional regulation[28].	One pilot study on children with SPD[28], clinical case studies and extensive feedback from professionals and their clients.	Occupational therapists, speech therapists, physiotherapists and psychologists. Training is done in one course with the option to do two advanced courses[82].
SSP	Children with autism and, recently, children with SPD[76, 77].	Specialised headphones and the SSP music on an iPod/device [76, 77].	The child listens to the prescribed music for an hour per day for five consecutive days[76, 77].	• Emotional control[76, 77]. • Behavioural organisation [76, 77]. • Reduce auditory, visual and tactile over-responsivity [76, 77]. • Auditory processing[76, 77].	Two peer-reviewed studies on children with autism[76, 77].	Professionals with backgrounds in therapy, education, medicine and psychology. Training programme takes between three and five hours to complete[83].

The four sound-based therapies are summarised in Table ***2.1***. The sound-based therapies presented all lack evidence regarding the improvement of a child's occupational performance outcomes, and the sustainability of sound-based therapies has not been fully investigated[40]. These studies could also not confirm whether it was the occupational therapy process or the sound-based therapy programme that resulted in the change due to their small sample size and poor designs[28, 30, 38, 39]. Therapeutic Listening® appears to be the sound-based therapy that is the most researched for children with SPD and was designed specifically for children with SPD. However, all of these sound-based therapies are used by occupational therapists in Gauteng, as they are available and were mentioned by the participants in this study.

2.6.2 Factors influencing implementation

Occupational therapists have noted several factors that affect the implementation of sound-based therapy: affordability of the equipment, training, affordability of the programme, compliance, accessibility, monitoring and scope of practice[28, 30, 33, 42, 62, 70, 76, 77, 81-83]. These factors are considered during occupational therapists' clinical reasoning for incorporating sound-based therapy into their practice and the child's occupational therapy process.

2.6.2.1 Affordability of sound-based therapy equipment

Sound-based therapy can be a costly treatment tool to pursue. The equipment required for the Tomatis® Method, SSP and iLs is expensive and has to be imported[33]. Therapeutic Listening® is considered more affordable; however, it can be costly to ensure the therapist has all the available music collections to match their clients' individual goals and needs[30, 62].

2.6.2.2 Sound-based therapy training

The training to use sound-based therapy is costly. SSP and iLs can be conducted in one course, but these are mainly conducted overseas[82, 83]. The basic course in Therapeutic Listening®—allowing the therapist to become a certified Therapeutic Listening® provider—can now be conducted online. Advanced courses can still be pursued to further improve the therapists' implementation and clinical reasoning[81]. The Tomatis® Method training consists of a series of sessions (Level 1 to Level 4), all

of which are expensive and require the therapist to have bought the equipment to undergo the training. Level 1 is a basic course which provides the therapist with the fundamental postulates for the Tomatis® Method and a few programme options. However, the therapist can only adapt these programmes to suit the child's needs as they progress through the levels of training[80].

2.6.2.3 Affordability for family

Sound-based therapy can be costly for the family, depending on how the occupational therapist incorporates the therapy into the child's occupational therapy process. Therapists sometimes incorporate sound-based therapy into their occupational therapy sessions, resulting in the family having to pay the occupational therapy session rate. The Tomatis® Method consists of a number of hours of sessions, which may not always be insurer funded. It can also be done at home, which can cost approximately R1800-R5000 for one cycle depending on the practice and even the province, and it is recommended to do at least two to three cycles depending on the child's needs and goals. This is based on the researcher's exposure to the Tomatis® Method programme run by different practices. Similarly, iLs requires 30 one-hour sessions, which can be done either in the occupational therapy sessions or at home, and could be a more expensive option[28]. Therapeutic Listening® tends to be more affordable. The therapist using Therapeutic Listening® can rent out the headphones, or the family can purchase the specific headphones and then rent or buy the music using the application ('app')[33]. The most affordable sound-based therapy is SSP, as it only consists of a one-hour session over five consecutive days. The therapist often conducts this sound-based therapy during their occupational therapy sessions[76, 77].

2.6.2.4 Compliance

Compliance with the sound-based protocol is affected by two factors: comfort and time. All the sound-based therapies require wearing headphones, which can be uncomfortable as they cause sweating and are often too large for the child[70]. Considering that children with sensory over-responsivity are generally recommended to receive sound-based therapy, comfort can be a factor a therapist takes into account when incorporating sound-based therapy into the child's occupational therapy process. The Tomatis® Method and iLs include a bone conduction device which

assists the child in tolerating the headphones[28]. Sound-based therapies all require a dedicated amount of time to ensure effectiveness and to be executed according to the sound-based therapy's protocol[70]. Parents and therapists comply with the SSP protocol because it requires only five consecutive one-hour sessions—it is quick and easy to implement[76, 77]. The Tomatis® Method, iLs and Therapeutic Listening® require more time and energy devoted to implementing the sound-based therapy appropriately[28, 30, 62]. This is often a source of difficulty for parents and can affect the effectiveness of the sound-based therapy.

2.6.2.5 Accessibility

The devices needed for iLs, the Tomatis® Method and SSP must be imported, which can be difficult[28]. As a result, the compact discs and iPad options of Therapeutic Listening® are easier and more accessible[70].

2.6.2.6 Monitoring

Some therapists prefer to send the sound-based therapies home with the child and family to be administered by the parents. However, this means that the therapist cannot closely monitor how well and/or consistently the parents followed the treatment, which may influence the effectiveness of the sound-based therapy[30].

2.6.2.7 Speech therapy scope of practice

Speech therapists are primarily responsible for the treatment of the auditory system. Sound-based therapies naturally seem to fall into the scope of speech therapy, yet speech therapists do not incorporate sound-based therapies into their practice due to the ASHA's position statement, which states that sound-based therapy is not EBP[42].

These factors, therefore, call into question the reason occupational therapists incorporate sound-based therapies into their practice and the reasons they choose specific sound-based therapies for improving occupational performance in children with SPD.

2.7 CONCLUSION

Efficient SI elicits adaptive responses and neuroplasticity in a child's brain. This promotes the development of skills needed for independent and productive participation in school tasks, leisure tasks, play, iADLs, ADLs and rest and sleep. Based on the theory of SI, the auditory system influences various other sensory systems. The auditory system specifically influences sensory modulation and sensory-based motor disorders based on neuroanatomical and neurophysiological links between the sensory systems. This has resulted in occupational therapists starting to incorporate sound-based therapies into the occupational therapy process for children with SPD. The occupational therapy profession is expected to conduct its occupational therapy process based on EBP. However, there is minimal research on the effectiveness of sound-based therapy on children with SPD within the occupational therapy context. Therefore, it is important to explore the use and effectiveness of sound-based therapies by occupational therapists.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter explains the research design and the study participant sample. A description of the research tools and procedures used for data collection is provided. Ethical considerations are discussed at the end of this chapter.

3.2 RESEARCH DESIGN

This study was a qualitative, non-experimental and descriptive study design using individual interviews for data collection[84–87].

According to Polgar and Thomas[88], a qualitative approach is the best research method to explore research participants' thoughts, feelings, and experiences. This allowed the researcher to explore occupational therapists' experiences of the nature of the intervention and the perceived effectiveness of using sound-based therapies on children with SPD.

The study is non-experimental as there is currently limited research on sound-based therapy in occupational therapy for children who have SPD. The current experiences and knowledge of the nature of the intervention and the perceived effectiveness of sound-based therapies on children with SPD must be explored to understand the factors that may inform future experimental studies[84–87].

3.3 POPULATION

The population consisted of occupational therapists within the paediatric field who are trained in SI and use or refer out to sound-based therapy as a complementary technique in the treatment of children with SPD. The number of occupational therapists who meet these criteria is currently unknown; however, this number is expected to be very low because it is costly to become trained in ASI®, and the process takes approximately three to five years. Sound-based therapies are also costly to invest in and are mainly offered or presented by international occupational therapists who do not often come to South Africa. The population is expected to be less than the number of SI-trained occupational therapists in Gauteng which, according to the SAISI, is 275.

3.3.1 Sampling

Purposive sampling was used to acquire participants within the Gauteng region to participate in the individual interviews[89] (refer to Section 3.5.1.1 for procedure). This was an appropriate technique to use as the researcher deliberately wanted to include participants who are well versed in the topic being explored. It was important to ensure that these occupational therapists had the background, knowledge and experience of the topic.

Occupational therapists who met the following inclusion criteria were asked to participate.

- Provide occupational therapy services to children with SPD between the ages of zero and 18 years.
- Have at least one year of clinical practice in the paediatric field.
- Have at least six months' experience in using sound-based therapies or referring to therapists using sound-based therapies. The therapists referring to sound-based therapies must have knowledge on the programmes as well as still see the child for occupational therapy sessions to give accurate and appropriate feedback on their reasons for choosing the type of sound-based therapy and the effectiveness of the programme.
- Have completed their SI certification.
- Work within the Gauteng province. Ethical approval was limited to Gauteng as the study was designed for in-contact interviews. However, when the COVID-19 regulations came into effect the research had to change to non-contact but remained limited to Gauteng due to the ethics approval received.

3.4 RESEARCH TOOLS

The following research tools were used to collect all data for the study.

3.4.1 Demographic questionnaire

The researcher compiled a demographic survey (Appendix C) to gather background data deemed important to the study and to gain information for screening possible

participants based on the inclusion criteria. The survey was designed on Research Electronic Data Capture (REDCap) online software[90].

3.4.2 Individual interview questions

The interview guide consisted of two open-ended questions and suggested prompting questions to explore the nature of the intervention and the perceived effectiveness of sound-based therapy on children with SPD. Open-ended questions allow the participant to elaborate on their answers and facilitate a debate or discussion around the questions[84–87]. The questions were developed by the researcher and are shown in the interview guide in Appendix D. The lack of trends in the literature resulted in the use of open-ended questions and prompting questions to expand on/further explore each open-ended question[84–87]. These questions covered a broad definition of sound-based therapy, how and when sound-based therapies are used, and the perceived effectiveness of sound-based therapies on sensory processing and occupational performance outcomes. Questions were non-specific and open-ended to allow the participants to give their professional opinion to be true to the inductive nature of the study and to not place the answers in predetermined categories[84–87].

3.4.3 Validity of research tools

The demographic survey and interview guide were piloted on three occupational therapists in the paediatric field with more than five years' experience in paediatric treatment. These three experienced occupational therapists did not form part of the target population and agreed to review by personal invitation. They reviewed for face validity and to ensure the questions were coherent, complete and accurate with regard to terminology. This allowed the researcher to revise the question structure and decide whether additional demographic information, interview questions or prompts were needed or whether existing questions needed to be deleted. The results of the pilot study can be found in Section 4.2.

Before the research interviews were held, a pilot interview was conducted with an occupational therapist, who used sound-based therapies but was not yet formally trained in SI. The pilot interview allowed the researcher to practice the interview process and refine her interviewing skills, particularly in avoiding leading and biasing

the participant. The pilot interviewee was aware of the study's objectives and that her interview was a pilot interview. She was asked to sign the informed consent form. The pilot interview followed the intended interview process. The researcher encouraged the pilot interviewee to comment on the researcher's interview technique and the appropriateness and relevance of the questions. Adjustments to the pilot interview process are presented in Section 4.2.3.

3.5 RESEARCH PROCEDURE

3.5.1 Data collection procedure

3.5.1.1 Participant recruitment

An email invitation was sent out to the members of the Occupational Therapy Association of South Africa (OTASA), specifically within the Gauteng region. The invitation was also posted on the South African Institute for Sensory Integration (SAISI) Facebook group, consisting of 1027 members, and the Gauteng Health and Education Facebook group, consisting of 353 members. Participants who met the inclusion criteria were asked to fill in the demographic questionnaire and provide details to the researcher to allow for the organisation of the individual interviews.

3.5.1.2 Individual interviews

The occupational therapists who indicated a willingness to participate were contacted via email to organise the date and time of the individual interview. The semi-structured interviews were held at times convenient for both the interviewer and the participant and lasted between 45 and 60 minutes. Interviews were conducted over zoom due to COVID-19 restrictions, and every effort was made to ensure privacy. The interviewer sat with open posturing to encourage unhindered disclosure of opinions, and every effort was made to ensure participants' ease and to facilitate full disclosure.

Prior to the online interview, the occupational therapist was asked to sign an informed consent sheet (Appendix B). The interviewer (primary researcher) then followed the individual interview guide that had been developed and reviewed (Appendix E). The interviewer requested consent to record the participant. The researcher informed the participant that they were audio recorded to ensure that the notes were accurately recorded and the transcriber would have access to the audio recordings but that the

transcriber had signed a confidentiality agreement (Appendix F). The study was explained to the participants in terms of research objectives and outcomes.

Standard prompt questions were included to probe the two interview questions further. The prompt questions were only used if necessary, as many participants spontaneously mentioned the aspects with no need for prompts. The interviewer presented a brief summary at the end of the interview to determine if she had correctly understood the participant responses. The interviews were recorded using an audio recorder on the computer. The audio data was in an MP3 format and labelled according to the participant code.

After all the individual interviews were conducted, the transcriber was responsible for transcribing the recorded information verbatim[84]. For the transcription of the data, a participant code was used instead of the participant's name to ensure confidentiality.

3.5.2 Data analysis procedure

3.5.2.1 Demographic information

The demographic data is descriptively presented to describe the participants' background and the nature of their practice.

3.5.2.2 Individual interviews

The transcripts from the individual interviews were analysed using thematic content analysis. According to Green et al.[85] and Hsieh and Shannon[91], this process consists of categorising verbal and/or behavioural data to classify, summarise and tabulate the data. There were four key steps performed by the researcher. The analysis was conducted by the researcher and two other analysers to verify the coded themes and categories that emerged. The data analysis started and progressed after six individual interviews were conducted, and the researcher constantly moved back and forth between the different steps. Data saturation was achieved after the six interviews.

- **Step 1: Immersion in the data**—The researcher conducted the individual interviews, gaining first-hand insight into each interview. The researcher read and reread the individual interview transcripts, which allowed her to better understand the content of the data[85, 91].

- **Step 2: Coding**—The researcher read through each interview transcript to label words, phrases or whole paragraphs that contained information relating to a particular point (code) being made. The researcher used MaxQDA, a software package to keep track of the codes[92]. It was important that the researcher regularly moved back and forth between the transcripts to revise the codes[85, 91]. The code tree is presented in the results chapter in Table 4.4, Table ***4.5***, and Table ***4.6***.
- **Step 3: Creating categories**—The coded data was revisited to establish links between the different codes, allowing them to be clustered into categories. Contradictions and exceptions were sorted into different categories, allowing for all views to be recorded and observed in the results section[85, 91].
- **Step 4: Identification of themes**—This included an explanation and interpretation of the problem being investigated, using the collected data and the theory[85, 91].

3.6 TRUSTWORTHINESS

There are five criteria for trustworthiness according to Mann and MacLeod[93], namely credibility, transferability, dependability, confirmability and authenticity. These criteria are discussed as related to this study.

3.6.1 Credibility

Credibility suggests that the research has been conducted using an accepted methodology, and the results are agreed upon by the members[93]. Credibility is ensured through triangulation, member checking and peer scrutiny[93].

While triangulation is a common technique used in qualitative studies, this study sought participants' intellectual opinion. Therefore, triangulation of data was not needed. However, trustworthiness was achieved by member checking and peer scrutiny of the coding[85, 91, 94].

Following the analysis of the initial interview information, member checks were performed to reduce misrepresentation[85, 91]. The participants were provided with a summary of the results gained from the interviews via email. Participants were provided with the opportunity to comment on whether they felt that it was an accurate

reflection of their opinions on the topic, if they had any strong opposition to any of the findings presented, and if they wanted to add any further information.

Another occupational therapist, a lecturer at the University of the Witwatersrand, was recruited to review the extracted codes and check if they matched the quotes supplied. This particular therapist was used as she had experience with qualitative data analysis. It was important for the reviewer to have access to the original transcripts so she could scrutinise the codes' development to ensure accuracy of interpretation and that the researcher's bias did not influence the results. The reviewer's thoughts on each code were discussed with the researcher until an agreement was reached. MaxQDA allowed the researcher to ensure validity in terms of how the data was coded and weighted, and themes were determined and clearly described the approach to data analysis[85, 91].

3.6.2 Transferability

Transferability is the extent to which study findings can inform practice in similar contexts[93]. The study's context is reported in detail to allow other occupational therapists to determine the goodness of fit in their context and the possibility of implementing similar interventions with a reasonable expectation of similar outcomes[93].

Transferability was ensured by eliciting rich, thick data. Occupational therapists trained in SI and experienced in the use of, or referral to, sound-based therapies and the treatment of children with SPD participated in the interviews. This ensured that the data gathered was of high quality (rich and full of information) rather than superficial. The participants were encouraged to give details, expand on thoughts and give examples to support their ideas/comments.

The researcher conducted all six individual interviews before the data was analysed. The participants were given the option to add more information or disagree based on the data analysis once the data was sent back to them for review. Following the analysis of the six individual interviews' data, it was noted that no new themes emerged from the data collected, and data saturation was indicated[87]. No new

information was offered by the end of the sixth interview. Should saturation not have been achieved, then further recruitment of participants would have been initiated.

3.6.3 Dependability

Dependability is the quality of the research process's documentation so that it may be replicated and audited[93]. The study protocol was presented to the faculty research committee and the ethics committee for approval prior to starting the research. Thematic content analysis of the qualitative data was reviewed by a reviewer with knowledge and experience in qualitative studies and who was not involved in the study. Randomly selected transcript extracts were independently coded by the reviewer to ensure consistency of interpretation. An audit trail was kept by the researcher. This included the raw data, rationale for the use of collection methods, notes about decisions made throughout the study and the reasons for the decisions, and personal reflections of the researcher throughout the process. The personal reflections helped uncover any biased opinions or beliefs, specifically in the way that participants may have been prompted during the interviews and in later follow-up emails[91, 94]. Therefore, dependability was achieved by clearly documenting and auditing the research process[91, 94].

3.6.4 Confirmability

Confirmability is a declaration of the researcher's position in the study and the acknowledgement of the influence of personal beliefs and perspectives on the study outcomes[93].

The researcher was aware of her beliefs and ideas on this subject and had to approach the study with an open mind[91, 94]. The following is a description of the researcher's philosophy around and background in sound-based therapy.

The study researcher has been trained in SI and is interested in the nature of the use and perceived effectiveness of sound-based therapies due to exposure to several sound-based therapies since commencing practice in the paediatric field in 2014. The researcher is trained in Therapeutic Listening® and the Tomatis® Method and has referred children to therapists trained in iLs and SSP. The researcher has been

mentored in these sound-based therapies and has clinically observed changes in children with SPD when using sound-based therapies. The researcher believes in using a bottom-up approach whereby addressing underlying client factors and performance skills will elicit changes in occupational performance outcomes. However, the researcher values EBP, remaining occupation-centred and ensuring the tools incorporated into therapy will allow children to become independent and productive in their daily tasks. The researcher has identified family-centred practice as an important component that must be incorporated into effective intervention for children. She has also identified that recommendations and therapy plans must be suitable and individualised to each family and child.

Throughout the research process, the researcher documented any bias on reflection of the pilot interview. Documenting the biases was important as this may have influenced the interviewer's responses, and they were illuminated to prevent unintentionally leading participants in a specific way during interviews[91, 94].

3.6.5 Authenticity

Authenticity was guaranteed as the researcher showed ongoing and consistent commitment to the values presented to the participants. The researcher ensured her actions were trustworthy and without hidden motives. The participants maintained their participation in the study as they believed the research was worthwhile and valuable and would impact the children they treat. The researcher paid attention to maintaining a neutral stance during the interview to allow the participants to reflect on their experiences of sound-based therapy.

3.7 ETHICAL CONSIDERATIONS

Ethical clearance for the study was approved by the University of the Witwatersrand's Research Ethics Committee. An ethical clearance certificate was issued (Appendix H). The Declaration of Helsinki and the South African Medical Research Council ethical guidelines were considered and adhered to during the research process[95, 96]. The following ethical principles concerning research within the occupational therapy field, as described by Van Niekerk[97], were addressed in the following manner.

3.7.1 Respect for persons and their right to autonomy

Autonomy is related to free will and choices, and it is the participants' right to make decisions and feel in control of their actions[98]. The researcher ensured that the research's purpose and participation responsibilities were clarified for the participants by providing them with an invitation letter to voluntarily participate and by going through the purpose and roles of the research participants and interviewer at the start of each individual interview[99, 100].

Informed consent was ensured by providing the participants with information on the study purpose and confidentiality and the opportunity to ask questions or withdraw at any time with no consequences[99, 100]. This information was presented to the participants through an informed consent letter provided at the start of the individual interview. Each participant was asked to sign this before proceeding with the individual interview. An opportunity was given to clarify any issues or answer any questions regarding the study before starting the interviews.

The individual interviews were audio recorded to ensure the discussion was noted in full, and the participants were made aware of this at the start of the interview[99, 100]. Confidentiality was ensured by having the transcriber sign letters of confidentiality (Appendix F and G). The transcriber kept a record of the participant codes and their corresponding names, but this was handed over to the researcher on completion of the last interview and deleted from the transcriber's records. These participant codes allowed for the transcription to be recorded using the corresponding codes. The researcher kept the participant codes and corresponding names and any demographic information in a password-protected folder on a computer, and the informed consent forms were kept in a secured cabinet. All data will be stored in a secure location for six years, or for two years after the study is published, before being destroyed.

3.7.2 Beneficence (including non-maleficence)

The ethical principle of beneficence is to act for the benefit of others and includes non-maleficence, which is preventing harm from occurring to others[98]. The study was not directly beneficial to the participants; however, the participants will benefit from the study, once published, regarding the use and perceived effectiveness of

sound-based therapy as a complementary tool in the treatment of children with SPD. The study results will help improve services to children with SPD according to the profession's values of client-centredness and occupation-based intervention and will be a catalyst for further research.

3.7.3 Justice

The principle of justice necessitates one to fairly distribute benefits, risks, costs and resources[98]. All participants were treated equally and with respect by the researcher. The researcher provided all occupational therapists with an opportunity to participate through emails via OTASA and various other communication methods.

3.8 CONCLUSION

In this chapter, the research methodology was described. The research design was a qualitative descriptive research design. The population consisted of occupational therapists certified in SI and trained in—or who refer out to—sound-based therapy. Purposive sampling was used to acquire a variety of opinions and perspectives within this population. Semi-structured individual interviews were used, and a pilot study was conducted to trial the interview process. The data collection process was described, and thematic content analysis was used to analyse the interview transcriptions to appropriately code and identify themes emerging from the data. Creditability, transferability, dependability, confirmability and authenticity were discussed to ensure trustworthiness. Ethical considerations, including maintaining respect for persons, beneficence and justice, were discussed.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This study aimed to explore occupational therapists' experiences of the nature of sound-based therapy intervention and whether occupational therapists perceive sound-based therapy as effective in improving the occupational performance outcomes of occupational therapy intervention for children with SPD. This chapter presents the pilot study's results used to validate and refine the research tools (the demographic information survey and individual interview guide). The results of the participant demographics are then discussed. Finally, the results of the individual interviews are discussed based on thematic content analysis. The results reflect the views and opinions of six participants who fitted the inclusion criteria and were willing to take part in the study.

4.2 RESULTS FOR PILOT STUDY

The research tools were validated and refined through a pilot study to ensure that accurate and comprehensive demographic information was collected and that the open-ended questions with prompts for the individual interviews were broad enough to elicit a wide scope of information. The tools were given to three experts in the paediatric field of occupational therapy to review. The results are reported in Section 4.2.1 and 4.2.2. A pilot interview was conducted with one occupational therapist, and the outcomes are reported in Section 4.2.3.

4.2.1 Demographic information survey

Table ***4.1*** shows the comments received from the reviewers. As a result, the demographic information survey was refined and can be found in Appendix C.

Table 4.1: Review comments on demographic information survey

	Reviewer		
Comment	**1**	**2**	**3**
Include "Other" in the gender question		X	
Change the age ranges in Question 2 as there is currently an overlap	X	X	
Needs to include further questions around SI certification e.g.	X		

	Reviewer		
Comment	**1**	**2**	**3**
• Through which institution did the participants receive their SI certification • When did the participants receive their certification? • If they are not SI certified, are they currently in the process and through which institution are they receiving their SI certification			
Change the range of years practising as an occupational therapist, as ranges overlap and need to increase the range	X	X	
Change the range of years working in the paediatrics field	X	X	
The question around working in the paediatrics field is misleading as it asks two questions. Rewrite the question to only ask one question			X
Include other settings such as non-profit organisations (NPOs)/non-governmental organisations (NGOs) and clinics and include “Other” to allow participants to list any other institutions they are based at		X	X
Include a question on what proportion of clients with SPD occur within their occupational therapy practice (no comorbid diagnoses)		X	
Include a question on the age range of these clients		X	
Include a question on whether they have any comorbid diagnoses		X	
Include a yes/no question on whether they would be willing to participate in an interview			X

4.2.2 Individual interview questions

The following comments in Table ***4.2*** were received from the reviewers. As a result, the individual interview questions were refined and can be found in Appendix D.

Table 4.2: Reviewer comments on individual interviews

	Reviewer		
Comment	**1**	**2**	**3**
Create two open-ended questions and use the other questions as prompts • One question for the nature of the intervention • One question for the perceived effectiveness of sound-based therapies	X		
Incorporate a question around what the participants’ understanding is of sound-based therapies			X
Be careful of using closed questions	X		
Incorporate questions on why and how the therapist incorporated these specific sound-based therapies into practice	X		
When in the process does the therapist recommend – include why?	X		

	Reviewer		
Comment	**1**	**2**	**3**
Include a question on “how the therapist decides when a child with sensory processing difficulties would benefit from participating in a sound-based therapy”	X	X	
Include a question on whether the participants think that sound-based therapy is effective			X
Prompt on client factors and performance skills; include how the therapist has decided on these being the most beneficial	X	X	
Prompt on main occupational performance areas; include why these specific ones	X		
Prompt on main occupational performance outcome changes; include how this has been observed	X		

4.2.3 Pilot interview

Following the pilot interview, the pilot interviewee did not have any questions or prompts to add. The pilot interviewee did not have any comments on the interview style. Upon personal reflection on the interview and a discussion with the researcher’s supervisor, the researcher did implement some changes. The questions were phrased to guide participants to consider what their opinion was of best practice in using sound-based therapy in occupational therapy intervention for children with SPD.

4.3 PROFILE OF PARTICIPANTS

Seven occupational therapists responded positively to the invitation to participate, but only six met the inclusion criteria. The participants selected for this study were all occupational therapists working in the field of paediatrics. Table ***4.3*** is a summary of the demographic profile of the interview participants. They all received their certification in SI and were generally trained in sound-based therapies but also referred out to specific sound-based therapies. The sound-based therapies include Therapeutic Listening®, the Tomatis® Method, iLs and the SSP. The majority have been utilising a sound-based therapy for six to ten years. The participants were female. Most of the participants had a Bachelor of Science in Occupational Therapy, and two had their master’s degrees in occupational therapy. At the time of the study, they were all employed in private practice within the Gauteng region, and one participant also worked in a school and hospital setting. Their years of experience ranged from less than five years to 31 to 35 years, with the majority having worked for longer than 11

years. The participants' caseload mainly (61% to 70%) consisted of children with SPD and no comorbidities between the ages of zero and ten years.

Table 4.3: Demographic profile of interview participants

Participant code	Gender	Age range	Highest level of Education	SI certification	Years of practice as an occupational therapist within the paediatric field	Practice area	Proportion of clients with SPD	Age range of clients	Sound-based therapies
P1	Female	30-34 years	BSc (OT)	SAISI 1-5 years	< 5 years	Private practice	61-70%	0-10 years	Trained in Therapeutic Listening® (1-5 years); Refer out to Tomatis® Method (1-5 years)
P2	Female	25-29 years	MSc (OT)	SAISI 1-5 years	< 5 years	Private practice	11-20%	0-10 years	Refer out to iLs, SSP and Therapeutic Listening® (1-5 years)
P3	Female	60+ years	BSc (OT)	SAISI 26-30 years	31-35 years	Private practice	61-70%	0-20 years	Trained in Therapeutic Listening® (11-15 years); Refer out to Tomatis® Method (6-10 years)
P4	Female	45-49 years	MSc (OT)	SAISI 11-15 years	21-25 years	Private practice; School setting; Hospitals	61-70%	0-10 years	Trained in Tomatis® Method – Level 1 practitioner (6-10 years)
P5	Female	30-34 years	BSc (OT)	SI network 6-10 years	11-15 years	Private practice	61-70%	0-10 years	Trained in iLs, SSP and Therapeutic Listening® (6-10 years)
P6	Female	50-54 years	BSc (OT)	SAISI 6-10 years	26-30 years	Private practice	61-70%	0-10 years	Trained in Tomatis® Method – Level 3 practitioner - and Therapeutic Listening® (6-10 years)

4.4 THEMATIC ANALYSIS OF DATA

In this section, the results regarding the thematic content analysis are presented.

4.4.1 Overview of themes, categories, subcategories and codes

Analysis of the data obtained from the individual interviews resulted in codes that were then clustered into sub-categories and clustered again into categories. The data were combined to develop two themes:

- Theme 1: The nature of the intervention of sound-based therapy in occupational therapy practice.
- Theme 2: The effectiveness of sound-based therapy on children with SPD.

Table ***4.4*** presents a summary of the themes, categories and subcategories.

Table 4.4: Themes, categories and subcategories

Theme	Category	Subcategories
1. The nature of the intervention of sound-based therapy in occupational therapy practice	Factors influencing therapists' reasons for including sound-based therapies into their occupational therapy practice and choice of sound-based therapy	SI and the auditory system
		Speech therapy and occupational therapy scope of practice
		Contextual factors
		Evidence-based reasoning
		Business model of sound-based therapy
		Therapist's philosophy
	Factors influencing the choice of sound-based therapy for client and family	Ages suitable for sound-based therapy
		Factors affecting the implementation of sound-based therapy
2. The effectiveness of sound-based therapy on children with SPD	The effectiveness of sound-based therapy	Client factors and performance skills
		Occupational performance outcomes
		Prolonged gains
	Measurement of effectiveness	Measuring mainly qualitatively
		Sound-based therapy or occupational therapy

Each theme is presented in more detail, including the various categories, subcategories and codes, along with appropriately demonstrative quotes from the interviews. An example of coding can be found in Appendix J, but for the purpose of the results chapter, only exemplar quotes have been used.

4.4.2 Theme 1: The nature of the intervention of sound-based therapy in occupational therapy practice

Theme 1 explores the factors influencing the participants reasons for including sound-based therapies into their occupational therapy practice and choice of sound-based therapy. Theme 1 also discusses the factors influencing the choice of sound-based therapy for the client and family. Table ***4.5*** presents the three categories with their related subcategories and codes identified in relation to Theme 1.

Table 4.5: Categories, subcategories and codes for Theme 1

Theme 1: The nature of the intervention of sound-based therapy in occupational therapy practice		
Category	**Subcategories**	**Codes**
Factors influencing therapists' reasons for including sound-based therapies into their occupational therapy practice and choice of sound-based therapy	SI and the auditory system	• Auditory input important in the SI approach • Missing link • Auditory input has links with other sensory systems • Auditory input is calming • Auditory input and sensory regulation
	Speech therapy and occupational therapy scope of practice	• Reasons speech therapists do not use sound-based therapy • Role of occupational therapists vs speech therapists in the use of sound-based therapies and scope of practice
	Contextual factors	• Exposure to sound-based therapy • Mentoring and support influence choice • Availability of sound-based therapy training • Cost of sound-based therapy and training • Clinician's skills and knowledge
	Evidence-based reasoning	• Research evidence

Theme 1: The nature of the intervention of sound-based therapy in occupational therapy practice		
Category	**Subcategories**	**Codes**
		• Research or clinical experience influences the choice of sound-based therapy
	Therapist's philosophy	• Top-down versus bottom-up approach • Client-centredness • Should be individualised to each client
	Business model of sound-based therapy	• Business model or effective therapy tool • Therapist values and vision influence choice of sound-based therapy
Factors influencing the choice of sound-based therapy for client and family	Ages suitable for sound-based therapy	• Younger vs older children • Differences in the use of music for different ages
	Factors affecting the implementation of sound-based therapy	• Family-centred practice • Barriers and facilitators • Differences and similarities between sound-based therapies • Practice-based vs home-based sound-based therapy

4.4.2.1 Factors influencing therapists' choice of sound-based therapy

The first category describes occupational therapists' reasons for incorporating sound-based therapies into their practice and the factors influencing their choice of sound-based therapies.

a. Sensory integration and the auditory system

All the participants noted that the auditory system could play an **important role in the SI approach** and that auditory modulation and auditory integration should be treated when considering the child as a whole. They highlighted that the auditory system allows a child to achieve a calm-alert state. The participants also noted that the auditory system **integrates with other sensory systems**, which can facilitate an upright posture and improved motor coordination. The participants reported one of the main reasons for incorporating sound-based therapy into their occupational therapy

practices is because the value of auditory input as a modality is not well recognised and thus may be the **'missing link'**.

> *"I definitely think within the South African context that auditory input isn't highlighted enough, in terms of how we can use it to co-regulate our children." (P2)*

All the participants noted that the auditory system has links with other sensory systems, specifically the vestibular system, which facilitates postural activation and improved coordination. Within their clinical experiences, participants have observed that specific **auditory input is calming** and can be used informally in sessions as a quick calmer. This emphasised the **valuable role of auditory input in the child's sensory regulation**. A formalised programme allows for sustained results, which contributed to the majority of the participants seeking a sound-based therapy tool.

> *"I'm missing how to make the therapy more effective in the moment because maybe they're not a hundred percent, like, reaching that regulated state that I'm wanting them to get to." (P2)*

The auditory system, specifically auditory processing, is assessed and treated by speech therapists[42]. However, occupational therapists—rather than speech therapists—seem to be the ones who incorporate sound-based therapies into their practice. This raises the question of which profession should be assessing and treating auditory modulation.

b. Speech therapy and occupational therapy scope of practice

Participants P4 and P6 reasoned **that speech therapists do not incorporate sound-based therapies into their practice** because they are wary of the insufficient research evidence supporting this modality. The ASHA does not endorse sound-based therapy as EBP. The South African Speech and Hearing Association has adopted a similar stance towards sound-based therapy, as stated by Participant 4:

> *"So, their feeling was that it didn't have enough research, and they were really critical of it, so because the [ASHA] didn't accept it, the [South African Speech and Hearing Association] didn't accept it. And the speech therapists didn't know very much about it but were still very sceptical about it."*

Three participants (P3, P4 and P6) believed speech therapists should embrace sound-based therapies but do not assess and treat the auditory system the way that occupational therapists are (that is, in terms of sensory modulation).

> *"So speech therapists, […] don't embrace the sound systems in the way that occupational therapists, who use it, have. And they can be quite sceptical about [sound-based therapies], […], they feel that [sound-based therapies are] just not worth introducing, but my feeling was that [occupational therapists trained in SI] were missing a component and [the Tomatis® Method] seemed to answer that." (P4)*

One of the participants (P4) commented that the auditory system is an important system in the sensory profile, but neither occupational therapists nor speech therapists address it. Two participants (P3 and P6) stated that a possible reason why speech therapists are not tackling auditory modulation and using sound-based therapies in their practice is that sound-based therapies are introduced to the South African market by occupational therapists. Participant 4 noted that OTASA is more open to new therapies than the speech therapy board.

> *"I haven't come across anything about using [sound-based therapies] or not using [sound-based therapies], but I think, perhaps, [the South African occupational therapy professional bodies] are a little bit more open to [occupational therapists] using new therapies because […] the OT board has reviewed and allowed […] hippotherapy and these kinds of things. They are much more open to different options coming into [occupational] therapy." (P4)*

Participant 4 reported that speech therapists are specifically trained in assessing and treating the auditory system. However, there appears to be a gap in who treats auditory modulation to allow a child to self-regulate and participate in daily tasks. The participants (P3, P4 and P6) stated that it is important to remember our occupational therapy scope and when to refer on, even when considering sound-based therapy.

Participants (P3, P4 and P6) commented on the **role of occupational therapists' vs speech therapists' in the use of sound-based therapies and scope of practice**. They stated occupational therapists incorporate sound-based therapies into their occupational therapy practices due to the gap in auditory modulation treatment. The participants indicated several contextual factors influencing a therapist's choice of why and which sound-based therapies are incorporated into their occupational therapy practice.

c. Contextual factors

Participants (P1, P2, P3 and P6) reported **clinical experience and mentoring** in sound-based therapies as influencing their understanding of sound-based therapies, including the benefits of the sound-based therapies. As highlighted by Participant 1:

> *"My boss had so much exposure to sound-based therapies [that] she, obviously, gave me mentoring on the ones that she was familiar with."*

Exposure and mentoring made participants aware of sound-based therapies available. Mentoring was identified by Participants 1, 2 and 6 as important for knowing when to appropriately use a sound-based therapy, how to make decisions around which sound-based therapy to use and the specific programmes to conduct based on clinical reasoning.

Another factor identified by Participants 1, 2, 5 and 6 was the **availability of training**, as these courses are generally brought into South Africa by therapists from other countries. These therapists are predominantly occupational therapists, and the training was not always available in Gauteng as it depends on where the therapist

conducting the training was hosted. These sound-based therapies are **costly** to be trained in, and it is costly to invest in the formal programmes (equipment and tools).

Another factor affecting the implementation and use of sound-based therapy is the **clinician's skills and knowledge**. Participants 1, 2, 3, 4 and 6 acknowledged that they were unsure how to implement the sound-based therapy and that it has been a learning process.

> *"So, it's incredibly powerful stuff. [The therapist] can make the wrong choices and really bomb a child out, and over time, I realised that those two CD's, in particular, are ones that I should wait. I was using too quickly, too soon. I was trying to effect changes the child wasn't ready for." (P3)*

A lack of knowledge and feeling unsure are why several participants sought out further training or mentoring. Participant 6 acknowledged that her lack of knowledge and feeling unsure was potentially why she was not using the Therapeutic Listening® programme appropriately and not seeing the results that she was expecting.

Contextual factors are an important area for occupational therapists to consider when clinically reasoning whether a tool should be incorporated into their occupational therapy practice. The occupational therapy profession requires occupational therapists to consult research and evidence to ensure the tools they use in their practice yields EBP.

d. Evidence-based reasoning

Evidence-based reasoning was mentioned by two participants (P4 and P5) as influencing which sound-based therapy they incorporated into their occupational therapy practice.

> *"So, at the time that I started the Tomatis® Method, there wasn't very much research coming out of Therapeutic Listening®. So, that was*

the reason why I chose [the Tomatis® Method] over the Therapeutic Listening®—because it had a heavier research base to it." (P4)

The majority of the participants commented on the importance of **research** but stated they do not keep up with the research or are not critical enough of the research provided. One participant (P1) stated that during her mentoring sessions, they had discussed the research evidence behind sound-based therapy. However, she was aware that she is not critical enough of the research and acknowledged that sound-based therapy does not have sufficient evidence. Two participants (P4 and P5) specifically considered the research behind the sound-based therapy they chose to incorporate into their practice but acknowledged that they have not followed up on the literature developed around the other sound-based therapies. One participant (P4) stated that even though she had seen more literature on another sound-based therapy, she had already invested in the Tomatis® Method and was not about to change the therapy.

There were mixed comments regarding whether **research or clinical experience** had influenced their choice of sound-based therapy. Only two participants' (P4 and P5) choice of sound-based therapy was based on research. Participant 2 had noted clinical changes in her clients with SPD but was not convinced by the evidence. This is similar to Participant 1, who was concerned about insufficient research behind sound-based therapy but had observed clinical improvements during therapy. Participant 4 indicated more research and evidence are needed on the auditory system and why the auditory system, specifically modulation and integration, is not assessed and treated by many therapists.

"I think that [sound-based therapy] is an area that definitely needs more research […]. Here we have this component in the brain, which is a major component in the brain, that's just not being addressed by so many therapists. Not addressed by Ayres Sensory Integration; not addressed by the boards." (P4)

The participants were aware of the importance of choosing complementary tools and techniques based on evidence but tended to choose sound-based therapies based on clinical experience rather than research.

The next subcategory which influences a therapist's choice of sound-based therapy was discussed in depth by the participants: the therapist's philosophy. Philosophy refers to a therapist's fundamental knowledge, beliefs and values about their occupational therapy practice. The choice and inclusion of sound-based therapies were often influenced by the therapist's philosophy.

e. Therapist's philosophy

The theory of SI influenced participants' philosophy of occupational therapy practice, as the participants considered a child using **a bottom-up approach rather than a top-down approach**. All the participants stated that they had not thought of specific occupational performance issues surrounding why they implement sound-based therapy into a child's occupational therapy process. All the participants acknowledged that they look at the underlying reasons for children with SPD's occupational performance issues, and based on the underlying reasons, determine whether a sound-based therapy is needed or not.

> *"I will explain to them in terms of the [occupational performance] areas that [the sound-based therapy] could impact but doesn't always impact. And that has been made clear to the parent. It doesn't always impact the area that the child is struggling with." (P1)*

A fundamental core philosophy in occupational therapy is **client-centredness**. The study participants acknowledged the importance of client-centredness, specifically when incorporating sound-based therapies. The participants stated that they ensure their practice is client-centred through accurate and comprehensive assessments. The importance of accurate assessment determines whether or not sound-based therapy would be beneficial for the child. Participant 1 stated that occupational therapists conduct an assessment to consider why a child is presenting with certain occupational performance problems in order to determine a therapy plan and whether

sound-based therapy would be a suitable tool to use for improving these occupational performance areas. Participant 3 and 4 noted that assessment results influence which sound-based therapy and music or programme they choose as most appropriate for the client.

> *"It's just, if you've assessed what you're looking for, and you've picked your music effectively, you're going to make a difference." (P3)*

Participant 5 stated that she often implemented a sound-based therapy, specifically when seeing 'red flags'. These red flags refer to areas that are meant to change due to SI occupational therapy but are not changing as the therapist would expect. Participant 5 described it this way:

> *"I'd be quite specific about why I've chosen it, so I'd have some red flags about […] my standard OT processes just maybe not getting the child to where I need [him/her] to be. I would have for that specific child some red flags that I would've picked up on, like, 'Okay, I need something else. I need to access this sound-based therapy'." (P5)*

All the participants acknowledged that the implementation of sound-based therapy must be based on **good clinical reasoning and be individualised** to that specific child rather than being a programme-driven and implemented tool. Half of the participants (P1, P2, and P6) were concerned about the use of sound-based therapy within the South African context, as therapists tend to use it as a programme-driven tool or prefer to follow a script, which is giving sound-based therapy a bad name. Therefore, the participants indicated the importance of ensuring that sound-based therapy is based on good clinical reasoning and is individualised to the child.

> *"I think the therapist's clinical reasoning has to be really good, and I feel like sound-based therapies can't just be a blanket for all kids. For it to be beneficial and for it to not have a terrible name, we're needing to do it properly for the right children with the right combination of therapies." (P1)*

Participant 6 noted the importance of good knowledge and understanding of SI to understand the neurology and impact of sound-based therapy on a child with SPD. These therapists can then make a greater difference when using sound-based therapies than other therapists who simply follow the prescribed programme with children with SPD. For effective changes to occur due to sound-based therapy, one must be an experienced therapist and understand the art of therapy, as was stated by Participant 3.

A therapist's philosophy influences which sound-based therapy they choose and may result in the therapist resonating with a specific sound-based therapy's business model, including vision and fundamental knowledge of the business model.

f. Business model of sound-based therapy

Sound-based therapies are supplied by medical technology companies. The Tomatis® Method and Therapeutic Listening® are trademarked products. During the interviews, participants (P1, P3, P5 and P6) expressed concerns about the **business model** behind the sound-based therapies, especially as the therapies are supplied by international therapists who have a programme-driven intervention focus:

> *"And I think [one of the international therapists has] had quite a profound effect on a lot of OTs here. I think a lot of, I don't agree with everything she does because I think, in America, they are very programme driven. So, [the therapist walks in and does the Tomatis® Method, then DIR, then Interactive Metronome, then this, then that]." (P6)*

All the participants commented that their **values and therapeutic approach** influenced which sound-based therapy they incorporated into their practice. The following influences were stated: Participant 1 valued accessibility and cost-effectiveness for the parents. Participant 4 believed that parents should be aware of the auditory system's influence on their child's performance of daily tasks. Participant 4 and 6 refused to persuade parents to pursue additional therapy

intervention but rather provided parents with all sound-based therapy options and informed consent regarding choice in pursuing sound-based therapy. Participant 5 stated that her sound-based therapy is in line with her therapeutic approach as she believes in the importance of using a multisensory approach and in making therapy functional.

This category emerged from participants identifying key factors that influenced their choice and inclusion of sound-based therapy in their occupational therapy practice. The primary subcategories to emerge include the importance of the auditory system in SI and auditory input not being applied fully within the SI approach. The use of sound-based therapies developed as occupational therapists appreciated the use of auditory input as a modality in the treatment of children with SPD. Speech therapists are responsible for assessing and treating the auditory system with respect to hearing and auditory discrimination; however, occupational therapists seem to be incorporating sound-based therapies into their practice in treating sensory modulation in children with SPD. Sub-categories influencing an occupational therapists' choice of which sound-based therapies are incorporated into their practice include contextual factors, evidence-based reasoning, the business model of the sound-based therapy and the therapist's philosophy.

Occupational therapists must consider the child as a person and the resources available to the child and family. These factors influence occupational therapists' clinical reasoning in determining whether sound-based therapy is appropriate for the child and the family.

4.4.2.2 Factors influencing the choice of sound-based therapy for client and family

The second category describes the factors influencing the choice of sound-based therapies for the client and family. The primary subcategories to emerge was the age of the child and factors affecting the implementation of sound-based therapy.

a. Ages suitable for sound-based therapy

The age of the child—**a younger versus an older child**—is important to consider when determining whether a sound-based therapy would be appropriate for that child. The participants generally did not use sound-based therapies on children with SPD aged two to three years and younger but would play music in the background over a speaker. The participants had different views on when they would use a sound-based therapy, but it depended on the age range of clients they generally treat. They all agreed that from four years old and on is the most appropriate time to incorporate sound-based therapy into occupational therapy treatment and programmes. Participant 5 explained her reasons behind why she thought sound-based therapy is more suitable for children with SPD of school-going age:

> *"…from your Grade 1, going up into higher ages, where maybe our intervention needs to be a little more intensive, and we don't have as much time as we would for the littlies, and also, we need the kids to have the cognitive understanding of what they need to do."*

Participant 1 stated that it is a good tool to use with older children with SPD (around the age of ten), who have been in therapy for a long time, to restimulate the neuroplasticity processes that trigger changes in the therapy process. However, Participant 5 stated that it may not be the most functional thing for an older child to use in their therapy process as these children cannot always access a sound-based therapy for sensory regulation during the school day or at home, so she would prefer to use a cognitive method for self-regulation. Thus, there are **differences in the use of music for different ages**.

Based on the above comments, all the participants agree that children with SPD who are older than four years of age would be suitable for sound-based therapy.

b. Factors affecting the implementation of sound-based therapy

Another important factor highlighted by all participants in the implementation of sound-based therapy is **family-centred practice**. Family-centred practice believes that the best way to meet the child's needs is by acknowledging the important role

family plays in the child's occupational therapy process. The participants noted contextual factors such as **barriers and facilitators** that the therapists must consider in their clinical reasoning before recommending and including a sound-based therapy into a child's occupational therapy practice.

Participant 1 explained that she considers the parents and how they will cope with the recommendation. Occupational therapists must 'read' the parents carefully during feedback sessions to avoid bombarding them with intervention recommendations. However, these decisions must be based on the parents' needs and carefully monitored by the therapist throughout the therapy process. Thus, the participants acknowledged that they need to be careful about when to introduce to the parents the concept of sound-based therapy as a tool in the treatment of their child with SPD.

The participants trained in more than one sound-based therapy (P1 and P5) did not consider how they present the options of the sound-based therapy but rather considered the family's circumstances and which sound-based therapy would be best for that specific child. Participant 1 stated that sometimes the occupational therapist needs to give all the options of sound-based therapy available so the parents can make an informed decision; however, she tends to recommend, based on her clinical reasoning, which sound-based therapy would be the best for the child. This is because the therapist must consider the **differences and similarities between the sound-based therapies** and which one would be most suitable to that child and family.

The participants (P1, P3, P4 and P6) believed it important to consider the cost of sound-based therapies, the time-consuming nature thereof and the parent's compliance with the sound-based therapy.

> *"…it isn't always a therapy that the parents embrace, because it's so time-consuming. So, my experience is that the child has to be really severe in order for the parents to stick out the home programme process and to really stay with the programme." (P3)*

Two participants (P4 and P6) reported that some families do not return to complete their second cycle of the Tomatis Method®, which affects the effectiveness and prolonged gains of the programme.

Participant 6 stated that in addition to the cost of the sound-based therapy, medical aids generally do not fund sound-based therapy.

The participants acknowledged that there are several barriers to implementing sound-based therapy within the South African context. Solutions to these barriers need to be determined to ensure that children with SPD have access to this complementary therapeutic tool.

The participants have methods of integrating sound-based therapy into the child's therapy process based on the contextual factor of it taking place within either **the home setting or the practice setting**. Half of the participants (P1, P3, P4) send the devices and music home with the parents to implement the programme within their home setting. The downside to implementing sound-based therapies within a home setting is described by Participant 6:

> *"So, [the therapist is] sending [the sound-based therapy] home and then you are not sure if [the parents] are doing it properly or not…So, even though [the therapist] explains everything, [the parents] don't always do it."*

Two participants (P1 and P3) using Therapeutic Listening® as a home programme often try it within the practice setting before sending it home. This cannot be done with the Tomatis® Method as the therapist and parents have to commit to the programme. Participant 5 does sound-based therapy during her therapy sessions, depending on the child's age—if the client is a teenager, she rather sends the device home. Depending on the parents' compliance and situation, she sends the programme home if she has noticed that the sensory regulation has not shifted as much as she had wanted after 30 occupational therapy sessions. Participants P2 and P6 preferred

conducting sound-based therapy during the therapy sessions to monitor the child's response and to ensure that the programme is implemented properly.

This category emerged from participants identifying key factors that influenced their choice and inclusion of sound-based therapy in their occupational therapy practice. The primary subcategories to emerge were the ages suitable for sound-based therapy and the factors affecting the implementation of sound-based therapy. The participants acknowledged that children with SPD aged four years and older were the most suitable for sound-based therapies. Occupational therapists must ensure they use good clinical reasoning around whether an older child might benefit from the tool as a catalyst for the therapy process or if it may not be an accessible tool to help with self-regulation. Family-centred practice is important within the paediatric field as therapists must consider the family's barriers and facilitators to implementing the sound-based therapy and the types of sound-based therapies available that would best fit that child and family, depending on the factors affecting the implementation of sound-based therapy. This may also influence the therapists' decision to incorporate the sound-based therapy into the practice or home setting.

Theme 1 emerged from participant views on aspects that influenced their choices and their reasons for incorporating sound-based therapy into their occupational therapy practice. Theme 1 also explored the family and child factors that influence which sound-based therapy is appropriate for each child and family.

4.4.3 Theme 2: The effectiveness of sound-based therapy on children with SPD

Theme 2 explores the participants' perceived effectiveness of sound-based therapy on client factors, performance skills and occupational performance outcomes of treating children with SPD. Theme 2 also discusses the prolonged gains of sound-based therapy and how the clinicians measure the effectiveness of sound-based therapy. Table 4.6 shows the categories, subcategories and codes for Theme 2.

Table 4.6: Categories, subcategories and codes for Theme 2

Theme 2: The effectiveness of sound-based therapy on children with SPD		
Category	**Subcategories**	**Codes**
The effectiveness of sound-based therapy	Client factors and performance skills	• Sensory modulation • Emotional regulation • Speech and language skills • Praxis • Postural control • Attention • Sensory discrimination
	Occupational performance outcomes	• Social participation • Education • Sleep • Feeding and eating • Toileting • Play • Dressing and bathing • Community mobility • Sport/leisure
	Prolonged gains post-intervention	• Lasting effect
Measurement of effectiveness	Measuring mainly qualitatively	• Qualitatively • Quantitively
	Sound-based therapy or occupational therapy	• Sound-based therapy in isolation vs in conjunction with occupational therapy • Tool and not a magic pill

4.4.3.1 The effectiveness of sound-based therapy

This first category explores the effectiveness of sound-based therapy on the client factors, performance skills and occupational performance outcomes of treating children with SPD.

a. Client factors and performance skills

The first subcategory is the effect of sound-based therapy on the underlying client factors and performance skills addressed by the occupational therapist when treating children with SPD. Table ***4.7*** identifies the specific client factors and performance skills that each participant noted to have changed following their sound-based therapy interventions.

Table 4.7: Improvements noted by participants in client factors and performance skills following sound-based therapy

Client factors and performance skills	**Participant number**					
	1	**2**	**3**	**4**	**5**	**6**
Sensory modulation	X	X	X	X	X	X
Emotional regulation	X	X	X	X	X	X
Speech and language	X	X	X			X
Praxis	X		X		X	
Postural control	X		X			X
Attention	X	X			X	
Sensory discrimination					X	

All the participants noted improvements in **sensory modulation**, which affects a child's ability to achieve a calm-alert state and engage appropriately with others. This, according to the participants, is the main reason for occupational performance changes in children undergoing sound-based therapy. A child with sensory over-responsivity is observed to have changed the most through sound-based therapy, possibly due to greater occupational performance challenges experienced by such a child. Three of the participants specifically mentioned a reduction in sensitivity towards auditory input, resulting in children with SPD coping better with noises in different environments, for example, classrooms or shops. Changes in tactile over-responsivity were observed but queried as being due to decreased anxiety following the use of a sound-based therapy programme.

All of the participants noted improvements in **emotional regulation**. Sound-based therapy appears to take the "edge off of the child" (P2) due to children with SPD being better regulated and less anxious and withdrawn. Participant 2 reported fewer to no

meltdowns and tantrums. Participant 6 noted that as soon as the occupational therapist works on the child's anxiety and emotional regulation through SI and sound-based therapy, everything improves:

> *"Once you decrease [anxiety], then everything improves… I think a lot of them are stuck in [a fight, flight and freeze state] and with the Tomatis® Method decreasing anxiety, it's profoundly calming and […the child will] feel marvellous." (P6)*

Improvements in **speech and language skills** were reported by Participants 1, 2, 3 and 6. Children with SPD started to display improved and consistent eye contact. The children also began using words and sounds that previously they had not used or made. They made attempts to connect with other children, indicating that relationships improved, and started participating in more socially appropriate communication. The participants queried whether improvements in sensory modulation and emotional regulation allowed for this positive change.

Participants 1, 3 and 5 reported improvements in **praxis**, including bilateral integration and sequencing, as they observed improved use of both sides of the body in a more coordinated and smooth manner. Participant 5 queried whether the therapist can see the child's true potential and abilities due to improved sensory regulation.

Participants 1, 3 and 6 observed improved transitions between positions, sitting upright, protective extension and righting reactions. Two of the participants (P1 and P3) acknowledged that an improvement in **postural control** occurs because sound-based therapy affects the vestibular system.

Improved **attention** allowed children with SPD to perform better in school tasks (as noted by their teachers), reported Participant 1 and 2. Participant 5 stated that she is unsure if sound-based therapy improved attention or if the shift in attention is due to improved sensory modulation and self-regulation.

"So, I know that they all talk about [how] it helps attention, and it helps body scheme, and it helps bilateral coordination, and I am not a hundred percent convinced that it does that in all cases. I feel like it does that in the cases where those have been affected because of the regulation, personally." (P5)

One participant (P5) commented on a change in **sensory discrimination**, particularly auditory discrimination, which helped with the child's reading.

Most of the participants observed the biggest shift in sensory modulation and emotional regulation, which resulted in other changes in client factors and performance skills. However, occupational therapists must consider the occupational performance outcomes influenced by sound-based therapies.

b. Occupational performance outcomes

Table ***4.8*** identifies the specific occupational performance outcomes that each participant noted to have changed following the integration of sound-based therapy into treating children with SPD. These occupational performance outcome changes are due to underlying sensory, emotional and motor changes.

Table 4.8: Changes noted by participants in occupational performance outcomes following sound-based therapy

Occupational performance outcomes	**Participant number**					
	1	**2**	**3**	**4**	**5**	**6**
Social participation	X	X	X	X	X	X
Education	X	X		X	X	X
Sleep	X	X	X	X	X	
Feeding and eating	X	X		X		
Play	X	X				
Toileting	X		X			
Dressing and bathing	X			X		
Community mobility	X	X				
Sport/leisure	X					

All participants reported changes in **social participation** as they noted children with SPD to be more interactive, more comfortable with friends and better able to

communicate effectively with others. The children also displayed improved confidence and an improved ability to present themselves. The participants stated that it might be because they were more comfortable in their bodies and had improved sensory modulation. Participant 5 stated that as the child is less sensory sensitive and less overwhelmed, they are open and willing to access more social environments, for example, attending birthday parties.

> *"Because of the sound-based therapy, they become more regulated and engaged, which obviously facilitates more to their communication and social interaction." (P1)*

Changes in **education** were reported by Participants 1,2, 4, 5 and 6 as children with SPD were able to focus better and get through more tasks in the classroom. Participant 6 reported that one of her clients started to understand and use English more appropriately for his age and his maths marks improved by 20%. Participants reported that educational changes mainly related to improved attention and sensory modulation.

Most of the participants (P1 to P5) also observed changes in **sleep**. The two possible reasons for this was due to improved sensory modulation and reduced anxiety. Participant 5 stated that although she saw improvements in sleep, she could not attribute it to sound-based therapy because not all children with SPD were sleeping better.

> *"…my experience has just been that they, that the kids who, that they go to sleep easier, more quickly. So, I presume that that means that they are more regulated going into a sleep state. I can't remember with this child if he stayed asleep for longer. I can't remember if he was still having multiple, you know, waking up later, or in the early hours of the morning." (P4)*

Changes in **feeding and eating** were observed by Participants 1, 2 and 4 as children with SPD started to eat a more varied diet due to improved sensory modulation and

reduced tactile sensitivity. Changes in **toileting** were attributed to becoming more sensorially aware of their bodies, as reported by Participant 1 and 3. Two of the participants (P1 and P2) noticed changes in **play** as children with SPD were becoming more sociable due to confidence in wanting to interact with others and improved sensory modulation and emotional regulation.

> *"…the diversity of the play just in terms of like... I'm regulated, so, I'm able to, like, then try." (P2)*

Participants (P1 and P4) observed improved ability to perform **dressing and bathing** tasks without sensory overload and following a routine. **Community mobility** changes were reported in terms of children transitioning more easily from one environment to the next, as highlighted by Participants 1 and 2. Only one participant (P1) noticed a change in **sport/leisure,** particularly the timing and rhythm when performing a sport such as swimming.

However, most of the participants have observed the majority of the changes in education, social participation and sleep. Based on these varied responses, the effectiveness of sound-based therapy still requires further investigation, seeing as occupational therapists focus on eliciting changes in occupational performance outcomes.

c. Prolonged gains post-intervention

The participants felt that the sustained gains and outcome permanence of sound-based therapies on the underlying client factors, performance skills and occupational performance outcomes should be considered. There were mixed views around the lasting effect of the changes observed in children with SPD. Participant 1 believed that sound-based therapy is a springboard for the occupational therapy process, but it is difficult to determine whether sound-based therapy or occupational therapy helps maintain the changes. Participant 1 uses sound-based therapy in conjunction with her normal occupational therapy process; thus, it is hard to isolate which causes the **lasting effect**.

"I think it does last. It is hard, also to know… I think, sometimes, it is a springboard in your therapy process. So, you start with it and then it kind of helps to get things going for the child. And then, the therapy itself often helps to maintain things. I think it is hard to know what the lasting effect is for a child if you are not… if you don't do it without the therapy process." (P1)

Participant 2 stated that sustainability often depends on which sound-based therapy the occupational therapist chooses to implement in therapy and that sound-based therapy is definitely not a - "once-off-fix-all kind of programme". Participant 5 stated that she has not found Therapeutic Listening® sustainable and that the occupational therapist has to do SI occupational therapy to make it functional. Participant 3 noticed that the Tomatis® Method has sustained results, which impact the child in various areas.

"…it's not long term. You've got to actually do the therapy to make it, like, functional." (P5)

There were mixed comments around the prolonged gains of sound-based therapies. This indicates that this area needs to be researched further. It may be difficult to examine the sustainability of sound-based therapies due to the lack of an appropriate method to measure the effectiveness of sound-based therapy as a complementary tool to occupational therapy. Improvements in the client factors, performance skills and occupational performance outcomes may be due to the combination of sound-based therapy and SI and not due to sound-based therapy alone.

This category emerged from participants exploring the effectiveness of sound-based therapy in the treatment of children with SPD. The primary subcategories to emerge was the effectiveness of sound-based therapy on client factors and performance skills and occupational performance outcomes and the prolonged gains of sound-based therapy. The participants stated that the most notable client factors and performance skills to be affected by sound-based therapy are: sensory modulation and emotional

regulation, which resulted in changes in the other client factors and performance skills. Despite the participants not specifically prescribing sound-based therapies for occupational performance difficulties, there were differences noted in social participation, education and sleep. The participants stated that the prolonged gains of sound-based therapy requires further investigation as it is difficult to tell whether it is due to sound-based therapy in isolation or due to the combination of sound-based therapy and occupational therapy using an SI approach.

4.4.3.2 Measurement of effectiveness

The second category in Theme 2 was repeatedly alluded to by the participants: the method of measuring the effectiveness of sound-based therapy, and the ability to discover whether it is the sound-based therapy, occupational therapy or a combination of the two making a difference. This category explores the participants' perceptions of these ideas.

a. Measuring mainly qualitatively

Most participants (P1, P3, P4 and P6) commented that effectiveness is measured **qualitatively** rather than **quantitatively**. The participants reported that the Tomatis® Method has a listening test which allows the occupational therapist to conduct a before-and-after test, which the therapist can show to the parents, allowing for the effectiveness to be recorded quantitatively. Other sound-based therapies rely on clinical observations and reports from a variety of sources such as parents and teachers, as described by Participant 1:

> *"…you try to look at gathering as much data from different people and different sources in order to make decisions about whether it is working or not." (P1)*

Participant 6 reported that it is difficult to quantify effectiveness as sound-based therapies affect the whole person.

b. Sound-based therapy or occupational therapy

All the participants reported that measuring the effectiveness of sound-based therapy is difficult because sound-based therapy is often conducted in conjunction with occupational therapy or another therapy. Thus, it is difficult to measure sound-based therapy as a discrete intervention variable. As a result, it is hard to tell whether the changes occurring are due to **sound-based therapy in isolation or in conjunction with occupational therapy**. Occupational therapists need to develop appropriate tools for measuring improvements and effectiveness that also allow for quantitative measurements. Participant 5 adequately described this dilemma and highlighted that sound-based therapy must be conducted with the right combinations of therapy at the right time.

> *"…because if I were to say it's just the sound-based therapy that made that change, I can't because, personally, I've never just used it in isolation, and when I have used it in isolation, I haven't really found it to be that effective. So, in terms of the functional changes, the ones that I can say, absolutely, it has gone down to because I used the sound-based therapy in combination with the therapy that I was using, and it was all just perfectly aligned." (P5)*

The effectiveness of sound-based therapy is debatable due to various factors. Further research using randomised-controlled studies must be conducted to investigate the effectiveness, especially as occupational therapists need to determine whether sound-based therapy, occupational therapy or a combination of the two elicits the improvements noted by the participants. However, all the study participants acknowledged that sound-based therapy is only one tool in their occupational therapy box (**not a magic pill**) and must be applied carefully to each child and family.

This category emerged from participants exploring how they are measuring the effectiveness of sound-based therapy in the treatment of children with SPD. The primary subcategories to emerge was the measurement of the effectiveness of sound-based therapy is mainly done qualitatively and that it is difficult to tell whether the

changes are occurring due to sound-based therapy in isolation or due to the combination of sound-based therapy and occupational therapy.

Theme 2 identified that the main improvements observed by the participants following sound-based therapy are sensory modulation and emotional regulation. Improvements in these two areas were determined by the participants—based on the SI frame of reference—to elicit changes in other client factors and performance skills. Furthermore, improvements in sensory modulation and emotional regulation result in changes in social participation, education and sleep. The prolonged gains of sound-based therapy were questioned as the participants stated that it is difficult to isolate the changes from occupational therapy using the SI frame of reference and sound-based therapy intervention. These two are often conducted in combination. The participants also highlighted the need for more suitable methods to measure effectiveness, as they generally used qualitative measures. This is an important consideration, especially if occupational therapists want to ensure that occupational therapy intervention is evidence-based.

4.5 SUMMARY

This chapter presented the comments on the demographic survey and individual interview questions to refine and validate the study research tools. A pilot interview was conducted, which allowed the researcher to reflect on her interviewing skills and make the necessary changes.

The demographic information of the study participants was presented. Six occupational therapists participated in the study. The types of sound-based therapies they were trained in or referred to are the Tomatis® Method, Therapeutic Listening®, iLs and SSP. Two themes emerged from the thematic content analysis of the occupational therapy interviews.

The first theme referred to the nature of the intervention of sound-based therapies in occupational therapy practice. This theme explored occupational therapists' perspective of auditory input within the SI approach and as a modality to affect change in occupational performance. The theme elaborated on the factors influencing both

the therapist and client's choice of using sound-based therapy in the intervention for a child with SPD.

Theme 2 explored the perceived effectiveness of sound-based therapy on the client factors, performance skills and occupational performance outcomes of children with SPD and the sustainability of these changes. This theme also explored how the effectiveness of sound-based therapy is measured and considered whether sound-based therapy in isolation or in conjunction with occupational therapy results in occupational performance changes observed in children with SPD.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

The study set out to explore occupational therapists' experiences of the intervention of sound-based therapies. It also set out to discover whether occupational therapists perceive sound-based therapy as effective in improving the occupational performance outcomes of an intervention for children with SPD. Limited research is available in this area within the global and South African context. This chapter discusses the findings related to the perceptions of participant occupational therapists—with experience in the paediatric field of practice—regarding the nature of the intervention and the perceived effectiveness of sound-based therapies on occupational performance outcomes in the treatment of children with SPD. This discussion reflects the themes presented in Chapter 4.

5.2 DEMOGRAPHICS OF PARTICIPANTS

The participants were all female, worked in private practice and ranged in age from 25 to 60+ years, with 50% below the age of 40. This is consistent with a South African study by Ned et al.[101], which found that most occupational therapists are female, work in private practice and are below the age of 40. Interestingly, this study included more experienced occupational therapists than Ned et al.[101] noted as being the typical level. This is possibly due to the time-consuming and expensive nature of sound-based therapy, which younger occupational therapists may not be able to afford. All the participants received their SI certification through SAISI, except for one participant who trained through the SI network. SAISI is the only SI-certified trainer in South Africa and is easily accessible. Most occupational therapists in South Africa are aware of this training, and SI is generally recommended to occupational therapists practising in the paediatric field. The proportion of clients with SPD in the participants' practices was generally 61% to 70% for children between the ages of zero and ten years. SPD is typically identified in children in this age range, and parents typically seek intervention when the child is between three and seven years of age[50,102]. This finding indicates that the participants are treating mainly children with SPD in their practices and highlights the importance of including tools and techniques that benefit children with SPD. The diversity in clinical experience and types of sound-based

therapy used allowed for participant heterogeneity and assisted in attaining diverse responses.

5.3 THEME 1: THE NATURE OF THE INTERVENTION OF SOUND-BASED THERAPY IN OCCUPATIONAL THERAPY PRACTICE

Theme 1 emerged through the thematic content analysis of the participant interviews. This theme explored the participants' experiences of the nature of sound-based therapy intervention and met the first study objective: to explore occupational therapists' experiences of the nature of sound-based therapy intervention for children with SPD in Gauteng. Two categories emerged from this theme: factors influencing the therapists' choice of sound-based therapy and factors influencing the choice of sound-based therapy for the child and family. These factors influence a therapist's clinical reasoning in determining whether a sound-based therapy would be appropriate for the client and how and why the therapist determines the appropriateness of a sound-based therapy. The subcategories that emerged from each category are indicated in bold text in this discussion.

5.3.1 Factors influencing therapists' choice of sound-based therapy

According to Ayres[4] and Schaaf and Mailloux[5], occupational therapists have identified the important effect **auditory input in SI** has on a child's arousal level and ability to organise their movements. Auditory input can play an important role in allowing a child to function more productively and independently in daily tasks. Auditory input is used in the SI approach through the therapist tailoring the use of themself or including music to alert or calm a child's sensory system. This has resulted in occupational therapists becoming more aware of the impact of the auditory system in the SI approach.

Auditory processing is typically treated by speech therapists[42]. However, the ASHA has released a position statement stating that it does not endorse sound-based therapy[42], and speech therapists have been wary of using it due to insufficient research evidence supporting this modality. However, the treatment of auditory modulation and movement difficulties through auditory input fits appropriately within the occupational therapy **scope of practice**. Occupational therapists assess and treat

children with auditory modulation difficulties as these difficulties significantly impact participation in daily occupations[1, 5, 61]. The ability to modulate auditory input assists the child in achieving an optimal level of arousal and in participating in their daily activities. The auditory system also provides input that is rhythmical and integrates with other sensory systems through neurological connections in the brain, for example, the vestibular system. The rhythmicity and integration with other sensory systems assist in improving the child's coordination and timing of their movements. The use of sound-based therapies has been identified as helping children with auditory modulation and movement difficulties. Therefore, compared to speech therapists, occupational therapists are better positioned to incorporate sound-based therapies into their practice due to their knowledge of SI and their ability to assess and treat arousal and movement difficulties. Ayres SI offers little in the way of specific intervention for auditory modulation difficulties; however, one such tool is sound-based therapy which is used by occupational therapists.

Four **contextual factors** emerged in this study as influencing an occupational therapist's inclusion of sound-based therapy in their occupational therapy practice, namely exposure to sound-based therapies, access to a mentor, cost of sound-based therapy training and equipment, and availability of sound-based therapy equipment and training. This finding is similar to that of other studies investigating the use of sound-based therapies[10, 13, 45]. According to Copley et al.[45], the cost and availability of interventions affect whether or not a therapist can incorporate the treatment tool. Shafaroodi et al.[10], Giving[13] and Copley et al.[45] stated that exposure and training within one's work setting (that is, access to a mentor) also influence the treatment tools incorporated and used. The participants noted how their employers, mentors and work settings influenced which sound-based therapies they used. The participants tended to train in the same sound-based therapy used in the practice they were employed at, as they had access to the mentoring and equipment. Giving[13] cautioned occupational therapists who have availability and exposure to treatment tools to use their discretion in determining whether the tool is best practice. The younger study participants noted that they tend to neglect critically appraising the research evidence of the available and other sound-based therapy tools as they rely on the more experienced employers or mentors to ensure they incorporate best practice. An interesting study finding is that

exposure to sound-based therapies not only influences the choice of sound-based therapy incorporated into practice but also allows the therapist to create patterns for clinical decisions. According to Copley et al.[45], this pattern matching uses the clinician's prior experience to make intuitive decisions about which interventions may work for the child. The therapist's competency and knowledge of and experience with sound-based therapies noticeably influences the use of sound-based therapies and the appropriate and individualised application to the child[10].

Contextual factors are important for occupational therapists to consider when clinically reasoning whether a tool should be incorporated into their occupational therapy practice. The occupational therapy profession requires occupational therapists to consult research evidence to ensure the tools they use in their practice conforms to EBP.

Evidence-based reasoning is the process of using evidence to solve problems, make decisions and justify one's therapy processes[16]. The participants acknowledged that they are aware of the importance of choosing complementary tools and techniques based on evidence. This is encouraging as the occupational therapy profession strives to ensure that it is based on EBP. However, the participants noted that they know that sound-based therapy lacks research evidence, as emphasised in other studies[28, 30, 38, 39, 103]. The participants tended to choose sound-based therapies based on clinical experience rather than research. Researching evidence was difficult due to the lack of skills for the critical appraisal of research, limited time and limited access to research[104]. The cost of sound-based therapy also influenced the therapist's appraisal of research, as the therapist had financially invested in a particular sound-based therapy and could not afford to incorporate another sound-based therapy, even if it had more substantial research evidence. This study highlighted that the use of sound-based therapy in occupational therapy practice requires a combination of critically appraising research and clinical experience[13, 45] throughout the occupational therapy process to ensure effective and individualised treatment.

Another factor influencing the inclusion and choice of sound-based therapy into occupational therapy practice was the **therapist's philosophy,** which is their values, beliefs and foundational knowledge of occupational therapy. In this study, the therapist's philosophy relates to the therapist acknowledging the importance of using a bottom-up approach and being client-centred. The study participants were open to using sound-based therapies as they have a good knowledge and understanding of the importance of SI as the foundation for learning, behaviour, skill development and optimal performance in daily tasks. Occupational therapists using a bottom-up approach focus on identifying specific underlying client factors and performance skills that influence a child's occupational performance[101]. The study participants were observed to use client factors and performance skills rather than an occupational performance difficulty to determine whether sound-based therapy was appropriate for the child. Copley et al.[45] stated that it was important to understand the underlying reasons contributing to occupational performance difficulties, as this assists in guiding the therapist in appropriate and effective intervention approaches and affects the choice of intervention.

The therapists in this study also valued client-centredness. A fundamental core philosophy in occupational therapy is client-centredness, and the participants acknowledged this as particularly important when incorporating sound-based therapies. Client-centredness is an approach that encourages the therapist to treat the child and family with respect and compassion while providing them with individualised treatment to suit their needs and wants[6]. The participants highlighted the importance of accurate assessments to ensure that the occupational therapy process is individualised to each child and improves their occupational performance outcomes. According to the College of Occupational Therapists of Ontario[44], assessment is the foundation for all clinical decisions, treatment and recommendations. This finding was extremely important to the participants as it allowed them to choose the appropriate sound-based therapy for the client and know when to intervene and how to incorporate the sound-based therapy into the child's occupational therapy process.

The implementation of sound-based therapy must be based on good clinical reasoning and be individualised to that specific child rather than being a programme-driven

implemented tool[6]. A programme-driven implemented tool refers to therapists using sound-based therapy for every child seeking occupational therapy services and following the prescribed programmes without individualising it. Half of the participants were concerned about using sound-based therapy within the South African context as therapists tend to use it as a programme-driven tool or prefer to follow a script, which gives sound-based therapy a bad name. Therefore, the participants indicated the importance of ensuring that sound-based therapy is based on good clinical reasoning and individualised to the child[1, 10–12].

Furthermore, it is important to have a good knowledge and understanding of SI in order to understand the neurology and impact that sound-based therapy has on a child with SPD. Experienced therapists value client-centredness. Therapists who employ individualised therapy ensure more effective treatment and outcomes using sound-based therapies than therapists who follow the prescribed programme with all children[1, 10–12]. For effective changes to occur due to sound-based therapy, one needs to be an experienced therapist and understand the art of therapy[1, 10–12]. The therapist's philosophy influences which sound-based therapy they choose and may result in the therapist resonating with a specific sound-based therapy's **business model,** including vision and fundamental knowledge of the business model.

Occupational therapists must consider the child as a unique person and carefully consider the resources available to the child and family[6]. These factors further influence the occupational therapist's clinical reasoning in determining whether sound-based therapy would be appropriate for the child and the family.

5.3.2 Factors influencing the choice of sound-based therapy for client and family

The participants identified client and family-related factors that would influence their choice of sound-based therapy. The participants reported that the client's **age** influenced their choice of sound-based therapy. Shafaroodi et al.[10] and Copley et al.[45] noted that child-related factors are the most influential in the choice of treatment. The participants stated they would use sound-based therapies on children older than four years of age. Copley et al.[45] reported that sensory-based interventions

are appropriate for children in the younger years. The intensity of therapy is important in the younger years due to the growing urgency of functional needs as the child prepares for school and the brain's malleable state[45]. The participants stated that they would be cautious around using sound-based therapy for a child older than ten years as it is not a functional tool. Older children, according to Copley et al.[45], would benefit from compensatory techniques rather than sensory-based interventions such as sound-based therapies.

Copley et al.[45] highlighted **other factors** that may affect the implementation of sound-based therapy. The previous therapy history (amount and type) and response to therapy could also influence intervention choice. The participants stated that children who had been in therapy for a long time or who had not shown the expected progress were candidates for sound-based therapy. This may be because auditory input was not used previously and could be the last resort for the therapist to attempt to change the child's occupational performance outcomes. Other factors—according to Copley et al.[45] and which were not mentioned in this study—that influence clinical decisions include the child's motivation and cognitive ability. The child's motivation and cognitive ability may not be identified by occupational therapists as sound-based therapy is quite passive. However, these factors may influence whether the child understands why they are listening to the music and may ensure no negative response towards the programme.

Family-centred practice is another foundational belief of an occupational therapist's practice that may influence the choice and use of sound-based therapy. Espe-Sherwindt[17] and Delany and Galvin[46] reported that family-centred practice is important to achieve the child and family's outcomes. The participants noted that the most effective way to ensure permanency and well-being is to provide services that involve, engage and support families. Therefore it is important to consider factors that could influence family-centred practice, for example, the families' time and emotional, financial and physical resources.

This study noted that the cost of the sound-based therapy, the time available for the child and family, and the parents' compliance influence the occupational therapist's

choice in incorporating sound-based therapy. Chiu and Li[70] found that time and compliance influences a family's use of sound-based therapies. In the South African context, the cost may be more problematic as sound-based therapies are not covered by medical insurance or families do not have the finances to afford sound-based therapies. Within South Africa, sound-based therapies can be included within therapy or as a standalone. The costs of the sound-based therapies range from R1800-R5000. However the costing is vary dependent on the practice and the type of sound-based therapy available at that practice. Currently, there are no specific procedure codes that can be used for sound-based therapies therefore this prevents families from being able to claim back from medical insurance (refer to 2.6.2.3 for specific costs and hours related to each sound-based therapy). Gee et al.'s[29] study queried whether sound-based therapies would be used more with clients if the cost was not a deterrent. One study participant stated that sound-based therapies are not being used as optimally as they could due to the cost and practicalities of implementing sound-based therapies into practice.

The factors influencing a therapist's choice of implementing sound-based therapies into their occupational therapy practices determine which sound-based therapies are incorporated. The factors influencing the implementation determine if a sound-based therapy is a viable option based on finances, time available and ability to comply with a programme. These factors also influence how the sound-based therapy is implemented—at home or during the sessions—based on the parent's compliance and time available and which programme the family can afford and have access to. These are important clinical decisions the therapist must account for to ensure that the sound-based therapy will be an effective complementary tool to the child's SI occupational therapy process.

5.4 THEME 2: THE EFFECTIVENESS OF SOUND-BASED THERAPY

Theme 2 emerged from the thematic content analysis and explored the participants' perceived effectiveness of sound-based therapy on children with SPD's occupational performance. This theme met the second study objective: to explore occupational therapists' experiences of the perceived effectiveness of using sound-based therapies on occupational performance outcomes in the intervention for children with SPD in

Gauteng. This theme explored the effectiveness of sound-based therapy on client factors, performance skills and occupational performance outcomes of a child with SPD. The occupational therapists' perception of measuring the effectiveness of sound-based therapies was also explored.

5.4.1 Effectiveness of sound-based therapy

The participants reported the perceived effectiveness of sound-based therapy on client factors, performance skills and occupational performance outcomes of children with SPD. An important study finding is that the participants focused on changes to underlying factors and required prompting to discuss occupational performance outcome changes[13]. This finding is concerning because the profession is occupational therapy, and the main goal is to allow a child to become independent and productive in daily occupations. The participants stated that they do consider how the underlying factors influence the child's occupational performance. To remain true to the profession, occupational therapists must consider occupational performance first and foremost in the assessment and treatment of children[8, 19–21, 43, 44]. If occupational therapists assess and treat client factors and performance skills, as is done with a bottom-up approach, then they must link these difficulties to the child's occupational performance. Villasenor et al.[40] stated that an improvement in client factors and performance skills cannot be assumed to contribute to nor correlate with an improvement in a child's occupational performance.

The participants reported that the main **client factors and performance skills** affected by sound-based therapy were sensory modulation, emotional regulation, and speech and language skills. This finding is unique to this study as it was the first to consider the perceived effectiveness of sound-based therapy on a child with SPD holistically rather than focus on specific skills and underlying factors.

Improved sensory modulation, also reported by Schoen et al.[28] and Hall and Case-Smith[30], was observed as the children achieved an optimal level of arousal and displayed improved engagement and a reduction in auditory sensitivity. Improvements in sensory modulation resulted in decreased behavioural and emotional responses. Neurologically, an improvement in sensory modulation occurs as auditory input is

processed via the reticular formation and is connected with the vestibular system, which links with the limbic system[1, 2, 4, 5]. Both of these connections affect the child's ability to achieve an optimal level of arousal[1, 2, 4, 5]. From a neurological perspective, the changes in sensory modulation through the use of auditory input is feasible. Both Schoen et al.[28] and the study participants noted that children with sensory over-responsivity respond more effectively to sound-based therapy. The reason for this finding, according to the participants, is that children with sensory over-responsivity display more easily observable occupational performance difficulties; therefore, changes in occupational performance and responses to sensory input are noticeable.

Due to a reduction in auditory sensory over-responsivity and an improvement in sensory modulation, the participants stated that children tend to fall asleep easily, have improved sleep quality and wake up feeling refreshed. Both Schoen et al.[28] and Hall and Case-Smith[30] observed similar findings and concurred that it is due to sensory modulation improvements and reduced auditory sensory over-responsivity.

The children also presented with improved emotional regulation as they were less anxious and displayed fewer emotional meltdowns[28, 30, 70, 74]. Improvements in emotional regulation occurred due to improvements in sensory modulation. Emotional regulation difficulties arise as children with SPD experience difficulty regulating and processing incoming sensory input[2]. Improved ability to regulate and process incoming sensory input would result in fewer meltdowns, and the child would be able to regulate their emotions appropriately in different situations and contexts.

Speech and language skills improved, as noted by the participants and Hall and Case-Smith[30] and Bazyk et al.[38]. Children with SPD started to use consistent eye contact and a wider vocabulary and could socialise more appropriately with others. The participants further acknowledged that this finding is due to improved sensory modulation and emotional regulation. The child would be at an optimal level of arousal, which facilitates improved communication and social skills. The participants reported that social participation is the main occupational performance area that changes following sound-based therapy due to improved communication and social skills. The main changes in children with SPD in this study were achieving a calm-alert state and

improved speech, language skills and emotional regulation. These are all important underlying skills for effective socialisation.

The participants reported improvements in praxis, bilateral integration and sequencing, and postural control. No other studies noted changes in these areas; they are mainly noted in case studies and through clinical observation. From a neurological perspective and based on the participants' reasoning, improvements in these areas are due to the functions of auditory integration. The auditory system plays a role in the rhythmicity and timing of movements and assists with spatial-temporal organisation [4, 62]. The participants may also have been able to comment on these changes more than participants in other studies as they have worked alongside the child for a longer period and consider the child as a whole. This is a positive finding as it suggests that occupational therapists using sound-based therapy consider that various client factors and performance skills could improve due to sound-based therapy.

Two major **occupational performance outcomes** affected by sound-based therapy are sleep and social participation, which are seen as the respective sequelae of auditory modulation, and speech and language skills. Another occupational performance area influenced by sound-based therapy is education. The participants reported that the children displayed improved task perseverance and attention and decreased distractibility, allowing them to complete tasks in a timelier manner. This finding is unique to this study as no other studies have explicitly measured educational outcomes[40]. A systematic review by Villasenor et al.[40] explored this in-depth and supports this study's findings that improvements in underlying client factors and performance skills influence performance in educational outcomes. The main reason the participants stated that improvements in education were observed was due to improved sensory modulation, specifically a reduction in auditory sensitivity. This is consistent with Villasenor et al.[40] and Ashburner et al.[105], who found that a reduction in auditory sensitivity is associated with improved academic performance.

Other occupational performance outcome improvements were eating a more varied diet, the ability to recognise the need to toilet and to go independently, fewer meltdowns during bathing and dressing, the ability to transition between activities and

places, better coordination in sports and greater participation in social play. These findings are unique to this study as it attempted to identify the perceived effectiveness of sound-based therapy on occupational performance outcomes. Some of these occupational performance outcomes are assumed to be due to improvements in sensory modulation and emotional regulation, for example, eating a more varied diet and having fewer meltdowns as the child can achieve an optimal level of arousal with reduced tactile sensitivity.

Improvements in client factors, performance skills and occupational performance outcomes were noted by participants. However, the participants had mixed views on the **prolonged gains** of sound-based therapies, stating that some children sustained the gains whereas others did not. Studies by Schoen et al.[28] and Hall and Case-Smith[30] were short-term studies, and prolonged gains were not researched. Other studies on sound-based therapies[28, 30, 38, 39] stated that research on prolonged gains requires further investigation. This study's participants tended to be involved in their client's occupational therapy process over a long time. This allowed the participants to comment, based on their clinical experience, on the prolonged gains of sound-based therapies. This finding is, therefore, unique to this study.

Prolonged gains are affected by client-related factors. Espe-Sherwindt[17], Fingerhut et al.[18] and Delany and Galvin[46] acknowledged the importance of considering the child and family in clinical decisions around treatment. This was further emphasised by the study participants. Occupational therapists must understand the child and their family to determine whether sound-based therapy would be a suitable tool for their priorities and needs. The participants stated that if sound-based therapy is a suitable tool, then it allows for improved goal attainment of and family satisfaction with occupational therapy services for children.

5.4.2 Measurement of effectiveness

The participants noted the difficulty around measuring the effectiveness of sound-based therapy on children with SPD. These findings are not unique to this study as Schoen et al.[28], Hall and Case-Smith[30], Bazyk et al.[38] and Nwora and Gee[39] consistently reported similar findings.

The participants and studies concurred that the difficulty is due to **sound-based therapy being conducted alongside occupational therapy rather than in isolation**. The changes elicited cannot be determined to be due to the sound-based therapy tool alone. Occupational therapists can account for this difficulty by assessing the child's client factors and performance skills by using standardised assessments pre- and post-implementation of the sound-based therapy as a complementary tool, without changing any other variables. This allows the therapist to clinically determine if the sound-based therapy affects a change in the underlying client factors and performance skills.

Both this study and previous studies[28, 30, 38, 39] identified that occupational therapists measured changes in the underlying client factors and performance skills rather than in occupational performance outcomes. The use of the SI frame of reference as the foundation for incorporating sound-based therapies into occupational therapy practice results in the use of a bottom-up approach lens for practice and accounts for this finding. Alotaibi et al.[8] noted that occupational therapists within the paediatric field tend to focus on underlying factors rather than occupational performance outcomes. Only Schoen et al.[28] measured occupational performance outcome changes through the use of individualised goals. Occupational therapists are encouraged to be occupation focused in their treatment of children with SPD[41]. This should be considered when using a tool in occupational therapy practice to ensure that the tool affects the changes in occupational performance. Occupational therapists can use two methods to measure changes in a child's occupational performance outcomes: goal attainment scaling[106] and the Canadian Occupational Performance Measure[107]. Previous studies[28, 30, 38, 39] concurred that occupational performance outcomes must be more rigorously measured to ensure that occupational therapy is based on best evidence and is occupation-centred.

The study participants stated that they use **qualitative measures** to record changes, specifically in the underlying client factors and performance skills. These qualitative measures consist of reports from teachers and parents as well as clinical observations during therapy sessions. Other studies[28, 30, 38, 39] tended to use a mixture of both

quantitative and qualitative measures. The quantitative measures consisted of standardised assessments on the underlying client factors and performance skills. The qualitative measures were reports from parents and teachers on the child's behaviour and performance in daily occupations. This difference in measurement indicates the need for occupational therapists to identify appropriate standardised assessments for measuring the effectiveness of sound-based therapy in conjunction with occupational therapy. The use of quantitative measures in research studies may easily be implemented, and the quantitative measures are readily available. However, in clinical practice, occupational therapists may not have access to all standardised assessments. It may also be costly and consume therapy time to conduct a standardised assessment when finances and time are already scarce. Qualitative measures, including clinical observations, are used as they are easy to implement in the child's occupational therapy process. Gee et al.'s[29] study encouraged occupational therapists to aim for objective assessments to identify whether sound-based therapy affects occupational performance outcomes.

Occupational therapists should consider using both quantitative and qualitative tools to measure the effectiveness of sound-based therapy on the occupational performance outcomes of a child with SPD to ensure one's practice is evidence-based, client and family-centred and occupation-focused.

5.5 SUMMARY

Sound-based therapies are incorporated into occupational therapy practice in the treatment of children with SPD. Occupational therapists identified the importance of using auditory input as a modality to achieve an optimal level of arousal and to improve movement. Considering the theory of SI, this affects the occupational performance outcomes of a child with SPD.

Various factors influenced the inclusion of sound-based therapy in the participant's practices. Exposure and mentoring influenced the decision regarding which sound-based therapy to incorporate into their practices; however, this resulted in the participants not always critically appraising the research. The cost and availability of sound-based therapies were a deterrent for the inclusion of sound-based therapies in

practice, and that may be why there is only a small pool of occupational therapists trained in sound-based therapy in Gauteng. If cost were not a deterrent, the participants questioned whether sound-based therapies would be used more, which would also allow for more research. The participants tended to rely on clinical experience rather than research, despite studies suggesting that a balance between clinical experience and research evidence ensures best practice. The participant's philosophy influenced their occupational therapy practice and the tools they incorporated into their practice. The study participants, based on their SI perspective, used a bottom-up approach for assessment and treatment. Client and family-centred practice were important to these participants and influenced their clinical reasoning regarding whether a sound-based therapy is beneficial and appropriate for the child and family, which sound-based therapy to choose and how it should be incorporated. This was often based on child-related factors such as the child's age and nature of difficulties, and family-related factors such as finances, time availability and parent compliance.

This study acknowledges that sound-based therapies affect changes mainly in sensory modulation, emotional regulation, and speech and language skills. These findings are consistent with those of other studies. The main occupational performance areas that improve are social participation, sleep and education. The therapists stated that it is difficult to determine whether the changes are due to sound-based therapy or SI occupational therapy as they are often conducted simultaneously. This study highlights the importance of using quantitative measurements of client factors and performance skills and including an outcome measure for occupational performance. Accurate measurement of effectiveness would allow therapists to determine the effect that sound-based therapies have on the child and would promote EBP.

CHAPTER 6: CONCLUSION

6.1 SUMMARY OF STUDY PURPOSE, DESIGN AND FINDINGS

The purpose of this study was to explore occupational therapists' perspectives on the use and perceived effectiveness of sound-based therapy in the treatment of children with SPD. The data was collected using an exploratory, descriptive qualitative methodology and revealed two central themes. Six occupational therapists participated in individual interviews that explored their personal experiences of using sound-based therapies to treat children with SPD.

The first research objective for this study was to explore occupational therapists' experiences of the use of sound-based therapy intervention for children with SPD in Gauteng. This was explored in Theme 1.

Theme 1 indicated the reasons for incorporating sound-based therapy in the treatment of children with SPD. The participants mentioned several factors affecting their reasons for incorporating sound-based therapy into their practice. The participants stated one factor was that auditory input was the missing link for achieving an optimal state of arousal and for addressing sensory and emotional regulation. A few participants indicated that auditory stimulation is often undervalued in the SI treatment of children with SPD as it is a focus of speech therapists. However, these participants stated that auditory modulation is not addressed by speech therapists, and that may be the reason why occupational therapists are addressing it in their therapy, specifically considering the SI frame of reference. The participants commented on the not following up on research evidence, using research as a basis for making choices and on not being critical enough of research. However, these participants observed from their clinical experience changes in children with SPD who participate in sound-based therapy. The participants acknowledged that an occupational therapist must have good clinical reasoning, gained by experience in this field, to use sound-based therapy as a complementary tool. They also commented that occupational therapists must ensure that their practice is evidence-based.

The use of sound-based therapy in the treatment of children with SPD is also dependent on client-related factors. There are different types of sound-based therapy available. The reason behind implementing a specific sound-based therapy often depends on a child's presenting problems and their family and context factors. Furthermore, not all the participants had access to all types of sound-based therapy due to the expense of training in different sound-based therapies and investing in different programmes. It was noted that the participants did not consider occupational performance issues as the main reason for referral to a sound-based therapy but rather the underlying factors that contribute to those occupational performance issues, for example, sensory modulation to assist with sleeping difficulties. As a result, the participants acknowledged that they must have a good understanding of the impact of sensory processing on occupational performance. The participants stated that sound-based therapy requires good clinical reasoning, and it should not be used as a programme-driven tool after one has been trained in the programme. Furthermore, participants noted that they must remember that they are occupational therapists, and their focus is to allow the child and family to participate to the best of their abilities in their occupations in order to become productive and independent. Sound-based therapy is not a magic tool and does not fix everything. Occupational therapists need to consider the child holistically, and therapy should be directed towards individualised occupational performance outcomes for each child.

The second research objective explored occupational therapists' experiences of the perceived effectiveness of using sound-based therapies on occupational performance outcomes in the intervention for children with SPD in Gauteng. This was explored in Theme 2.

During the exploration of Theme 2, an important study finding is that the participants focused on changes to underlying factors rather than occupational performance outcome changes. This is concerning because the profession is occupational therapy, and the main goal is to allow a child to become independent and productive in daily occupations. However, the participants stated that they do consider how the underlying factors influence the child's occupational performance.

The participants reported that the main client factors and performance skills affected by sound-based therapy were sensory modulation, emotional regulation, and speech and language skills. Improved sensory modulation was observed as the children achieved an optimal level of arousal and displayed improved engagement and a reduction in auditory sensitivity. Due to a reduction in auditory sensory over-responsivity and an improvement in sensory modulation, the participants stated that children tend to fall asleep easily, have improved sleep quality and wake up feeling refreshed. The children also presented with improved emotional regulation as they were less anxious and displayed fewer emotional meltdowns. Improvements in emotional regulation occurred due to improvements in sensory modulation. Speech and language skills improved and children with SPD started to use consistent eye contact and a wider vocabulary and could socialise more appropriately with others. The participants acknowledged that this finding is due to improved sensory modulation and emotional regulation. As a result, social participation is the main occupational performance area that changes following sound-based therapy due to improved communication and social skills. Another occupational performance area influenced by sound-based therapy is education. The participants reported that the children displayed improved task perseverance and attention and decreased distractibility, allowing them to complete tasks in a timelier manner. The main reason the participants stated that improvements in education were observed was due to improved sensory modulation, specifically a reduction in auditory sensitivity. Other occupational performance outcome improvements were eating a more varied diet, the ability to recognise the need to toilet and to go independently, fewer meltdowns during bathing and dressing, the ability to transition between activities and places, better coordination in sports and greater participation in social play.

Sound-based therapy appears to have an effect on occupational performance outcomes. However, the participants had mixed views on the prolonged gains of sound-based therapies, stating that some children sustained the gains whereas others did not. Furthermore, it is difficult to measure the effectiveness of sound-based therapy on children with SPD as the sound-based therapy is conducted alongside occupational therapy rather than in isolation and through the use of qualitative measures for example, clinical observations in therapy sessions and teacher and parent reports.

Thus, the changes elicited cannot be determined to be due to the sound-based therapy tool alone. Furthermore, the use of qualitative measures may not be the most accurate method of measurement of the effectiveness of the sound-based therapy tool.

6.2 CONCLUSIONS

The use of sound-based therapy in the treatment of children with SPD shows promise of being an effective tool to address sensory modulation and emotional regulation difficulties. However, occupational therapists must constantly examine the evidence and use good clinical reasoning to determine whether a client would be suitable for sound-based therapy. Parents should be educated on the potential benefits of sound-based therapy but informed that it is not yet an EBP. Occupational therapists must be aware that they are often in the power seat in therapy, and they need to provide the families with all the information—benefits and risks—to allow them to make an informed decision. Furthermore, occupational therapists must adhere to their scope of practice and ensure they focus on addressing the child's occupational performance difficulties.

Occupational therapists should not use sound-based therapy as a programme-driven tool following training. However, they should seek out mentoring and support from more experienced occupational therapists in sound-based therapy to ensure it is recommended appropriately and at the correct time during the child's therapy process. Each child should be considered individually. Occupational therapists must acknowledge when to refer the child on for a different intervention and must not give parents false hope with sound-based therapy as it is not a magic tool to fix all the child's problems.

Occupational therapists are encouraged to conduct accurate assessments and interpret the results carefully to guide their intervention plan. It appears that children with sensory modulation and emotional regulation difficulties are the most suitable for sound-based therapy. However, the occupational therapy process alone can allow for improvements.

6.3 LIMITATIONS OF THE STUDY

The study consisted of a small population. Therefore, the results of the study cannot be generalised to occupational therapy in South Africa.

Some of the participants had a previous acquaintance with the interviewer, which may have resulted in the interview being perceived as slightly informal. However, this may also have eased any potential anxiety and resulted in more accurate and honest opinions.

The researcher acknowledges that this is a small sample size, which influences the generalisability of the results. Therefore, further research is required in this area, but this study can be used as a basis for more quantitative, scientifically significant research studies.

6.4 RECOMMENDATIONS

6.4.1 For further research

Further research, using higher levels of evidence-based methodologies (such as randomised control trial studies), is needed to determine the use and effectiveness of sound-based therapy in the treatment of children with SPD in the South African population. This study could form the basis of a future investigation into the themes, categories and subcategories that emerged from this study in more depth. This could allow for more rigorous research to be conducted on the effectiveness of sound-based therapy in order to work towards best practice clinical guidelines for its use as a tool in the treatment of children with SPD.

Research is needed to determine the effectiveness of sound-based therapy without occupational therapy or in controlling for the occupational therapy intervention as a variable in a child's occupational performance outcomes. Additional research is needed to examine the parents and children's perspectives on the use and perceived effectiveness of sound-based therapy.

Clarification from the OTASA should be provided around the use of sound-based therapy and whether this tool is endorsed for use by occupational therapists by issuing a position statement on the role of sound-based therapy in occupational therapy.

It may be useful to investigate the effectiveness of sound-based therapy as a home programme versus within the occupational therapy practice setting.

6.4.2 For practice

Occupational therapy practitioners are encouraged to critically appraise the tools that they use within their practice and the tools that they are trained in. This critical appraisal must include a literature review and should be evidence-based rather than clinically based.

Occupational therapy practitioners should uphold their ethical responsibilities when using these complementary tools by ensuring the families are given all the necessary information and latest research to allow them to make an informed decision.

Occupational therapy practitioners are encouraged to seek out mentoring and supervision to assist with their clinical reasoning and implementation of these complementary tools if they are unsure.

Occupational therapy practitioners should conduct an in-depth and accurate assessment of the child to ensure they make clinically sound decisions around the use of these complementary tools. They are encouraged to always ensure that their practice is evidence-based, and currently, the SI frame of reference is an EBP, but this does not yet incorporate sound-based therapy.

Good clinical reasoning is needed in order to use sound-based therapy as a complementary tool in therapy. Occupational therapy practitioners are advised to keep clear and concise documentation on the reasons for incorporating sound-based therapy into the child's therapy process and the improvements related to the family and child's goals for therapy.

6.4.3 For education

EBP and clinical reasoning were highlighted by the study participants as vitally important to the treatment of children with SPD. These two areas of practice should be fully incorporated and more comprehensively explored during the training of undergraduate students as this is an area of concern for the future of the practice.

Rigorous training in the critical appraisal of literature, research and training courses should be promoted at university to ensure that these students will become evidence-based and critical practitioners.

Occupational therapy students must have a firm understanding of the profession's philosophy and scope to ensure these additional tools they implement are true to the fundamentals and values of the occupational therapy profession.

6.5 SUMMARY

Sound-based therapy shows promise in being an effective tool in the treatment of children with SPD. Occupational therapists must use good clinical reasoning and EBP to determine the appropriate use of and recommendation for sound-based therapy for each child and family. This should be based on individualised intervention plans. There are some limitations in the generalisability of this study due to the small population; however, this study can be used as a basis for further research. This study suggested several recommendations to be implemented during further research—within the practice and education of occupational therapy students—specifically regarding EBP, occupational therapy's scope of practice and philosophy, clinical reasoning and the importance of supervision and mentoring.

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APPENDICES

APPENDIX A: INVITATION FOR PARTICIPATION IN RESEARCH STUDY

This invitation will be sent through to all occupational therapists on the OTASA database to invite occupational therapists working in the field of paediatrics to participate in the focus groups.

(Month) 2020

INFORMATION SHEET

Dear Occupational Therapists,
My name is Taryn Everett, and I am completing research for my master's degree at the University of the Witwatersrand.

I am inviting all occupational therapists working in the field of paediatrics who use sound-based therapies in the treatment of children with sensory processing difficulties to take part in a research project entitled:

Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties.

Please take some time to read the information presented here, which will explain the details of this project. Please ask the researcher about any part of this project that you do not fully understand.

Why have you been invited to participate?
The purpose of the study is to examine the perceived effectiveness of sound-based therapies on children with sensory processing difficulties. Sound-based therapy is often prescribed in conjunction with occupational therapy for various deficits in children with sensory processing difficulties and, depending on the child's needs, has been used to assist with the regulation of arousal and mood. Changes in behaviour related to social interactions, noise and visual stimuli, as well as improved balance, posture, fine motor control and visual-motor integration, have been linked to sound-based therapy, but more research evidence is needed on the effectiveness of this technique for children with sensory processing problems.

What will be expected?
You will participate in an individual interview of approximately 1 ½ hours where you will discuss open-ended questions. The interview will occur at a venue and on the time and day that is most suitable to the participant. You may be asked to review the analysis of the individual interview to ensure that the views and opinions were accurately portrayed.

Will you benefit from taking part in this research?
It is hoped that by discussing the questions in the interview during this research that you will develop a clearer idea of the nature of the intervention and the perceived effectiveness of sound-based therapies as a complementary occupational therapy technique for children with sensory processing difficulties in the South African context. The information can also assist in exploring the changes in occupational performance areas based on the clinical observations by the occupational therapists working with these children.

Are there any risks involved in taking part in this research?
No risks are expected for you by taking part in this research project.

Who will have access to your records?
All information that is collected will be treated as confidential and protected. No names will be recorded on any data collection sheets. Any personal information that is collected will only be accessible to the researcher and her supervisor. All data collected in the course of the study will be securely retained for two years if a scientific publication arises from the study or six years if there is no publication. Thereafter it will be destroyed accordingly.

Confidentiality:
All participant details will be kept confidential. The interview will be audio recorded, but the transcription will be kept confidential, and the transcriber will sign a confidentiality agreement.

Voluntary participation:
It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is entirely voluntary, and you are free to decline to participate. You are also free to withdraw from the study at any point, even if you do agree to take part.

Will you be paid to take part in this study, and are there any costs involved?
No, you will not be paid to take part in the study. Tea/coffee will be provided.

Is there anything else that you should know or do?

- You can contact the researcher, Taryn Everett, or her supervisor, Dr. Paula Barnard-Ashton, at the University of Witwatersrand (cell: 072 786 6984) if you have any further queries or encounter any problems.
- You will receive a copy of this information and consent form for your own records.
- This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee, Professor Clement Penny, who may be contacted by telephone on 011 717 2301 or by email at Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234, and the email addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this research information sheet.

If you are interested in participating in this research study, then please complete the demographic survey, which will take you no longer than five minutes, by clicking the following link:

https://redcap.core.wits.ac.za/redcap/surveys/?s=N4F8DEHPMW

Thank you in advance,
Taryn Everett

APPENDIX B: INFORMED CONSENT SHEET FOR OCCUPATIONAL THERAPISTS

INFORMED CONSENT SHEET

By signing below, I ……..…… (occupational therapist's name) understand what is required of me in the participation of the research entitled: ***Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties,*** and agree to participate.

I declare that:

- I have read or had read to me this information and consent form, and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions, and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary,** and I have not been pressured to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I consent to being audio recorded and that these recordings will be transcribed for the purpose of analysing the data.
- I acknowledge that my details will be kept confidential.

Signed at (*place*) .....…..…….. on (*date*) ……...……..

..... **.....**

Signature of participant Signature of witness

APPENDIX C: DEMOGRAPHICS SHEET

OCCUPATIONAL THERAPIST'S PERSONAL INFORMATION

This will be done using a REDCap survey and will be kept separately.

Please complete all the information where needed.

PARTICIPANT CODE:

SECTION 1: INFORMATION FOR PARTICIPANTS AND CONSENT

Thank you for being willing to participate in this research study entitled:

Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties.

Please read the information sheet, which will provide you with all the necessary information on this research study. If you happy with participating in this research study, you must provide your consent which acknowledges that you:

- Have read all the information and it is written in a language with which you are fluent and comfortable.
- Understand that taking part in this study is voluntary, and you have not been pressurised to take part.
- You may choose to leave the survey at any time and will not be penalised or prejudiced in any way.
- You acknowledge that my details will be kept confidential.

Please complete the demographic survey on the next page, which should take you no longer than five minutes. The following page will request your details (which will be kept confidential) to allow for arrangements to be made for the interview.

Thank you!

(The information study sheet will be included as a pdf document to be read before consenting to participate below)

1. Do you consent to participate in this study?

Yes	☐
No thank you	☐

2. Please sign to acknowledge your consent to participate

Participant to sign

3. Date of consent

Participant to add in date of consent

SECTION 2: DEMOGRAPHIC SURVEY

Please fill in the following information.

Please select more than one option if applicable.

Once you have filled in all the information, please press the "submit" button at the bottom to proceed to the next page.

4. What gender are you?

Female	☐
Male	☐
Other	☐

5. What age range do you fit into?

20 – 24 years	☐
25 – 29 years	☐
30 – 34 years	☐
35 – 39 years	☐
40 – 44 years	☐
45 – 49 years	☐
50 – 54 years	☐
55 – 59 years	☐

60+ years ☐

6. What is your highest level of education?

BSc (Occupational Therapy) or B (Occupational Therapy) ☐
MSc in Occupational Therapy ☐
Postgraduate Diploma in Occupational Therapy ☐
PhD ☐

7. Are you sensory integration (SI) certified?

Yes ☐
No ☐

If yes, the following question will be posed.

a. Through which institution have you become SI certified?

South African Institute of Sensory Integration ☐
Sensory Integration Network ☐
University of Southern California ☐
Other ☐

If other, then participant will be required to list the institution.

b. When did you become SI certified?

<1 year ☐
1-5 years ☐
6-10 years ☐
11-15 years ☐
16-20 years ☐
21-25 years ☐
26-30 years ☐
31-35 years ☐
36 years+ ☐

If no, the following question will be posed.

a. Are you currently in the process of becoming SI certified?

Yes	
No	

If yes, the following question will be posed.

a. Through which institution are you doing your SI certification?

South African Institute of Sensory Integration	
Sensory Integration Network	
University of Southern California	
Other	

If other, then participant will be required to list the institution.

8. How long have you been practising as an occupational therapist?

<5 years	
5-10 years	
11-15 years	
16-20 years	
21-25 years	
26-30 years	
31-35 years	
36+ years	

9. How many years have you been working with children with sensory processing difficulties (aged 0-18 years)?

<5 years	
5-10 years	
11-15 years	
16-20 years	
21-25 years	

26-30 years ☐
31-35 years ☐
36+ years ☐

10. Where is your practice based? (Mark all that apply)

Private practice ☐
Government ☐
School setting ☐
Hospitals ☐
Clinics ☐
NPOs/NGOs ☐
Other ☐

If other, then participant will be required to list other practice area.

11. What is the proportion (percentage-wise) of clients with sensory processing difficulties (no comorbid diagnoses, e.g. ASD or cerebral palsy) in your practice?

0-10% ☐
11-20% ☐
21-30% ☐
31-40% ☐
41-50% ☐
51-60% ☐
61-70% ☐
71-80% ☐
81-90% ☐
91-100% ☐

12. What is the age range of these clients?

0-4 years ☐
5-10 years ☐
11-15 years ☐

16-20 years ☐

13. Are you trained in a sound-based therapy?

Yes ☐

No ☐

If yes, the following question will be posed.

a. What type of sound-based therapy do you have at your practice that you are trained in? (Mark all that apply)

Auditory Integration Therapy ☐

Therapeutic Listening® ☐

Tomatis® Method ☐

Integrated Listening Systems ☐

Other ☐

If other, then participant will be required to list other sound-based therapies.

b. How many years have you been trained in your sound-based therapy/therapies?

<1 year ☐

1-5 years ☐

6-10 years ☐

11-15 years ☐

16-20 years ☐

21-25 years ☐

26-30 years ☐

31-35 years ☐

36 years+ ☐

If Question 13 is answered 'no' or 'yes', then Question 14 will be asked.

14. Do you refer clients out to receive sound-based therapy?

Yes	☐
No	☐

If Question 14 is answered 'no', then the survey will proceed to Question 15.

If Question 14 is answered 'yes', then the following question will be posed.

a. What type of sound-based therapy do you refer to? (Mark all that apply)

Therapeutic Listening®	☐
Tomatis® Method	☐
Auditory Integration Therapy	☐
Integrated Listening Systems	☐
Other	☐

If other, then participant will be required to list other sound-based therapies.

b. How many years have you been referring clients out for sound-based therapy/therapies?

<1 year	☐
1-5 years	☐
6-10 years	☐
11-15 years	☐
16-20 years	☐
21-25 years	☐
26-30 years	☐
31-35 years	☐
36 years+	☐

SECTION 3: INDIVIDUAL INTERVIEW

Thank you for completing the demographic survey. If you would like to participate in the research interviews, which will most likely occur in March-April, please provide details below for the researcher to contact you.

Thank you!

15. Would you be willing to participate in the research interviews?

Yes	☐
No	☐

If Question 15 is answered 'no', then the survey will be ended.

If Question 15 is answered 'yes', then the following questions will be asked.

Please provide me with the following details (which will be kept confidential) so that the researcher can contact you to arrange the interview time, place and venue:

Name: ……

Email address: ……

Cell number: ……

Area where you live: ……

Suitable times and days: ……

END SECTION

The below information will be displayed on completion of the survey.

Please contact me if you need any further information at taryn.occupationaltherapy@gmail.com

Thank you for your participation and willingness to participate in this research study!

Have a nice day!

APPENDIX D: INDIVIDUAL INTERVIEW QUESTIONS

Time for individual interviews: Approximately 60-70 minutes.

Question 1: How have you experienced using sound-based therapies in your practice with children with sensory processing difficulties?

Prompts

- What is your understanding of sound-based therapies?
- What type of sound-based therapies do you use at your practice?
- Why and how did you decide to incorporate it/them into your intervention for children with sensory processing difficulties?
- Why did you decide to incorporate this/these specific sound-based therapy/therapies into your practice over the other ones?
- When in the therapy process, do you normally recommend a child with sensory processing difficulties participates in a sound-based therapy and why?
- How do you decide when a child with sensory processing difficulties would benefit from participating in a sound-based therapy?
- If you are trained in or refer out to more than one sound-based therapy, how do you decide which one to recommend for the child?

Question 2: How have you perceived the effectiveness of sound-based therapies on these children's occupational performance outcomes?

Prompts

- How effective do you find sound-based therapy in general?
- Which client factors and performance skills of a presenting client do you feel benefit the most from participating in sound-based therapy, and how have you decided on this?
- When using sound-based therapy, what are the main occupational performance areas you address, and why did you choose these occupational performance areas?

- What are the main occupational performance outcome changes you have observed in children with sensory processing difficulties following sound-based therapy, and how have you observed this?
- Which sound-based therapy in your clinical experience have you found to be the most effective in treating children with sensory processing difficulties? Why?

APPENDIX E: INDIVIDUAL INTERVIEW FORMAT

Time scheduled for each group: Approximately 1-1 ½ hours.

Basic outline of the interview:

- Introduction to the researcher and the purpose of the study.
- Norms are established.
- Questions are then facilitated.
- Conclusion and researcher thanks the participant for their time.

On arrival

Participant will be given an information sheet and informed consent sheet to sign. Tea and coffee will be available during this time. If the participant has not yet completed the demographic survey, then the participant will have time to complete it via the REDCap survey link.

Opening (15 minutes)

"Hello. My name is Taryn, and I'm an occupational therapist working in the field of paediatrics. I have been trained in two different sound-based therapies and have seen the benefit of incorporating this into daily practice with children with sensory processing difficulties. Parents have, however, often asked which sound-based therapy is the best for their child, considering the costs and commitment to the programmes. I want to investigate the use of sound-based therapies to determine their effectiveness and when, why and how they are being used. So, the purpose of this interview is to get a better understanding from you as to what you are seeing clinically to better inform other occupational therapists about the nature of the intervention and perceived effectiveness of sound-based therapy on children with sensory processing difficulties. Are there any questions?"

Respond to participant questions.

"Let's go over some norms. First, let's turn off our cell phones so we are not interrupted. So, I can keep track of what people are saying, remember that we have one person talking at a time. Everything that you tell me will be kept completely

confidential. I will summarise the things that you tell me and combine it with the other interviews I am conducting. One of my jobs as the researcher is to make sure that we discuss all of the issues we planned to discuss. If I ask you questions while you are talking, then I'm not being rude; I'm just making sure that we discuss all of the issues."

"Are there any questions?"

Respond to participant questions.

"Let's begin."

Questions (60-70 minutes)
Question and prompts in Appendix D.

Conclusion (5-10 minutes)
"Is there anything else that you want to add?"

Respond to comments.

"Are there any final questions or comments?"

Respond to questions and comments.

*"*Thank you for participating in the interview today. I was excited to learn what you think about occupational therapy and the use of sound-based therapy."

APPENDIX F: TRANSCRIPTION CONFIDENTIALITY AGREEMENT

TRANSCRIPTION CONFIDENTIALITY AGREEMENT

Thank you for your participation in the research project: ***Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties***. Protecting the confidentiality of the research participants is essential, and you are, therefore, asked to sign the following confidentiality agreement.

I, _____, agree to maintain full confidentiality in regard to any and all verbal information and audio recordings received from the researcher for the above project. Furthermore, I agree:

1. To hold in strictest confidence the identification of any individual and the content of any discussion that may be revealed during transcription.
2. To not make copies of any audio files or computerised files of the transcribed individual interviews, unless specifically approved to do so by the researcher.
3. To store all audio files and materials in a password-protected computer or safe, secure location as long as they are in my possession.
4. To return all materials to the researcher in a complete and timely manner at the completion of transcription.
5. To delete all electronic files containing study-related documents or audio files from my computer hard drive and any back-up devices on completion of transcription.

I am aware that I can be held legally responsible for any breach of this confidentiality agreement and for any harm incurred by individuals if I disclose identifiable information contained in the audio files and/or files to which I will have access.

Name (printed) _____

Signature _____

Date _____

APPENDIX G: NOTETAKER CONFIDENTIALITY AGREEMENT

NOTETAKER CONFIDENTIALITY AGREEMENT

Thank you for your participation in the research project: ***Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties***. Protecting the confidentiality of the research participants is essential, and you are, therefore, asked to sign the following confidentiality agreement.

I, _____, agree to maintain full confidentiality in regard to any and all verbal information and observations recorded during the above project. Furthermore, I agree:

1. To hold in strictest confidence the identification of any individual and the content of any discussion that may be revealed during the focus group.
2. To not make copies of any of the observation notes taken down during the individual interviews, unless specifically approved to do so by the researcher.
3. To store all materials in a password-protected computer or safe, secure location as long as they are in my possession.
4. To hand over all the observation notes to the researcher in a complete and timely manner on completion of recording the observations.
5. To delete all electronic files containing study-related documents or audio files from my computer hard drive and any back-up devices on completion of recording the observations.

I am aware that I can be held legally responsible for any breach of this confidentiality agreement and for any harm incurred by individuals if I disclose identifiable information contained in the files to which I will have access.

Name (printed) _____

Signature _____

Date _____

APPENDIX H: ETHICAL CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Miss Taryn Everett

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M190918

NAME: (Principal Investigator)	Miss Taryn Everett
DEPARTMENT:	Occupational Therapy
PROJECT TITLE:	Occupational therapists' experiences of sound-based therapy on occupational performance outcomes in children with sensory processing difficulties
DATE CONSIDERED:	27/09/2019
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Miss Paula Barnard-Ashton
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	24/10/2019

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

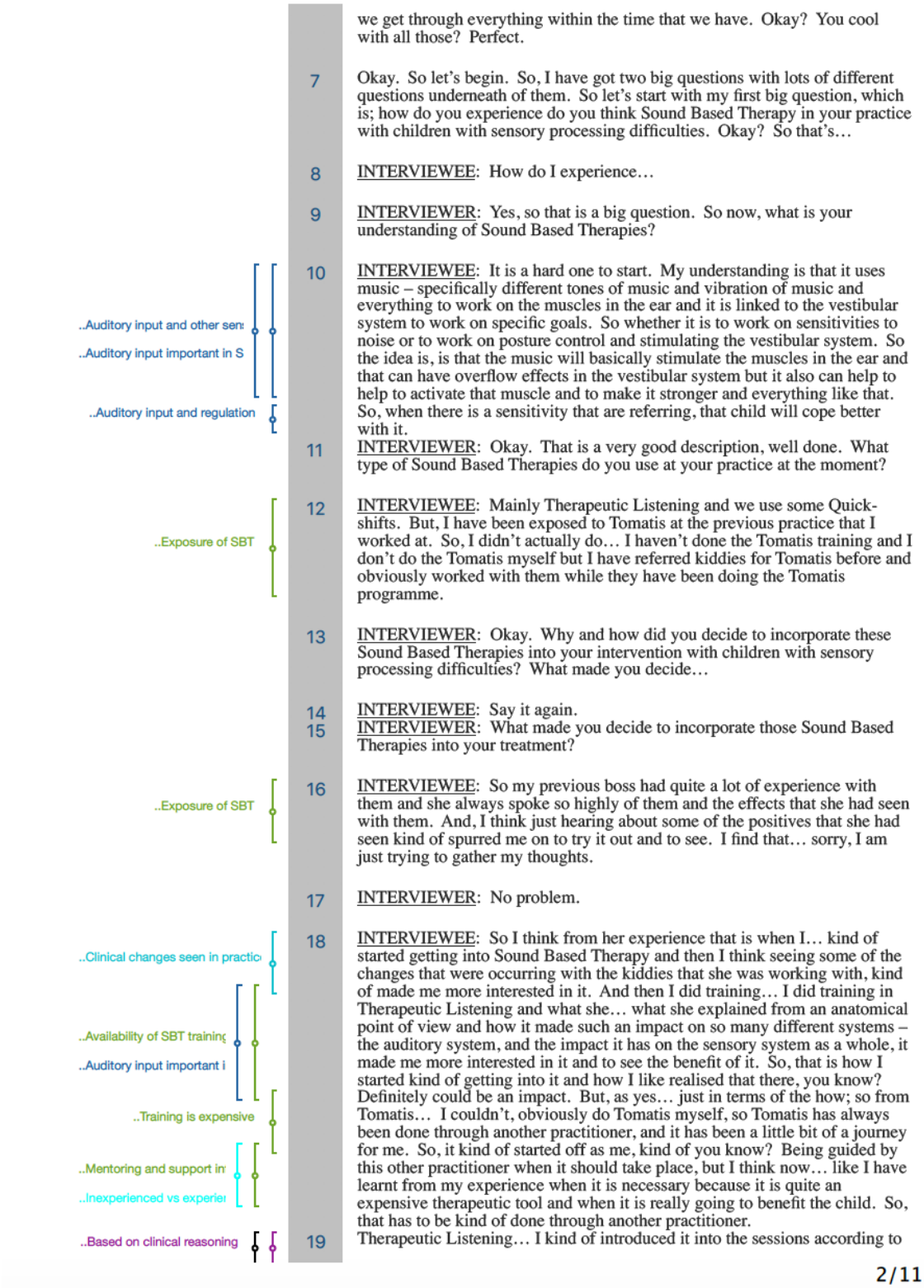
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **September** and will therefore be due in the month of **September** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date 23/10/2019

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX I: EXCERPT OF CODING OF AN INDIVIDUAL INTERVIEW



we get through everything within the time that we have. Okay? You cool with all those? Perfect.

7 Okay. So let's begin. So, I have got two big questions with lots of different questions underneath of them. So let's start with my first big question, which is; how do you experience do you think Sound Based Therapy in your practice with children with sensory processing difficulties. Okay? So that's…

8 INTERVIEWEE: How do I experience…

9 INTERVIEWER: Yes, so that is a big question. So now, what is your understanding of Sound Based Therapies?

10 INTERVIEWEE: It is a hard one to start. My understanding is that it uses music – specifically different tones of music and vibration of music and everything to work on the muscles in the ear and it is linked to the vestibular system to work on specific goals. So whether it is to work on sensitivities to noise or to work on posture control and stimulating the vestibular system. So the idea is, is that the music will basically stimulate the muscles in the ear and that can have overflow effects in the vestibular system but it also can help to help to activate that muscle and to make it stronger and everything like that. So, when there is a sensitivity that are referring, that child will cope better with it.

11 INTERVIEWER: Okay. That is a very good description, well done. What type of Sound Based Therapies do you use at your practice at the moment?

12 INTERVIEWEE: Mainly Therapeutic Listening and we use some Quick-shifts. But, I have been exposed to Tomatis at the previous practice that I worked at. So, I didn't actually do… I haven't done the Tomatis training and I don't do the Tomatis myself but I have referred kiddies for Tomatis before and obviously worked with them while they have been doing the Tomatis programme.

13 INTERVIEWER: Okay. Why and how did you decide to incorporate these Sound Based Therapies into your intervention with children with sensory processing difficulties? What made you decide…

14 INTERVIEWEE: Say it again.
15 INTERVIEWER: What made you decide to incorporate those Sound Based Therapies into your treatment?

16 INTERVIEWEE: So my previous boss had quite a lot of experience with them and she always spoke so highly of them and the effects that she had seen with them. And, I think just hearing about some of the positives that she had seen kind of spurred me on to try it out and to see. I find that… sorry, I am just trying to gather my thoughts.

17 INTERVIEWER: No problem.

18 INTERVIEWEE: So I think from her experience that is when I… kind of started getting into Sound Based Therapy and then I think seeing some of the changes that were occurring with the kiddies that she was working with, kind of made me more interested in it. And then I did training… I did training in Therapeutic Listening and what she… what she explained from an anatomical point of view and how it made such an impact on so many different systems – the auditory system, and the impact it has on the sensory system as a whole, it made me more interested in it and to see the benefit of it. So, that is how I started kind of getting into it and how I like realised that there, you know? Definitely could be an impact. But, as yes… just in terms of the how; so from Tomatis… I couldn't, obviously do Tomatis myself, so Tomatis has always been done through another practitioner, and it has been a little bit of a journey for me. So, it kind of started off as me, kind of you know? Being guided by this other practitioner when it should take place, but I think now… like I have learnt from my experience when it is necessary because it is quite an expensive therapeutic tool and when it is really going to benefit the child. So, that has to be kind of done through another practitioner.

19 Therapeutic Listening… I kind of introduced it into the sessions according to

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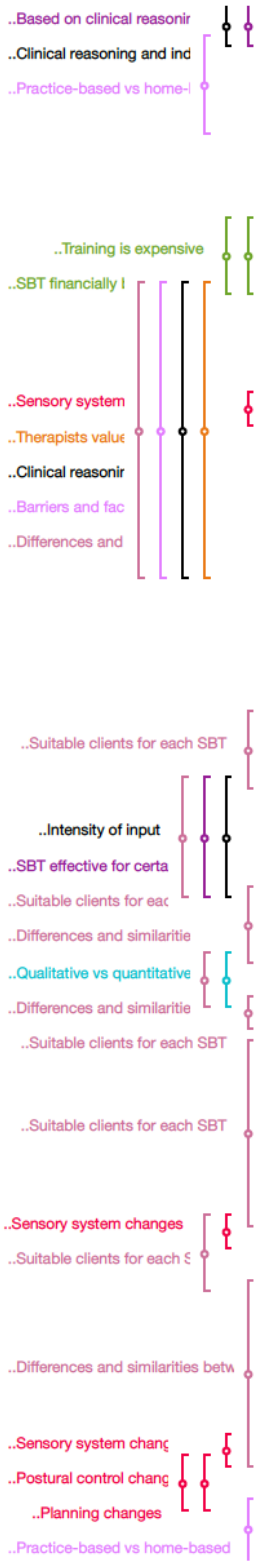


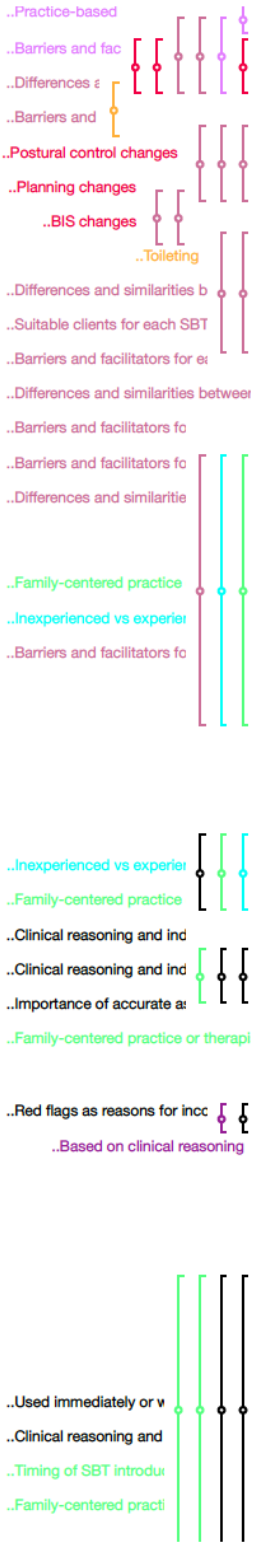
what the child's goals are. So there is different albums and I do according to what the child's goals are. So whether it is posture control and I want to activate it, I will use obviously a very rhythmical music to try and activate the posture control and then I see how they will respond. And then, start introducing it at home or Quick-shifts is kind of what we do in the session itself.

20 INTERVIEWER: Okay. And, just tell me the reasoning behind why you chose to be trained in Therapeutic Listening versus Tomatis?

21 INTERVIEWEE: I am very aware of the cost of sound therapy and I think for me, Tomatis is something that you can refer someone to. So, there are so many practitioners that are trained in Tomatis, and if you feel that a person needs Tomatis you can refer them on. What I liked about Therapeutic Listening is that it is something that is more cost effective for parents. It also is something that you can test out beforehand. So Tomatis you put them in and they have got to, kind of commit to the programme and you can test them out beforehand and see the response. And, I found it covered a little bit more than Tomatis. I find Tomatis is very good at core sensory modulation difficulties whereas Therapeutic Listening is… it covers more… like you can get, you know? Target posture control and that kind of thing. So for me from a like a practitioner point of view, I always try and find ways to make things accessible for the parents but also cost effective. Therapy is a very expensive process and to kind of expect them to go through the Tomatis route from a cost perspective is… yes, it is a bit much for me. But also, I find that it is not always the most effective. So, I find Therapeutic Listening can work on things that Tomatis can't always work on.

22 INTERVIEWER: And, so elaborate more on the differences and the benefits between Tomatis and Therapeutic Listening – it is quite an interesting perspective to have.

23 INTERVIEWEE: I find Tomatis is very good for children that have quite significant sensory modulation difficulties, and specifically those who are on the spectrum or have a more… their diagnosis is more severe than generalised sensory processing disorder. So I find it is good, it is intensive. It is hard for the parents but it is an intensive amount of time and I think what is good about that is, a lot of these kids, you know? That are on the spectrum or have an additional diagnosis to sensory processing – they are in therapy for a very long time. And so, Tomatis is a short… it's is intensive and you see changes quite quickly and so, I think that is very beneficial. It is also easier for those kiddies to keep the headphones on because of the vibration. So the bone conduction device, they find it a bit easier to keep the headphones on, and you know? You obviously… that's a benefit. I do also think it is nice in Tomatis, you can do a listening test and so… to do a listening test and then you can show the parents the impact of Tomatis later on. So, it works very well for our kids who are more severely affected. And I mean, even just from a planning point of view for them, it makes a huge, huge difference. I don't really see as much benefit for kiddies that are generalised just normal Sensory Processing Difficulty, specifically when it is discrimination that they are struggling with; there is not as much of a shift. And, I think parents often… And, I… This has just been my experience – I have got quite a few friends whose kiddies have done OT and they have been through the Tomatis process, a lot of them have just said they did not really see a huge change. So, I think for kiddies that are, you know? Not as significantly impacted by condition, they… you don't see as much of a change and then you question whether it is worth it. So for me, as I said Sensory Modulating difficulties that are quite significant, specifically those kiddies that are, you know? Have an additional diagnosis to Sensory Processing Disorder. Whereas Therapeutic Listening, it does work on a sensory modulation and there is no bone conduction device. So if your kiddie struggles to keep the earphones on, then it becomes a lot more challenging and sometimes it is worth it to say go on to Tomatis first and then go on to Therapeutic Listening if they are really, really struggling. So… but at the same time, I have managed to get kiddies though it but, it is harder. It is much harder and much more challenging for the parents from that perspective. So yes, I find it works well on sensory modulation difficulties but not to the same extent. And, I find that it works very well on things like motor planning and on posture control difficulties because of the rhythm and the timing of the music. So it is nice to kind of do some music beforehand and then you can kind of see a change in how the child is responding. So I love



that, I think it is nice. It is short, it is half an hour. It is twice a day but, it is half an hour. So yes, if a parent commits to it, I have seen some really nice changes in specifically like the motor planning and posture control, the bilateral integration with Therapeutic Listening. And, I have also seen some really nice changes in toileting with Therapeutic Listening, which is very interesting. Yes, so that is kind of the distinction – I find that the kids that aren't as… their sensory processing isn't as affected or impacted, I see more of a response with Therapeutic Listening. Where the problem comes in, to be honest is that parents don't always commit to it. So, Tomatis is obviously a huge… they are paying a lot of money so they commit to the process a lot easier. Whereas Therapeutic Listening I find that they… even if they bought headphones and they have got the music – we generally rent out our headphones, they… yes, it is because there isn't a huge cost over it and it is longer. So, I think that is kind of how people… it takes a lot longer to get through it and you have obviously got to change albums, whereas Tomatis is a set amount of time. Does that make sense?

24 INTERVIEWER: Yes, that does make sense. Just one to clarify, do you often give parents the choice between Tomatis or Therapeutic Listening or do you generally recommend one for that specific child?

25 INTERVIEWEE: No, I generally recommend… to be honest… I think for me, like… it is a very good question. I have never actually thought about it from that perspective. I think I just know, for me I know which one works or not. And so I don't want to send them down a route that, you know? Could be very expensive and then it is not effective. I also don't want parents to… sometimes I do find if they really… like you know? If they need Tomatis and they really… from a financial point of view, they are really struggling. So, sometimes I do from that perspective. So, I will say to them, you know? Listen, ideally you should be doing Tomatis or more… it is going to be more effective for your child but, this is another therapy that is, obviously more cost effective for you. So, if I am offering Tomatis and Therapeutic Listening I like to kind of give them both choices. Whereas, if it is just one… they just need Therapeutic Listening, I am not necessarily going to offer them Tomatis. You know what I mean?

26 INTERVIEWER: Okay.

27 INTERVIEWEE: So… yes, because obviously they need to know what's the benefit of it but obviously I will explain what the benefits are and why Tomatis is so expensive and why, you know? I think that one would be better for their child.

28 INTERVIEWER: Okay. So it is sort of based on your clinical reasoning and what the child's difficulties are within your therapy sessions that you've observed as to which Sound Based Therapy you are going to go towards.

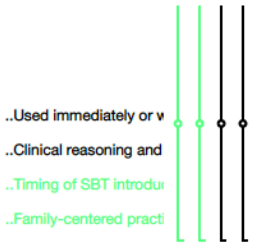
29 INTERVIEWEE: Exactly, yes.

30 INTERVIEWER: Okay.

31 INTERVIEWEE: So depending on how the child is presenting, yes.

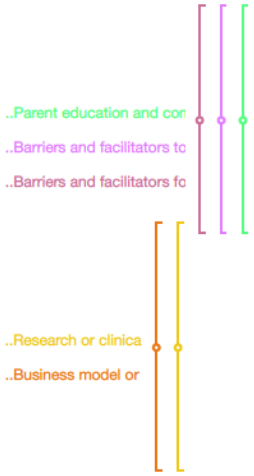
32 INTERVIEWER: And, when basically in the therapy process do you generally recommend Sound Based Therapies? Because there have been some therapists that do it in the beginning, some in the middle, some at the end – what is your clinical experience of it?

33 INTERVIEWEE: It is dependent on the child and how they are presenting, to be honest. I think sometimes it is worthwhile to just start off with some Sound Based Therapy but, you know? Sometimes a child also needs to you know? You need obviously build that report and they need to… they need to be exposed to a bit of the therapy first. So for example, if you are trying to get them to put headphones on and they are not necessarily going to cope, it is more beneficial to start off with some therapy and then kind of bring it in at a later stage. I really don't like to bombard parents in the first initial feedback. So I think in the past, like there have been a lot of therapy tools that have been recommended and, obviously you know? You have got to give them the best picture that you can, like this is what you can do. But, I feel that parents get bombarded when there is just too much. So what I do is, if I feel that a child



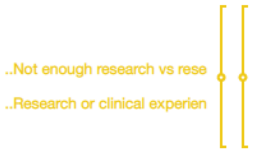
is really going to benefit from it from the get-go, then obviously I will say. Otherwise, if I feel that we could do some therapy, I might present it to the parents, and say "this is an additional therapy, he must do more." But often I like to see where the child is at and how they respond to the therapy process because sometimes I find a child with significant Sensory Modulation difficulties does so well in therapy, that to spend money on expensive programmes such as Tomatis which I would have wanted them to do initially, doesn't become such a big thing and I can do Therapeutic Listening. So, it really is based on case by case, you know? If the child is quite severely impacted, then it might be worthwhile to start off with Tomatis. But yes, generally I start… I do it case by case. Does that answer your question?

34 INTERVIEWER: Yes, it does. And how do parents basically respond to the recommendation of Sound Based Therapies, in terms of using it as a complimentary tool or in terms of like Therapeutic Listening, which is quite a commitment and Tomatis which is also quite a commitment but also quite costly. How have you found parents reactions towards it?



35 INTERVIEWEE: I have had very varied responses. The Therapeutic Listening, they are quite… they are a little bit more willing to try it out. I don't always find they commit to it. So, they… sometimes they start out and they are like "oh, this is amazing" and they start out, and the first few weeks they go really well and you see nice changes but they don't always commit to the long-term process. They are more willing to try out Therapeutic Listening, I think it is because of the cost indication. So I find that yes, from that perspective, they are more willing to find out more and try. I have always found that they are interested in the idea of Sound Therapy and most of the time I find that parents are open to the idea of some Sound Therapy in sessions, so that is beneficial. I have found quite a few parents question the research basis to Sound Therapy. So, you know? You are obviously recommending this but, you know? What is the research base? How much has it actually made a difference to the therapy? So I have had quite a few people question, especially lately and I have also had a few people question that… specifically Tomatis, that that is a bit… it is made to look quite flashy so the website is very flashy and it sort of draws you in that way. And I think for them, they kind of like how much of it is a marketing ploy and how much to it is actually an effective therapeutic tool? You know? The fact that with Tomatis you can be anything and you can train in it, and it has been a concern to some of them. You could be… yes you could be a music teacher. You can train in it and advise people. Yes…

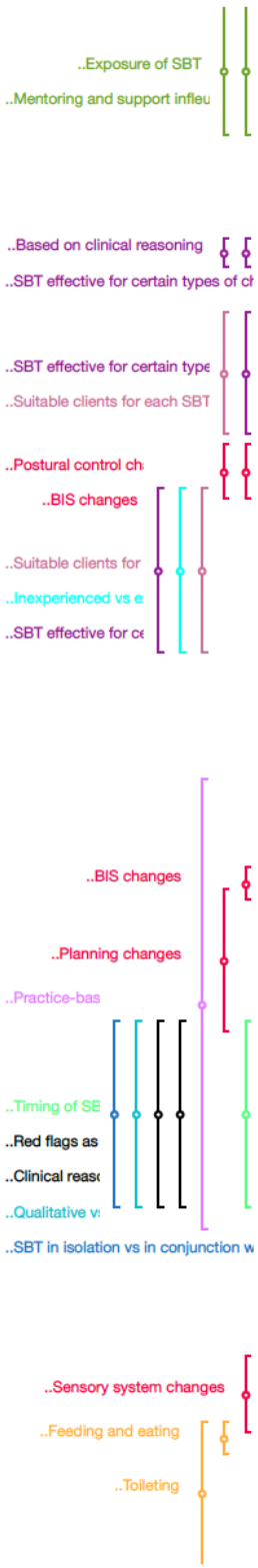
36 INTERVIEWER: And, what do you think about the research behind the Therapeutic Listening and the Tomatis programmes? Just in your personal opinion.



37 INTERVIEWEE: I don't think there is enough but I think it is hard also to do. So, I think there needs to be more of it – I really do think there needs to be more of it. And, it is a concern to me that there isn't enough research. But, at the same time I also… I have seen it work, so it is a hard one. It really, really is a hard one because there are benefits to it but obviously there isn't enough and there isn't enough good research to be honest – from what I have seen.

38 INTERVIEWER: Okay. So, based on the fact that you have seen changes, I am not going to sort of try and facilitate a discussion around what changes you have seen. I know that you have sort of spoken a little bit about your previous practitioner where you had seen some changes with Tomatis and you have obviously seen some changes with Therapeutic Listening. So, I would really like to get some more information from you. I just, before we go onto that, wanted to ask you… so there are other Sound Based Therapies that are available, what made you decide on… just to clarify, what made you decide on Tomatis and Therapeutic Listening rather than like, the Safe Sound Protocol, the Auditory Integration Therapy, the Integrated Listening Systems and all those other wonderful Sound Based Therapies?

39 INTERVIEWEE: I think it's just purely was something I was exposed to at the practice but also something that is also more common in South Africa. Other Sound Therapies haven't really taken root in South Africa to be honest. I think the Integrated Sound Therapy… I have heard a little bit about that but overall those were the ones that everyone kind of spoke about and that had seen changes with. So, I kind of went with what is available. You know? In



my last practice I got, like mentored. So, you know? She had… my boss had so much exposure to Sound Therapy, she obviously gave me mentoring on the ones that she was familiar with, and those were the ones that she was familiar with. So, it was really what was available and what was more common in South Africa, and what she was familiar with. Yes… but that is kind of how I got into it.

40 INTERVIEWER: Perfect, perfect. And tell me, how effective do you find Sound Based Therapies in general?

41 INTERVIEWEE: It is so dependent on the child. Like… and I think what cases you are working with. I wouldn't necessarily… if it was a handwriting child, I am not going to use, you know? Sound Based Therapy, just… yes, I don't think it is necessarily going to make an impact at all. So it really depends on like what your case load is and what kind of kids you are seeing, to be honest. I have seen some really effective results with kiddies that are on the spectrum or kiddies that have quite, you know? That are generalised disfunction in terms of sensory processing or have significant sensory processing difficulties, or have another as I said, have another diagnosis. So, the way I have seen it, it is really effective. And, I have seen some nice changes in kiddies that maybe just have postural control, bilateral motor control difficulties but not always to the same extent. So, it is so dependent on your case load and it is so dependent on the child. I mean, if you are only working with kiddies that are maybe in a mainstream school, I don't know if you are going to see that much impact. But if you are working with kiddies that have, obviously more significant diagnosis which is what we see quite a lot of, I think you do see quite a good change. So, it really is dependent on case by case and what the case load is that you are seeing. Yes, that is my experience.

42 INTERVIEWER: And you mentioned a few different, like clinical features like bilateral integration and motor planning in terms of those being more beneficial. How do you basically come to that decision? Or, that conclusion based on what you have seen?

43 INTERVIEWEE: I think it is just the impact of what you have seen. So, you can… what I do like about Therapeutic Listening is that you do it in a session. So, you have seen a child for a number of different sessions and then you put on some earphones and music, and suddenly it like… things start clicking into place. Like, you start seeing that they can integrate the two sides of the body together. That there planning shows improvement. I mean, if I took about like an example, I had a little boy who was so disorganised in his base, that he just… he couldn't come up with a plan, he couldn't organise what he needed to and I put some earphones on and some music, and suddenly this little boy could, you know? Figure out what he needed to and he didn't get completely side tracked with everything in the environment. So, like that's what I have seen. I see it first hand, or I see a child… and that is why sometimes I like to wait before I actually say; "let's do a Sound Therapy," is you see the difference. And then you know it is actually working. You know? You can say; "is it working now, is it not?" So, like you can start off with therapy and you see some kiddies that have such bad planning problems and you know? You often, you know? In the session you have seen changes but you are not seeing them to the same extent as you wanted – you put them on a Sound Based Therapy and send it home and suddenly like things start falling into place for them. So, yes that kind of… if that answers your question. Kind of what I… yes.

44 INTERVIEWER: And, what other things are you sort of seeing in terms of like that boy that you mentioned? What other clinical changes have you seen with some of your kids or what have parents mentioned to you that they have noticed being changed with the use of Sound Based Therapies?

45 INTERVIEWEE: So, one of the biggest things I have seen from a Sensory Motor perspective… I mean, I have kiddies that have been very, very sensitive to movement. There has been a big shift in how they… they now want to go on swings and they want to try those things out. I have seen some kiddies that refuse to eat anything besides toast to like have a more varied diet. I have also seen changes in toileting – I have seen two sides of toileting. I have found that sometimes Sound Based Therapy can cause a little bit of a regression in toileting, although it does correct itself. And, I have also seen that some kiddies start to actually use the toilet when they didn't before. So, that's been

APPENDIX J: EXAMPLE OF FULL CODING FOR SUSTAINABILITY

Theme 3: The effectiveness of sound-based therapy on children with SPD		
Category	**Subcategories**	**Codes**
The effectiveness of sound-based therapy	Prolonged gains post-intervention	• Lasting effect

Codes and related quotes

Code	**Related quotes**
Lasting effect	**P1: "**I have, yes. I think it does last. It is hard, also to know… I think, sometimes, it is a springboard in your therapy process. So, you start with it, and then it kind of helps to get things going for the child. And then, the therapy itself often helps to maintain things. I think it is hard to know what the lasting effect is for a child if you are not… if you don't do it without the therapy process. So, whether it is going to maintain it, if you are going to be able to maintain it without therapy, I don't know because I haven't done it without therapy. You know what I mean? So, whether it is a therapy that is maintaining it or whether it is the sound therapy, it is difficult to tell. But, if I look at a child that has done sound therapy, I don't really see after that a huge amount of regression from… you know? You do the sound therapy, and then you see such amazing changes, and then it disappears. I don't find that. But, it is also how to know, kind of, how to know how much of that is also… because they are, obviously in a therapy process so, that is also helping them to maintain it. Yes. So, it is a bit of a hard question to answer." **P1: "**Sometimes more effective because… well, I think it is because it is so targeted, you know what I mean? So, parents see the impact when they are doing… they listen to the music; the parents see the impact almost straight away or during that time. So, you know? In that sense, like if it is helping get a child through homework, that is very effective. The problem is, I don't think it is long lasting. So, I don't find it lasts as long as committing to a, like, listening programme. So, it is very effective at that moment. Whereas, if you did a sound-based therapy, you are not necessarily going to see changes right there and then. With Quickshift you sometimes do – you see a change there and then. And, you know? Obviously, that child is getting to do their homework, or the child is, you know, coping better with an extramural task like swimming. And so, there and then it is effective, and if I had to think about that from a clinical point of view, if they are coping better, they are developing those motor patterns, and they are developing better motor patterns, you know, when they are doing their swimming, so it is going to help them in the long term. But, I must say, it doesn't have the same long-lasting effect as actually being part of a therapy process, like a… I mean, like a listening process, like a Therapeutic Listening, not Tomatis, and I think it is purely because of the intensity of the programmes. If you commit to something intensively, you commit to therapy twice a day or once a day every day, you are going to see changes. I think it is because of the intensive nature of it. Yes…" **P2: "**Okay. I think it depends on which one, to be honest. I have found when I have used the iLs, it kind of … I mean, it's hard to tell because things change on the day, but I have found probably, like, a few weeks with the iLs children to be honest. But I haven't … I have had to, like … we've done, like, two sets… two iLs trials with Client Y and needing to, like, go back to it. Like, it's definitely not a once-off-fix-all kind of programme. And that it's something that is more of a tool that could maybe be incorporated within therapy, not necessarily just a once-off intervention." **P4: "**So I've had one or two children for whom it's been very successful but unsustainable. In the number of, I mean, I'm using that term very colloquially, you know, there's a handful for whom it's been successful but unsustainable."

	P4: "And then, there are always the parents who are slightly resistant in the first place, and then you're never really sure if they report that it's working or not working, or taking too much time, or whatever the case might be, is because the effort that they might have to put in, on the home programme. But the kids who've worked through several cycles, I have found, you know, to have really benefited from." **P4: "**I very seldom have had a parent come back and say, 'Wow, that changed my life', you know, but perhaps, if they went through more cycles of it, they would do that." **P5: "**I haven't found any of the Therapeutic Listening® and the Quickshifts to be, like, sustainable. It's almost like it helps get the kid to where you want them to be, but they can't— it's not long term. You've got to actually do the therapy to make it, like, functional." **P3: "**It was like they had a therapy intensive over a period of time, and the effects were completely sustained. I think that's the bit that impresses me the most about Tomatis. I don't know about the ill effects being sustained—certainly the benefits. The benefits are absolutely sustained and impact the child in a whole number of different areas. Almost too broad to describe." **P6: "**But he wrote a chapter in one of his books, Tomatis and the [science] behind it, and that, and how it keeps working. It was also one of the reasons that I went further because they reckon if you don't do that active part, you know, where you are talking. The first part is the passive part, where you just listen. The second part is when you either sing or talk or read or something like that, then you are not doing the proper Tomatis programme. So, that's also why I carried on."

APPENDIX K: TURNITIN REPORT

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CONFIRMATION OF PROFESSIONAL EDITING

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To whom it may concern,

I hereby confirm that I have copy-edited Taryn Maree van der Westhuizen's dissertation titled:

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I addressed language and grammar use, consistency, referencing style and formatting. I did not change the content, nor did I rewrite the document.

Yours sincerely,

Elize Berman
BSc Hons (cum laude); MSc (cum laude)
Professional Editors' Guild member

Please contact me if you require more information.