SENSORY PROCESSING AND BEHAVIOUR PROFILING OF NEUROTYPICAL CHILDREN.

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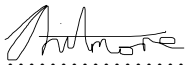
DECLARATION

I, **Tamryn Catherine Paulsen** declare that this research report is my own work. It is being submitted for the degree of **Master of Science in Occupational Therapy** in 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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ABSTRACT

This study investigated the sensory processing and behaviour profiles of 138 neurotypically developing children aged between six and ten years. A cross-section quantitative descriptive approach explored correlations between sensory processing and behaviour. Parents completed a demographic questionnaire and teachers completed The Sensory Processing Measure and Conners 3 rating scales.

The majority of participants presented with typical sensory processing and behavioural profiles. A portion of participants presented at risk of occupational dysfunction as a result of atypical profiles. The highest frequencies of dysfunction occurred in three sensory processing systems, namely ‘Social Participation’, ‘Planning and Ideas’, and ‘Balance and Motion’. Results revealed 30.37% of participants met the clinical symptom criteria for atypical Defiance/Aggression, Learning Problems, and ADHD. Of participants, 49.63% presented with one or more atypical anxiety behaviours; and 50.37% presented with one or more depressive behaviours. Moderate positive correlations between certain demographic characteristics, sensory processing profiles and behaviour profiles were observed.

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OPERATIONAL DEFINITIONS

Attention Deficit Hyperactive Disorder (ADHD): Persistent clinical pattern of inattention and/or hyperactivity-impulsivity that may manifest as academic, occupational, or social impairment (American Psychiatric Association, 2013).

Balance and Motion (BAL) SPM Scale: Ability to maintain balance, coordination, and sense orientation in relation to gravity. BAL is associated with execution and control of coordinated body movements (Parham et al., 2007).

Body Awareness (BOD) SPM Scale: Ability to sense the position in space of limbs, fingers, and other body parts. Proprioception is an essential part of coordinated movements such as grasping a pencil or catching a ball (Parham et al., 2007).

Defiance/Aggression (AG): Features include argumentative, defiant to authority, poor control over emotions such as anger and frustration leading to loss of temper, difficulty complying to norms and rules, and be prone to destructive behaviours (Sparrow, 2010).

Definitive Dysfunction Range on SPM (T-Score range of 70–80): Indicates significant sensory processing difficulties which may have an overt impact on the child's daily functioning, which may manifest across multiple sensory systems (Parham et al., 2007).

DSM-IV Symptom Scales: Based on three DSM diagnoses: 1) ADHD by subtype: a) Inattention and b) Hyperactivity/Impulsivity; 2) Conduct Disorder; and 3) Oppositional Defiant Disorder. Symptoms alone are insufficient for making a diagnosis but are useful in understanding variance in behavioural-emotional presentation (Sparrow, 2010).

Executive Functioning (EF): Initiating and completing tasks may be challenging, may rush to complete the task with reduced quality. Planning, organising and prioritising skills may require assistance (Sparrow, 2010).

Externalising behaviours: Outwards behaviour that affects the external environment. Features of externalising behaviour may include disruptive, hyperactive, aggression and delinquency, under-controlled and antisocial behaviours (Eisenber et al., 2001).

Global Index (GI): Indicator of overall behavioural psychopathology. A high GI T-Score can be associated with broad issues in general behavioural and/or emotional functioning. Typical features of a high GI score may include moodiness, emotional, restless, impulsive, or inattention difficulties (Sparrow, 2010).

Hearing (HEA) SPM Scale: Indicator of auditory processing and identifies if over or under-responsivity, seeking behaviour, and perceptual difficulties exist in the auditory system. Examples of hearing processing include the child's response to sounds and determining location of sounds (Parham et al., 2007).

Hyperactivity/Impulsivity (HY): Features include fidgeting, increased activity levels, restlessness, difficulty staying on seat, may be 'on the go', impulsive, interrupts others inappropriately, and difficulty with quiet time (Sparrow, 2010).

Inattention (IN): Reduced concentration/attention or difficulty in sustaining their focus on the task at hand. Features include difficulty focusing on one thing at a time, distractible, poor perseverance, loss of interest, poor task initiation and/or completion (Sparrow, 2010).

Internalising behaviours: Behaviours that affect a child's internal psychological environment rather than the external world. Features include anxiety, social withdrawal, inhibited or depressive mood, or over-controlling behaviour (Eisenber et al., 2001).

Learning Problems (LP): May have difficulty in academic concepts such as reading, mathematics, spelling and so on. May require additional one on one assistance in class when learning and remembering new concepts (Sparrow, 2010).

Learning Problems/Executive Functioning Combined (LE): Difficulty coping with academic workload and executive functioning at school, learning and remembering new concepts may be challenging, and repeating instructions may be required frequently (Sparrow, 2010).

Neurotypical: Defines the developmental achievement of physical, cognitive, social-emotional and sensory milestones within typical age-appropriate parameters. (Case-Smith & O'Brian, 2010)

Over-responsive: Relate to "aversive or defensive reactions to non-noxious stimuli across one or more sensory systems" resulting in changes in arousal, affective tone and stress (Wilbarger & Wilbarger, 2012).

Peer Relations (PR): Child's ability in forming and maintaining relationships. Disfunction may present as difficulty with social skills, may be the outlier in peer circles and may appear to be unaccepted by the group (Sparrow, 2010).

Planning and Ideas (PLA) SPM Scale: The ability to conceptualise, plan and organise movements in order to engage successfully in novel motor tasks. Praxis is considered to be an outcome of executive cognitive functioning that relies on the integration of multisensory inputs, particularly proprioception and tactile perception (Parham et al., 2007).

Responsiveness: A form of sensory vulnerability which represents disturbances of sensory modulation, in which a child's attention or emotional reaction to sensory input departs from a typical or expected response, i.e. over/under-responsive (Wilbarger & Wilbarger, 2012).

Sensory Integration: Complex neurological processing within the central nervous system relating to modulation, discrimination, perception and praxis functions, required to organise incoming sensation from body and environment (Ayres, 1972).

Sensory-Seeking Behaviour: Seeking additional sensory inputs to compensate for limited perceived experience with the sensory environment as a result of under-responsiveness in one or more sensory systems. Sensory seeking may result due to atypical internal processes such as unstable sensory modulation (Reynolds, Shepard & Lane, 2008).

Sensory Vulnerabilities: Clusters of SPM items that represent the child's descriptive clinical presentation of sensory integration, processing and praxis abilities (Parham et al., 2007).

Social Participation (SOC) SPM Scale: Peer and social interactions, including working as part of a team, resolving peer conflict without teacher intervention, handling frustrations, playing and engaging with peers, maintaining appropriate personal space and eye contact, and shifting conversation topics between peer and self-interests (Parham et al., 2007).

Some Problems Range (T-Score range of 60–69) on SPM: Indicates mild to moderate difficulties in behavioural or sensory functioning (Parham et al., 2007).

The Diagnostic and Statistical Manual of Mental Disorders (DSM): Classification system used by clinicians to understand mental disorders in terms of clinical, biological, psychodynamic, cognitive, behavioural, interpersonal/family systems (American Psychiatric Association, 2013).

Total Sensory Systems (TOT) SPM Scale: A composite score of five sensory systems including vision, hearing, touch, body awareness, balance and motion, plus the addition of a subcategory of taste and smell processing. This represents the general sensory processing of the child (Parham et al., 2007).

Touch (TOU) SPM Scale: This scale reflects the child's tactile or touch system and processing. Items screen for tactile defensiveness or over-responsivity, as well as under-responsivity, and seeking behaviours. Items include tolerating different sensations on the hands and body or showing distress to different tactile inputs (Parham et al., 2007).

Typical Range (T-Score range of 40–59) on SPM: Indicates the child's sensory functioning is similar to that of typical children, allowing for occasional minor problems in sensory processing which is within the normal variability that may describe the typically developing child (Parham et al., 2007).

Under-responsive: The central nervous system has difficulty registering and processing a sensory stimulus. This relates to a manifestation of behaviours such as apathy, indifference or lack of response to sensory experiences (Parham et al., 2007).

Vision (VIS) SPM Scale: Indicates visual processing and identifies if over-responsivity, under-responsivity, seeking behaviour, and perceptual difficulties exist. Examples include visual distractibility, squints/covers eyes or complains about visual stimuli, spins or flicks objects in front of eyes, stares intensely or shows distress at the change in lighting (Parham et al., 2007).

ABBREVIATIONS

ADHD	Attention Deficit Hyperactivity Disorder
AG	Defiance/Aggression
AH	DSM-IV ADHD Hyperactive/Impulsive subtype
AI	ADHD Index Scale
AN	DSM-IV ADHD Inattentive subtype
ASD	Autism Spectrum Disorder
BAL	Balance and Motion Sensory Processing System
BOD	Body Awareness Sensory Processing System
CD	DSM-IV Conduct Disorder
DCD	Developmental Coordination Disorder
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition
EF	Executive Functioning
GI	Global Index
HEA	Hearing Sensory Processing System
HY	Hyperactivity/Impulsivity
IN	Inattention
LE	Learning Problems/Executive Functioning
LP	Learning Problems
OD	DSM-IV Oppositional Defiance
PLA	Planning and Ideas Sensory Processing System
PR	Peer Relations
SOC	Social Participation Sensory Processing System
SOR	Sensory Over-Responsivity
SUR	Sensory Under-Responsivity
SPM	Sensory Processing Measure
TOT	Total Score in Sensory Processing Systems
TOU	Touch Sensory Processing System
VIS	Vision Sensory Processing System

CHAPTER 1: INTRODUCTION

1.1 PREFACE

Much literature exists examining maladaptive sensory processing and behaviour in young children and youth population, particularly in association with disability, diagnoses and atypical development. Even in recent years, literature has emerged on the postulated link between these neurophysiological systems of sensory processing, the nervous system and behaviour within populations representing atypical development and presentation (Schaaf et al., 2010). However, minimal research and evidence-based practice have come into fruition regarding the neurotypically developing child population, and the postulated relationship between sensory processing and behaviour without the presence of illness, disability or diagnosis.

School-based occupational therapy practitioners compromise a sizeable portion of occupational therapists practising in South Africa. These practitioners aim to use meaningful activities to assist children to participate in what they need and want to do, and aim to promote physical, mental and social well-being (The AOTA Workgroup of Leaders in State Departments of Education, 2017). Occupational therapy addresses the physical, cognitive, psychosocial-emotional and sensory aspects that constitute performance (American Occupational Therapy Association, 2014). School-based occupational therapists pay special attention to a child's educational, self-care, play, social, leisure and transitional skills (Coster & Frolek-Clark, 2013). Whilst many occupational therapists working in this setting focus on strategies for children with disabilities such as cerebral palsy, Down Syndrome, or Autism Spectrum Disorder (ASD), an inclining number of practitioners service the mainstream school environment where traditional disabilities are minimal.

Due to mounting global interest in sensory processing and behaviour within the child population and school context, further investigation has been highlighted as a key priority (Delsemme, 2015). It is well documented that children who present with sensory processing disorders display the inability to process or regulate the intensity and nature of response to daily sensory stimuli resulting in maladaptive behavioural responses (Miller et al., 2007). Such children are known to have difficulty processing, adjusting and responding to sensory stimuli

within the school context, and often underperformance in academic amongst other occupational areas can result (Ben-Sasson, Carter & Briggs-Gowan, 2009). In recent years, sensory modulation disorders specifically have been linked to internalising behaviours such as anxiety and social withdrawal and externalising behaviours such as inattention and restlessness (Gourley et al., 2013; Tauby, 2016; Ogundele, 2018). Advances in neuroscience have also contributed to the understanding of the neurophysiological relationship between sensory processing and behaviour, or rather the maladaptive functioning of these two systems (Lane, Reynolds & Thacker, 2010). Current advances in neurophysiological functioning can be used to identify and differentiate sensory over-responsivity as biophysiological dysregulation which has been linked to unpredictable behaviour, poor range of adaptive responses, reduced sensory habituation, excessive level of basal arousal, increased sympathetic nervous system and stress and anxiety response, and reduced parasympathetic nervous system involvement to maintain a calm, alert state of body (Mangeot et al., 2001; Miller et al., 2007; Schaaf et al., 2003, 2010).

Maladaptive sensory processing and behaviour can be debilitating on a child's occupational performance and scholastic engagement due to the nature of interaction with cognitive, sensory, motor and social-emotional development (The AOTA Workgroup of Leaders in State Departments of Education, 2017). The relationship between sensory processing, behaviour and occupational performance within a school environment is an important consideration for children of all abilities. A concern for school-based occupational therapy practitioners is that sensory processing disturbances can be substantial enough to impact on a child's behaviour and performance within a school environment, but are, however frequently misinterpreted, labelled as difficult children or go undetected (Ben-Sasson, Carter & Briggs-Gowan, 2009). A delay in academic performance and skill development may have a variety of foundations, but it is proposed that difficulty in sensory processing and self-regulation may adversely affect the child's ability to attend to tasks and manage their behaviour (Lynn et al., 2011). For these reasons, understanding sensory and behavioural profiling for children of all abilities, including the neurotypical child, is important.

This quantitative research study explores the sensory processing and behaviour profiles in neurotypically developing children and investigates potential correlations between sensory processing and internalising and externalising behaviours in children ages six to ten.

1.2 STATEMENT OF THE PROBLEM

The researcher, an occupational therapist servicing a variety of mainstream and specialised educational needs schools, noted that an increasing number of neurotypically developing children are referred to occupational therapy. Referral commonly includes the aim of assisting a child in their occupational performance in educational activities, successful engagement in the scholastic environment, as well as supporting the development of age-appropriate client factors (body functions, values and beliefs) and skills (motor, process and social interaction) needed for successful participation within the school environment. The researcher noted that upon assessment of these children, presentation of sensory processing disruptions and/or maladaptive behaviours often present as main concerns. Many occupational therapists assess and treat children with and without disability or diagnosis, therefore understanding the neurophysiological and social-emotional processes within the typically developing child is equally as important as a child with a disability, condition or diagnosis.

Ayer's Sensory Integration ® as a framework and therapeutic tool has gained global interest in research around children with atypical sensory processing. Understanding sensory integration and the neurobehavioural mechanisms involved with maintaining homeostasis in the central nervous system is, however not well documented in the typically developing child. This is even less so in the South African population.

As adequate sensory processing is necessary for adaptive behaviour, it is possible that internalising and externalising behaviours seen in the classroom are a manifestation of atypical sensory processing abilities (Schaaf et al., 2010). Sensory modulation in recent literature refers to the ability to regulate, monitor and respond to sensory inputs within the central nervous system, creating the foundation for meaningful participation in occupations (Dunn, 2006). Behavioural manifestations and sensory processing disorders such as sensory over-responsivity (SOR) and a sensory modulation disorder (SMD) have been well cited in the literature in a variety of atypical childhood developmental conditions and disorders (Dunn, Saiter & Rinner, 2002; Gourley et al., 2013; Miller et al., 2007). Researchers and theorists have established that SMDs such as over-responsivity amongst other sensory processing disorders have been linked to dysregulated behaviour and reduced cognitive, social and motor skills (Ayres, Robbins and Pediatric Therapy Network, 2005). An emphasis on understanding neurophysiological and behavioural systems in both the typical and atypically developing child has implications for

how these behaviours are managed within the classroom and warrants further investigation. In doing so, this will contribute towards the design of more efficient treatment goals and intervention strategies as well as aid collaboration between educators, schools and occupational therapists, in assisting with the development of more proficient learner support strategies.

The question that arises from this literature is whether typically developing children without diagnosis, who present with neurotypical sensory processing abilities are consistent with typical behaviour patterns. In addition, within a sample of typically developing children, the prevalence of sensory processing and behaviour difficulties experienced is largely unknown. Lastly, the question is raised, that should a population of neurotypically developing children present with sensory processing and behaviour difficulties, what are the strategies available to support these children within the context of their school environment to ensure occupational success.

Exploration of the aetiology and profiling of current sensory and behavioural systems in typically developing children has important implications for providing up-to-date, evidence-based preventative and therapeutic intervention strategies for clients, educators and other health care providers.

1.3 PURPOSE OF THE STUDY

This study was developed in response to the need for further investigation into sensory processing and behaviour of the neurotypically developing child within the school context. Many children who are referred to occupational therapy within a school setting present with sensory processing and behavioural difficulties without a formal diagnosis or childhood condition. It is proposed that a child who presents with adequate sensory processing and behaviours may be more successful within an educational setting; therefore it is imperative to gain further insight into the sensory and behaviour profiles within a sample population of neurotypical school-going children. The purpose of this study is to investigate the nature of and possible relationship between sensory processing and internalising and externalising behaviours within a population of typically developing children aged six to ten years, in the classroom environment.

1.4 RESEARCH QUESTION

What do sensory processing and behaviour (internalising and externalising) profiles look like in neurotypically developing school-going children? Are there associations between demographic characteristics in relation to sensory processing and behaviour? More so, are there correlations between sensory processing and behaviour in a neurotypically developing population of children?

1.5 AIM OF THE STUDY

This study aimed to investigate sensory processing and behaviour (internalising and externalising) profiles in a sample of neurotypically developing children aged six to ten years, within the mainstream school environment in the foundation phase of education (grades one to three). Consideration of participant demographic characteristics and possible associations with sensory processing and behaviour was explored. The study further aimed to investigate possible correlations between sensory processing and behaviour.

1.6 OBJECTIVES OF THE STUDY

1. To describe the sensory processing profiles in a sample of neurotypically developing children.
2. To describe the behaviour profiles (internalising and externalising features) in a sample of neurotypically developing children.
3. To investigate whether certain demographic characteristics are associated with sensory processing and behaviours (internalising and externalising features).
4. To determine whether correlations exist between sensory processing and behaviour (internalising and externalising features).

1.7 NULL HYPOTHESIS

1. Sensory processing and behaviour have no association with demographic characteristics.
2. A correlational relationship does not exist between sensory processing and behaviour (internalising and externalising features).

1.8 JUSTIFICATION OF THE STUDY

For a child journeying through the foundation phase of education, academic success, social participation, and occupational performance constitute key roles. For school-based occupational therapists, consideration of the child's occupational performance and engagement within the context of their school, home and community settings is essential in designing appropriate intervention strategies that facilitate growth in client factors (body functions, beliefs, and values), and skills (motor, process and social participation) required for successful engagement (American Occupational Therapy Association, 2014). In today's practice, many paediatric occupational therapists work within the mainstream school environment amongst other multidisciplinary team members. Since occupational therapy services are rendered for the promotion of health and well-being for children with disability and non-disability needs, it is of concern that minimal empirical evidence exists regarding sensory processing and behaviour profiling in neurotypically developing children. Limited research is available to support the proposed relationship between sensory processing and behaviour within a mainstream school environment, which many paediatric occupational therapists service. Even more so, limited research and literature exist regarding typical and atypical sensory processing and behaviour profiling, two topics which have piqued interest in occupational therapy over recent years, particularly in the unique South African context.

Investigating sensory processing and behaviour in typically developing children, may provide useful information to support and update approaches and strategies used within the classroom and school environment by occupational therapists and educationalists. Not only is the child a focus of school-based occupational therapy services, but the school itself may benefit from training, education, support and advocacy using an up-to-date understanding of children and the developmental trends and profiling that are forthcoming. In support of this rationale, the aim of this study was to investigate the nature of and possible relationship between sensory processing and internalising and externalising behaviours in a population of typically developing children aged six to ten within the mainstream classroom environment.

1.9 SIGNIFICANCE OF THE STUDY

1.9.1 Occupational Therapy Profession

At the centre of occupational therapy, the use of occupations to promote participation in life is a key foundation principle. As stated by the American Occupational Therapy Association's Practice Framework: occupational therapy's scope of practice is defined as:

> the therapeutic use of everyday life activities with individuals or groups for the purpose of enhancing or enabling participation in roles, habits, and routines in home, school, workplace, community and other settings (American Occupational Therapy Association, 2014: 1).

A child's ability to function and participate in everyday activities is thus viewed as a self-motivated, dynamic relationship between the person, interchanging environments, and assorted occupations. The role of the school-based occupational therapist with children encompasses occupational performance areas, such as education, play, leisure, social participation and activities of daily living. This study provides valuable insight into a neurotypically developing child's sensory processing, and behaviour profiling within one of their primary occupational settings, namely the classroom environment, and the impact these systems may have on their level of engagement, success and occupational performance.

1.9.2 Theoretical Constructs

This research was founded on two quintessential occupational therapy theorists namely, Dunn (2007) and Miller et al. (2007) who described models of sensory integration, processing and modulation and their relationship to behaviour and occupational performance. The theories that underpin these models propose that observable behaviours are explicitly linked to sensory integration and processing. The theories highlight the impact of these functions when there are dysfunction and its resultant disruption to occupational performance. Miller's contribution to the sensory integrative frame of reference and approach to sensory processing supported the current study.

Miller's et al. (2007) Ecological Model of Sensory Modulation (EMSM) proposed that four external dimensions namely culture, relationships, tasks, and environment interact with and affect three internal dimensions namely sensation, emotion, and attention. Subsequently, if a

good fit exists between external and internal dimensions, adaptive performance and ability to complete the task at hand is the successful outcome. On the contrary, a discrepancy or poor adaptation between external dimension's demands and internal dimension's, the unsuccessful outcome results in maladaptive behaviours in the child (Miller et al., 2007). Miller et al. (2007) classified these maladaptive behaviours as a sensory modulation disorder (SMD). Therefore, a child who exhibits a disturbance to their sensory modulation and processing can be understood in the context of their external and internal dimensions (Miller et al., 2007). This study provides valuable insight and expansion into how this theory interacts within a sample population of neurotypical children, and importantly the application within the South African context.

1.9.3 Mainstream School Environment

Since this study was conducted within two mainstream school environments, the results will provide a stepping stone for insight on the profiling of sensory processing and behaviour within a neurotypically developing sample that may be carefully considered when reflecting on the greater child population. This research aims to contribute towards future research as well as support strategies in collaboration with educators within the mainstream school system.

1.10 SUMMARY

There is substantial literature that indicates a relationship between sensory processing and behaviour in children with difficulties in these functions. Minimal empirical evidence supports the understanding of sensory processing and behaviour in the neurotypically developing child, even less so within the South African population. Occupational therapists may engage in a multitude of approaches and strategies when addressing sensory processing and behaviour in the typically developing school-going child. An understanding of a child's sensory processing and behaviour related to their daily occupations within their school environment would be beneficial in the concurrent development of effective intervention approaches, contribute to the understanding of the typically developing child, as well as scholarship within the school and classroom context. The development of appropriate treatment plans (both preventative and therapeutic) that encompass physical, social and emotional considerations with environmental influences will lead to successful occupational outcomes. It was towards the goal of increasing knowledge and understanding in these areas that the study was undertaken.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION TO THE CHAPTER

This chapter will review the literature regarding sensory processing and behaviour profiling in children and will serve as the foundation for the current study. It will review the theoretical constructs and neurophysiological basis of sensory processing and internalising and externalising behaviour. The relationship between sensory processing and behaviour will also be considered. The review concludes with a reflection of the South African context and summary of current literature.

2.2 THEORETICAL AND NEUROPHYSIOLOGICAL CONSTRUCTS OF SENSORY INTEGRATION

The term sensory integration was developed by Jean Ayres and describes the principles within the frame of reference (Ayres, 1979). Sensory integration is the normal neurological process of organising sensory information which we encounter every day (Ayres, 1979). Sensory integration is required not only for survival but also to lead satisfying lives where we are able to learn and engage within the world around us (Ayres, Robbins and Paediatric Therapy Network, 2005). Sensory information is received through visual, auditory, olfactory, gustatory, tactile, vestibular, proprioceptive and interoception systems (Ayres, Robbins and Pediatric Therapy Network, 2005).

Sensory integration is a theoretical framework used to understand sensory systems, sensory processing and the effect on occupation (Ayres, 1979). It is a developmental process, whereby incoming sensory information is analysed and organised by multiple systems within the central nervous system (Ayres, 1972). As infants, this process provides the primitive foundation on which we engage, respond and adapt to our environment, allowing for learning and meaningful engagement throughout our developmental trajectory and lifespan (Ayres, Robbins and Pediatric Therapy Network, 2005). Since sensory integration refers to the ability to identify and organise sensory information, successful sensory integration leads to accurate adaptive responses, appropriate reaction to sensory stimuli, and meeting challenges efficiently in our environment (Ayres, 1979). In doing so, a child develops the ability to participate in more

complex tasks, requiring higher levels of motor, perceptual and cognitive demands, through each successful environmental challenge, adaptive response and sensory organisation (Parham & Mailloux, 2010).

Ayres' sensory integration was used to identify patterns of perceptual-motor dysfunction, which continued to evolve into refinement of these patterns throughout the 1970s and 1980s (Ayres, 1972; Ayres, Robbins and Pediatric Therapy Network, 2005). Ayres (1979) suggested that by linking a sensory-based activity to neurobehaviour, one may assist a child in achieving successful adaptive responses. Adaptive responses, defined as an appropriate response to an environmental demand, allows for successful adaptation to and engagement in the environment (Ayres, 1979). Through opportunities requiring sensory integration, a child is faced with environmental demands, which results in adaptive responses and subsequent meaningful interactions with their environment. Ayers highlighted the relevance of sensory integration to occupation, which strongly impacted the occupational therapy scope of practice and the evolution of assessment and intervention (Ayres, 1979).

Understanding the functions of the central nervous system offered beneficial contributions to a therapeutic intervention that incorporates sensation to affect multisensory perception that will influence learning and behaviour. Ayres (1972) proposed that through the development of these sensorimotor functions and, specifically, by facilitating adaptive somatomotor responses, a child can develop improved learning, reading, math, visual perception, auditory perception, and skilled motor tasks. Advances in neuroscience defined sensory integration as the physiological cellular process whereby two or more senses are combined in the central nervous system (Davies and Gavin, 2007). From a neurophysiological standpoint, our ability to adapt and respond to both our external and internal environments are regulated through the autonomic nervous system's motor, sensory, visceral, and neuroendocrine modulatory functions, by two neural pathways namely the sympathetic and parasympathetic nervous system (Brett-Green et al., 2010). The sympathetic and parasympathetic neural pathways form the foundation for self-regulation and adaptation to environmental changes (Brett-Green et al., 2010). Sympathetic pathways mediate intermittent 'fight, flight or fright' responses necessary for survival, whereas parasympathetic pathways mediate a calm, restful state necessary for environmental engagement such as arousal, salivation, lacrimation, urination, digestion and defecation (Brett-Green et al., 2010).

Several updated taxonomies describe the theoretical constructs of sensory integration and processing, whereby new knowledge is being generated and previous paradigms challenged (Schaaf & Davies, 2010). A model that delineates two subtypes of sensory integrative function, namely dyspraxia and poor modulation was subsequently established (Bundy, Lane & Murray, 2002). With the development of measurement tools that specifically evaluate sensory modulation, namely the Sensory Profile and the Sensory Processing Measure, this further introduced new data which guided the understanding of the continuum from over-responsiveness and under-responsiveness to sensation, as well as behavioural responses to sensation based on underlying sensitivity (Schaaf & Davies, 2010). Suggesting sensory processing and specifically underlying sensitivity may be as a result of sensory behaviours such as seeking, registration or avoiding, as well as sensory modulation, or low registration (Schaaf & Davies, 2010).

A recent proposal called for sensory integrative dysfunction to be renamed to sensory processing disorders (Miller et al., 2007). The proposed nosology was suggested to assist in the diagnostic categorisation, however there is no consensus as yet in the field, and further empirical evidence is required (Schaaf & Davies, 2010). Since no consensus has been established, it was decided to trademark the principles and theory relating to "Ayres Sensory Integration ®" to avoid confusion between sensory integration and sensory processing (Lane et al., 2019). As it stands, sensory processing refers to a heterogeneous set of abilities which contributes towards the manner in which we use sensory information required for emotional regulation, motor abilities, social interaction, and occupational engagement in daily activities (Miller et al., 2017).

2.3 TYPICAL SENSORY PROCESSING FUNCTIONING

Sensory information is processed amongst multiple sensory systems and not in isolation (Ayres, Robbins and Pediatric Therapy Network, 2005). Ayres stated three key notions for successful sensory integration: learning takes place as an outcome of positive association, enjoyment, reward or reinforcement; one learns through interaction and engagement; and learning occurs through meaningful engagement and when there is purpose (Lane et al., 2019).

Ayres et al's (2005) framework of sensory integration, is based on five assumptions that posit typical functioning:

1. Neuroplasticity exists within the central nervous system, thus allowing for neural changes to occur through the use of sensory integration interventions
2. Sensory integration is a natural developmental process and is sequential in nature
3. Whilst the brain is comprised of hierarchical systems, it functions as an integrated unit
4. Adaptive responses result due to sensory integration; adaptive responses result in more efficient sensory integration
5. Through sensorimotor activities, children have an inert drive to develop sensory integration

Bundy stated a key postulate of typical sensory integration theory as "Learning is dependent on the ability to take and process sensation from movement and the environment and use it to plan and organize behaviour" (Bundy, Lane & Murray, 2002: 5.). Miller et al., (2007) further established an extension to typical sensory integration, who described the psychophysiological associations between sensory defensiveness and responses to sensory stimuli by measures of parasympathetic and sympathetic systems (Miller-Kuhaneck et al., 2007; Schaaf et al., 2003).

Dunn additionally contributed to the understanding of typical sensory integration and stated that an individual's response to sensory stimuli is as a result of the interaction between two parameters: the neurological thresholds and the behavioural self-regulation strategies (Dunn, Saiter & Rinner, 2002). Neurological thresholds refer to the quantity or intensity of incoming stimuli required in order for the individual to react or perceive that specific incoming sensory stimulus (Dunn, 1997, 2007). Behavioural self-regulation strategies, which are of significant importance to the current study, refer to the manner in which the individual responds to that specific incoming sensory stimulus (Dunn, Saiter & Rinner, 2002). The concept of "behavioural self-regulation strategies" is of significant importance to this research in understanding the proposed link between sensory processing and behaviour, albeit frequently described in the literature regarding atypical development and maladaptive sensory processing.

Typical sensory processing is deemed as smooth, prompt analysis of sensory information that once processed by the central nervous system would lead to the organisation of movement and behavioural responses, which allow for occupational engagement, learning, play, and meaningful interaction (Miller et al., 2017). The occurrence of sensory processing disruptions

in typical child populations, otherwise known as idiopathic sensory processing disorder, is postulated at 5–10% (Ahn, Miller, Milberger & MacIntosh, 2004).

The Sensory Processing Measure (SPM) has been widely recognised both internationally and within the South African context, albeit typically used in a population identified with known sensory processing difficulties, as a tool to obtain a profile of how a child processes sensory information, how they participate in social circumstances, and how they plan, execute and sequence motor tasks (Van Jaarsveld et al., 2016). Although the SPM has been standardised on the American child population, no such tool has been standardised within the South African population, making it a viable tool to evaluate sensory processing profiles within this research and to provide further investigation into the sensory processing profiling of the South African child population.

For the purpose of this study and use of the SPM, sensory processing will be referred to as the complex sensory processing which involves the neural processes of receiving, registering, modulating, organising, and integrating sensory input in order to execute successful adaptive behaviours for daily activity (Van Jaarsveld et al., 2016). Thus, sensory processing can be used as an umbrella term for the processes of sensory discrimination, sensory modulation and praxis which are required for successful interaction in occupations (Van Jaarsveld et al., 2016). Whilst not all occupational therapists and authors may agree, it has been suggested that sensory integration and sensory processing may be used interchangeably. For the purpose of this research the terms “sensory integration” and “sensory processing” are viewed as equivalent and as such, “sensory processing” has been used throughout.

With the continuous updates in taxonomies between sensory integration and processing, for the purpose of this study, sensory processing is intended to reflect the entire continuum of sensory abilities and dysfunction (Miller et al., 2017). The focus of this literature review will aim to describe the recent acknowledgements in neurodevelopmental, behavioural and functional characteristics and correlations to sensory processing and dysfunction.

2.4 ATYPICAL SENSORY PROCESSING FUNCTIONING

Ayres identified sensory integrative dysfunction, now known as sensory processing disorder (SPD), as a compromised ability to process and organise sensory information, unable to produce and maintain an appropriate response to sensory information, resulting in maladaptive engagement (Ayres, 1979; Dunn et al., 2002; Miller et al., 2007). Research suggested that when a child's sensory processing is compromised, multiple types of sensory integration difficulties often result and may be manifested within more than one sensory system (Parham & Su, 2014). It is thus possible due to the dynamic nature and symptomology of sensory integration that multiple sensory systems and features of dysfunction intermingle significantly (Miller et al., 2007). According to the Sensory Processing Measure Manual, atypical TOT scores were highly associated with learning difficulties, sensory processing dysfunction, Autism Spectrum Disorder, ADHD/ADD (Attention Deficit Hyperactive Disorder/Attention Deficit Disorder), speech and language impairments, visual processing impairments, developmental delay, motor disorders, and emotional and behavioural disorders (Parham et al., 2007). These findings were supported by Miller's (2006) research which suggested 70% of children with sensory processing disorders have more than one type of sensory problem – sensory discrimination, sensory modulation and even postural ocular control difficulties. Miller (2006) classified this presentation as "combination disorders". For example, perception may be affected by both discrimination (a child that is unable to discriminate textures due to reduced tactile discrimination) and modulation (a child who is unable to filter out extraneous information and is over-responsive to sensory information) thus resulting in a "combination disorder" of sensory integration (Miller et al., 2007; Miller, 2006).

The validity of sensory integrative dysfunction and SPD, which was first established in the 1960s, has however been questioned in recent literature. An updated nosology since proposed three patterns of SPD, namely sensory modulation disorder, sensory discrimination disorder and sensory-based motor disorder (Miller et al., 2017; Miller et al., 2007). Whilst SPD has not been recognised by the internationally accredited Diagnostic and Statistical Manual of Mental Disorders (DSM-V) or the International Statistical Classification of Disease and Related Health Problems (1CD 10), recognition has been noted by the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, the Psychodynamic Diagnostic Manual, and Diagnostic Manual for Infancy and Learning Disorders

(Interdisciplinary Council on Developmental and Learning Disorders, 2005; Miller & Brout, 2015).

A primary challenge with SPD and research was establishing a homogenous sample population with similar features, which as a result of heterogeneity would affect the validity of findings (Miller-Kuhaneck et al., 2007; Schaaf et al., 2003). Despite challenges for recognition, Miller and colleagues' nosology of SPD assisted in the collection of empirical evidence, as classification of SPD has become more accurate, homogenous samples can be collected for research, making for more precise and accurate results (Van der Linde, 2016). A challenge faced in SPD research is the limited volume and high-quality empirical evidence, which is predominantly focussed on atypical populations; thus, sensory processing profiling within typical sample populations is scarce. Sensory integration has faced criticism around the validity in diagnosis, and controversy around efficacy in assessment and treatment techniques thus emphasising the need for clearer categorisation and terms (Miller et al., 2007). A tremendous burst of research and articles on sensory integration has since followed, indicating a need for more evidence-based practice and empirical research. As a result, there is a high demand for sensory processing-based research.

Interestingly, a USA based study concluded that sensory features in typically developing children had no significant gender differences (Little et al., 2018). Contradicting literature has shown males as having more disturbances in their sensory processing than females (Reebye & Stalker, 2008). In another study investigating ASD, girls with autism indicated sensory sensitivity which was associated with connectivity between the salience network (modulation centers) and language cortical regions; in comparison to sensory sensitivity in boys which was associated with connectivity between the salience network and sensory cortical areas (Green et al., 2013). Both girls and boys with ASD differed on brain connectivity related to sensory seeking behaviours, whereby girls showed connectivity between modulation centers and the prefrontal cortex in comparison to boys that presented connectivity between the salience network to sensory regions as well as several interior brain areas (Green et al., 2013). No conclusive evidence has established gender differences in relation to sensory processing abilities, this is primarily due to the diverse population groups used in varying research markers.

Atypical Sensory processing is not as a result of hard neurological damage, however research supports that there are known neurological biomarkers (Chang et al., 2015). Several studies have evaluated specific biomarkers which have been helpful in establishing diagnostic features of sensory processing difficulties. McIntosh et al. (1999) explored sympathetic nervous system involvement in sensory processing by looking at electrodermal reactivity during the administration of sensory stimuli. The study found that atypical sensory processing in children resulted in abnormal electrodermal responses and habituated slower to sensory inputs. Schaaf et al. (2010), indicated that children with modulation difficulties presented with atypical cardiac vagal tone in comparison to typical children.

Davies & Gavin (2007) explored the relationship between EEG technology in identifying sensory processing disorders. The study indicated that EEG indicates unique neural processing in children with SPD. Chang et al., (2015) as well as Owen et al. (2013) found that children with SPD displayed different white matter structuring in comparison to neurotypical children using diffusion tensor imaging. Whilst these studies contribute significantly to the understanding of biological markers in SPD, ongoing conclusive evidence is still required.

Whilst biomarkers are useful in establishing neurological features of atypical sensory processing, many theoretical foundations exist, particularly around that of sensory modulation.

Sensory modulation refers to the ability to regulate, monitor and respond to sensory inputs within the central nervous system, creating the foundation for meaningful participation in occupations (Dunn, 2006). Modulation is a rudimental function of the CNS which allows for appropriate responses to both habituated, familiar and non-threatening sensory responses as well as responding to unfamiliar, threatening responses for survival and protection (Dunn, 2006; Lane et al., 2019). Sensory modulation provides maintenance of a calm yet alert state, optimal level of arousal and attention in order to produce appropriate adaptive responses and meet environmental challenges and prevents over- and under-reactions (Parham & Mailloux, 2010). Sensory modulation disorder (SMD) is, therefore, a maladaptive ability to regulate the intensity and nature of response to sensory information, resulting in poor organisation and adaptation to environmental demands (Dunn, 2006). Miller described three categories of SMD, namely sensory over-responsivity, under-responsivity and sensory seeking (Miller-Kuhaneck et al., 2007). As individuals perceive sensory information differently, SMD is marked by hypo- or hypersensitivity to what would otherwise be considered normal levels of that sensory input,

and when impaired regulation affects one's occupational performance in daily activities (Dunn, 1997; Parham et al., 2007).

According to Miller et al. (2007) under and over-responsiveness are as a result of sensory modulation disruptions, where the child's attention and emotional reactivity to sensory information are atypical. The response is defined as abnormal due to the under- or over-reactivity in response to the sensory input (Bar-Shalita, Vatine & Parush, 2008; Miller et al., 2007). Over-responsivity frequently manifests as aggressive, withdrawn or fearful responses; whereas under-responsivity frequently manifests as indifference, apathy, or lack of appropriate responses to sensory inputs (Miller et al., 2007). Sensory seeking behaviour is another disturbance of sensory modulation. Seeking behaviours is frequently associated with many underlying disturbances and is considered to be related to under-responsiveness (Mangeot et al., 2001; Miller et al., 2007). Ayres et al. (2005) suggested that a child who has limited sensory experiences may seek strong levels of sensory input as a compensatory response of under-responsiveness (Ayres, Robbins and Pediatric Therapy Network, 2005). Other literature stated that some children seek sensory experiences as a result of previous sensory deprivation or limitation (Miller-Kuhaneck et al., 2007). Miller et al. (2007) elaborated that sensory seeking may result due to atypical sensory modulation where previous sensory experiences were limited due to sensory avoidance or over-reactivity (Miller et al 2007). Some children may seek sensory experiences only in an environment or situation where they can control the direction of the sensory input, where typically the sensory experience would result in an over-reactive response or avoidance (Parham et al., 2007). Miller et al. (2007) hypothesised that sensory seeking can coexist with under- and over-responsiveness and that the child should be considered across multiple environments, occupations and sensory systems (Miller et al. 2007). Recent literature supports that children with SMD were more likely to present with behaviours such as inattention, hyperactivity, impulsivity, anxiety, and disorganisation (Bar-Shalita, Vatine & Parush, 2008; Ben-Sasson, Carter & Briggs-Gowan, 2009; Parham et al., 2007).

Sensory discrimination disorders typically refer to difficulty detecting the location, intensity and timing of a sensory stimulus or detecting multiple sensory experiences (Parham et al., 2007). Discrimination of sensory systems allows for an accurate understanding of where, how, and when sensory information is perceived (Parham et al., 2007). Miller-Kuhaneck et al. (2007) described sensory discrimination based on each individual sensory system, namely visual, auditory, tactile, vestibular, proprioceptive, and taste/smell. As discrimination is based on the

reception of sensory input, and modulation is based on the neurobehavioural response to the sensory input, maladaptive behaviour is linked to SMD rather than a discrimination disorder (Bar-Shalita, Vatine & Parush, 2008; Parham et al., 2007).

A child's ability to adapt and respond to their sensations (the ability to notice, perceive, organise and integrate information from their internal and external environments) contributes significantly to self-regulation (Shimizu, Bueno & Miranda, 2014). A child with difficulty in regulating sensory information regarding their proprioception, vestibular, visual, auditory, gustatory, olfactory and tactile sensory systems can lead to sensitivity towards modulating sensory stimuli (Baranek, et al., 2006; Dunn 2001). These sensory behaviours are otherwise known as sensory integration vulnerabilities, and can be interpreted either in each individual sensory system or alternatively as a whole in multiple sensory systems and environments to provide a holistic perspective on a child's sensory functioning (Shimizu, Bueno & Miranda, 2014). As adequate sensory processing is necessary for adaptive behaviour, it is possible that internalising and externalising behaviours seen in the classroom are a manifestation of atypical sensory integration. This has implications for how these behaviours are managed within the classroom and warrants further investigation.

Dunn (2007) suggested that patterns of sensory processing are as an output of the individual's neurological thresholds and behavioural self-regulation strategies.

Neurological thresholds can be further defined, as the point at which there is ample sensory input to cause a neurological response via action potentials thus resulting in the nervous system being activated (Kandell, Schwarts & Jessell, 2000). Neurological thresholds have been described as a continuum rather than isolated occurrences, ranging from high to low, in response to sensory information (Kandell, Schwarts & Jessell, 2000). An individual with a high neurological threshold would present with corresponding behavioural self-regulation strategies namely sensation seeking and/or low registration, require strong sensory stimuli to activate their nervous system and may even register some of the incoming sensory stimuli that others may notice immediately or more readily (Kandell, Schwarts & Jessell, 2000). Conversely, an individual with a low neurological threshold would present with corresponding behavioural self-regulation strategies namely sensory avoiding and/or sensory sensitivity where the individual would quickly respond to the incoming sensory stimuli more freely than others (Kandell, Schwarts & Jessell, 2000). Theory suggests that individuals may have a variety of

different neurological thresholds with regards to each individual sense, meaning that some sensations are more stimulating than others depending on the individuals sensory processing abilities for that sense (Kandell, Schwarts & Jessell, 2000).

The term "behavioural self-regulation" can be defined as a behavioural outcome or the individual's ability to orientate themselves to a sensory stimulus and produce a response to a situation by adjusting their actions (Dunn, Saiter & Rinner, 2002; Jackson, Mackenzie & Hobfoll, 2005). The continuum describes active versus passive behavioural self-regulation strategies whereby individuals who employ active strategies may attempt to engage in their environment with the outcome of their actions aimed at changing their environment; conversely, individuals who employ passive strategies may be inclined to observe the actions of their environment before engaging within it (Jackson, Mackenzie & Hobfoll, 2005).

2.5 BEHAVIOURAL RESPONSIVITY IN SENSORY PROCESSING

Literature suggests that sensory processing involves both physiological and behavioural processes (Parham & Mailloux, 2010). A worthwhile mention emphasising the relationship between behaviour and sensory processing is the Ecological Model of Sensory Modulation (EMSM), which provides a theoretical understanding of the contextual and individual factors which play an important role when mediating behavioural responsivity in sensory processing (Parham & Mailloux, 2010). The four contextual external dimensions, which include culture, environment, relationships and the task, influence the three internal dimensions, which include sensation, emotion and attention (Parham & Mailloux, 2010). The EMSM builds on the sensory integration framework described earlier in this literature review, and is based upon the works of Ayres, Dunn and Miller (Roley, Blanche & Schaaf, 2001). The EMSM embodies the belief that an individual's culture, environmental settings, relationships and occupations or 'tasks' (for children this is deemed as educational, play, social, sleep and daily activities) interact deeply with their behaviour, attention, emotion and sensation (Roley, Blanche & Schaaf, 2001). Attention is defined in the EMSM as the ability to control and sustain one's activity level, performance and impulses, for meaningful interaction in tasks and relationships (Roley, Blanche & Schaaf, 2001). Emotion is defined as the ability to regulate and control one's behavioural response to perceive emotional stimuli (Roley, Blanche & Schaaf, 2001). Sensation is defined as the ability to perceive sensory information that is managed through the

central nervous system, which allows for interaction with the outside world (Roley, Blanche & Schaaf, 2001).

The EMSM exemplifies that a relationship exists between each of the external and internal dimensions which may support or challenge responses to a specific situation or stimuli. A good fit exists when both the internal and external dimensions support the task demands, relationships, culture and environment and the individual's ability to process sensation, emotion and attention in harmony (Roley, Blanche & Schaaf, 2001). When the demands of a task, relationship, environment or culture exceed the abilities of the individual, dysregulation may occur (Roley, Blanche & Schaaf, 2001). The same may be said for when the external dimensions are not challenging enough, thus emphasising the importance of a 'just right match' and goodness of fit. Kimall's (2001) early work supported the EMSM and described how dysregulation interactions between these dimensions might manifest as both physiological and behavioural outcomes (Roley, Blanche & Schaaf, 2001). The EMSM supports the notion of how an imbalance between the demands and supports within external dimensions and the adaptive abilities within internal dimensions may result in maladaptive behaviours (Roley, Blanche & Schaaf, 2001). The model further describes maladaptive behaviours under each internal dimension: attention may present as preservation, being unaware, hyperactivity, impulsivity, inattention; emotion may present as flat affect, lack of empathy, hostility, anger, withdrawal; and sensation may present as atypically slow or quick response to stimuli, poor discrimination, intense reaction to stimuli, or 'fight, flight or fright' response to stimuli (Roley, Blanche & Schaaf, 2001). The underlying construct of this model is that a child with sensory processing difficulties has a core deficit in one or more of the following: sensory discrimination, integration and modulation. As a result, this atypical sensory processing may manifest as emotional, behavioural and/or attentional difficulties. EMSM literature shows a clear clink between sensory processing, particularly with regards to sensory modulation, and overt behavioural markers.

2.6 PARADIGMS OF BEHAVIOUR: INTERNALISING AND EXTERNALISING CLASSIFICATIONS

Behavioural and emotional difficulties in children and adolescents are often conceptualised as internalising and externalising groups of symptoms (Achenbach & Rescorla, 2001; Weiner,

2000). Internalising symptoms present as withdrawal, somatic complaints, anxiety, mood and depression; whereas externalising symptoms present as disruptive, rule-breaking and aggressive behaviours (Achenbach and Rescorla, 2001). Internalising behaviours are frequently overlooked as they do not have explicit behavioural manifestations and are often not disruptive to others; externalising behaviours, however cause definitive disruptions in a social environment (Miller & Jome, 2010). Children's ability to adapt to and engage within their occupational settings is dependent on their ability to behave in a socially appropriate manner (Shimizu, Bueno & Miranda, 2014). One of a child's main occupational settings is the classroom and school environment, where they spend a substantial portion of their time engaging in play and educational activities (Gourley et al., 2013). As a result, behavioural disturbances, especially those of an externalising nature, are most commonly identified within the school and classroom environment (Miller & Jome, 2010). Interestingly, a study indicated that teachers identify significantly more children as having externalising than internalising behaviours, where both teachers and parents perceive externalising behaviours as more serious and requiring urgent attention than internalising behaviours (Bruder, 2000; Soles et al., 2008).

According to research, due to differences in developmental socialisation, self-regulation and biological make-up, boys appear to be more disposed to externalising behaviours, and girls to internalising behaviours (Maniadaki et al., 2006; Zahn-Waxler, Shirtcliff & Marceau, 2008). Gender differences also impacted on how externalising and internalising behaviours were perceived and seen by teachers and parents; teachers rated girls as having more extreme externalising behaviours than boys (Maniadaki et al., 2006; Zahn-Waxler, Shirtcliff & Marceau, 2008).

Common examples of disruptive behaviour in the classroom reported by teachers may include: a disrespect for rules, excessive fidgeting, wandering in the classroom, talking excessively or out of turn, passive participation, disruption to others, and breaking or moving furniture and other objects in the classroom (Briesch, Briesch & Chafouleas, 2015; Postholm, 2013). Teachers associate these misbehaviours to a number of causes such as student's lack of interest, educational politics, school permissiveness towards misbehaviour and aggression, and lack of parental discipline (Lopes & Oliveira, 2017).

The current literature and research findings on disruptive behaviour propose that behaviours, such as those which are classified as internalising and externalising, are the product of a wide range of etiological influences (Zahn-Waxler, Shirtcliff & Marceau, 2008).

Regarding internalising behaviours, a study estimates anxiety levels in the child population to range between 3–24% in the USA (Settipania et al., 2012). In larger survey studies, prevalence findings have been suggested to range from 10–20% in youth experiencing debilitating anxiety (Costello et al., 2003). Findings from a systematic review estimates 50–70% of children with atypical levels of anxiety do not receive intervention, which is highly associated with impaired performance in school, family and social engagement (Chavira et al., 2004; Egger & Burns, 2004; Kendall, Settipani & Cummings, 2012).

A large meta-analysis of 51 published studies in the USA of children born between 1954 and 2004 found an overall prevalence rate of 3.8% of clinical depression; an update on literature was reevaluated after 2004 and found a lower prevalence rate of 2.7% (Boat and Wu, 2015). Depression prevalence seems to be lower in children in comparison to adults, with researchers citing similar prevalence rates of between 0.3–7.8% in children below the age of 13 years (Lima et al., 2013). Prevalence rates of depression in South African children are not well documented, and emphasise the need for further investigation (South African Depression and Anxiety Group, 2020b).

Literature states that children with atypical internalising behaviour profiles are at increased risk for the development of psychopathology later in life, such as clinical anxiety, depression, substance abuse and academic underachievement (Swendsen et al., 2010).

Regarding externalising behaviours, for the purposes of this study The Conners 3 has been utilised to evaluate behavioural features within a classroom environment such as learning and executive functioning, attention and activity levels, peer relations, defiance, aggression and conduct (Conner, 2008). Externalising behaviours have been viewed as a global health concern in children and adolescents (Jianghong, 2004). The presence of externalising behaviours indicates behaviour problems that are manifested in a child's outward behaviour and reflect the child acting on their external environment negatively (Jianghong, 2004).

In the USA, approximately 91 000 children were surveyed in 2011. The survey established that an estimated prevalence of 8% of children presented with learning difficulties with 4% rated as mild learning disabilities and 4% rated as moderate-severe learning disabilities (Boat and Wu, 2015). South African data is staggeringly limited regarding learning and executive functioning particularly within the general child population.

Attention forms the foundation on which a child learns, engages, attends to new information, and completes tasks independently (Elosúa, Del Olmo & Contreras, 2017; Lambek et al., 2011). Attention Deficit Hyperactivity Disorder (ADHD) has been considered as one of the most prevalent disorders in childhood, with an estimated prevalence of between 3–5% of the school-age population (Willcutt, 2012). It is posited that alterations in prefrontal cortical regions are interconnected and associated with neuropsychological deficits, specifically between executive functioning, learning, hyperactivity, impulsivity and inattention (Geurts et al., 2004). Interestingly, a high frequency of children who present with ADHD has associated comorbidities such as sensory processing disorders/difficulties (Shimizu, Bueno & Miranda, 2014). Another study evaluating attention in the classroom environment stated that limited flexible seating might contribute towards inattention, fidgeting and distractibility, since young children may have difficulty with sustained endurance in a traditional chair and desk setup (Hardin, 2017). The 2014 Healthy Active Kids South Africa Report Card indicated a general concern for South African children with regards to insufficient levels of physical exercise, healthy eating and maintaining a healthy weight (Draper et al., 2014).

A study sampled 94 hyperactive boys who indicated a prevalence of 32% for antisocial disorders in adulthood, compared to 8% in a control group of typically developing children (Mannuzza, Klein & Addalli, 1991). Literature indicates that young children with atypical externalising behaviour profiles including poor peer relations indicated higher prevalence and predictiveness for conduct problems later in life (Jianghong, 2004; Lilienfeld & Waldman, 1990; Mannuzza, Klein & Addali, 1991). This indicated that whilst typical developing children may develop antisocial behaviours, children with inattention, hyperactivity, aggression and conduct problems are more at risk for developing peer relation difficulties (Jianghong, 2004).

Aggression has been considered an important childhood behaviour due to its strong predictability for adult crime and violence (Farrington, 2001; Jianghong, 2004). Recorded prevalence rates in the USA indicate lower rates of clinical conduct disorder (6.8%) and

oppositional defiance disorder (6.5%). Aggression, Conduct Disorder and Oppositional Defiance Disorder are not well determined in the South African child population. Conduct Disorder refers to a persistent pattern of antisocial behaviours, whereby social norms are continuously broken and aggressive acts are carried out towards others (Sarkhel et al., 2006). The DSM-IV cites Conduct Disorder as one of the most frequently diagnosed behavioural deficits for both in- and out-patient mental health centres in children, with prevalence rates in males recorded as 6–10% and females 2–9% (American Psychiatric Association, 2013). The estimated lifetime prevalence of Conduct Disorder in the USA is 9.5% with a median onset of 11.6 years (Nock et al, 2006). A study in India recorded a prevalence of 4.58% for Conduct Disorder in typically developing children suggesting that under certain environmental and genetic predispositions some children may be more "at risk" for onset of Conduct Disorder than others (Sarkhel et al., 2006). An international meta-analysis study indicated worldwide prevalence among children and adolescents aged 6–18 years at 3.2%, suggesting this prevalence estimate does not differ significantly across countries despite different socioeconomic factors (Canino et al., 2010). However, a recent study reviewed multiple South African bodies which all noted variables that may impact on conduct and aggression such as early exposure to domestic violence, high crime rates, uncensored television and access to violent electronic games (Fitzpatrick et al., 2016).

Literature has varying results regarding gender and behaviour differences. Research based in Australia, presented at the 14th European Conference for Developmental Psychology, investigated 2490 six-year-old school-going children, which stated that girls were more likely to display a more positive approach to learning and display more positive classroom behaviours with fewer externalising behaviours in comparison to boys (Walker & Berthelsen, 2009). For anxiety, some literature identifies an equal prevalence rate amongst young boys and girls, with anxiety disorders becoming more prevalent in females, by the time they reach adolescence (Rockhill et al., 2010). Another study found that girls showed more internalising emotions than boys, and boys showed more externalising emotions than girls particularly during middle school (King et al., 2016). Layard & Dunn (2009) suggested that a reason for this was that gender and internalising behaviours may differ considerably because these behaviours are less apparent in a classroom environment and are difficult to quantify with objective observations. Contrasting literature suggests that gender differences within a neurotypical child population are small in early childhood (Maughan et al., 2004). These differences may become more apparent in adolescent years.

Research showed that environment and genetic factors contribute significantly towards the neural development of sensory processing and behaviour (Simonoff, 2001; Zahn-Waxler, Shirtcliff & Marceau, 2008). Other research and literature suggested alternative constructs such as socioeconomic status, occupational injustice, occupational deprivation, unidentified background histories of childhood maltreatment or neglect may also found explanatory pathways between sensory processing and behaviour disturbances (Davies & Gavin, 2007).

The Conners 3 has been widely used in clinical practice and literature as an ADHD diagnostic tool, however it boasts standardised features that allow for behaviour profiling of internalising and externalising behaviours which is why this specific assessment tool has been used in this research (Conner, 2008). Additional features include measuring Oppositional Defiance and conduct disorders, screener items for both clinical anxiety and depression as well as the inclusion of functional questions which measure the impact on a child's life at home, school and within a social context (Conner, 2008). The Conners 3 additionally offers a global index, an effective measure of general psychopathology, which offers valuable behavioural variables to this research. Whilst this tool has been used widely in South Africa, it has not been used to determine behaviour profiling within a neurotypically developing child population, in addition it has been standardised on the American population. In South Africa, it has been identified that there is a limited understanding of the prevalence of common mental disorders, as well as limited access to specialist resources with a service delivery and treatment gap of up to 75% within the adult population (Schoeman & Liebenberg, 2017). The use of The Conners 3 tool in this research will aim to contribute literature and statistics regarding behaviour profiling applicable to the South African context, the neurotypically developing child and the school-going child population.

2.7 SENSORY PROCESSING AND BEHAVIOUR – THE CURRENT UNDERSTANDING

Sensory processing abnormalities and resulting behaviours have a significant impact on the child's quality of life, by adversely disrupting their occupational performance and engagement in their activities of daily living (Dunn, 1997; Dunn, Saiter & Rinner, 2002). In the 1960s, an association was hypothesised between tactile over-responsiveness, a form of SMD known as

tactile defensiveness, and behaviours such as inattention and hyperactivity (Ayres, 1972). As discussed above, Dunn's work on neurological thresholds was also linked to behaviours, where individuals responding in accordance with their thresholds were likely to display passive regulatory strategies, whilst individuals trying to counteract their threshold would respond in an active regulatory manner (Ermer & Dunn, 1998).

Many advancements have since been made in understanding posited links between sensory processing and behaviour. Whereby sensory processing refers to the broad continuum and manner in which individuals use sensory information for emotion regulation, motor performance, social interaction, and engagement in daily occupations (Miller et al., 2017).

The reticular activating system located in the brainstem has multiple neural connections with sensory modulation centres and is responsible for maintaining the body's level of alertness (Bundy, Lane & Murray, 2002). Two systems work in synergy to perform habituation for high thresholds and sensitisation for low thresholds of sensory information (Bundy, Lane & Murray, 2002). The limbic system also has involvement in producing a behavioural-emotional response to sensory experiences (Bundy, Lane & Murray, 2002). Therefore, responsivity to sensory information (over, under and typical responsivity) is gauged based on the neural response in these regions (Bundy, Lane & Murray, 2002). A child in the optimal state of arousal, otherwise known as a 'calm-alert' state, is able to produce adaptive responses, appropriate behavioural outcomes to sensation, organised behaviour and engagement with the environment as a result of efficient processing in the reticular activating system, limbic system, and sensory modulation centres within the CNS (Bundy, Lane & Murray, 2002).

Ben-Sasson, Carter & Briggs-Gowan (2009) stated that children presenting with sensory over-responsivity (SOR) were three times more likely to meet the threshold for clinically atypical externalising behaviours, and four times more likely to have met the threshold for concern regarding internalising behaviours. The researchers examined the relationship between sensory processing, particularly SOR, and a child's social-emotional development and stated:

> Sensory over-responsivity may play a role in the emergence of social-emotional problems by causing an individual to withdraw, and avoid negatively perceived sensations and become anxious in anticipation of the stressful sensory experience … Alternatively, social-emotional problems may complicate a child's ability to cope with

> over-stimulation and may lead parents to notice a child's over-response (Ben-Sasson Carter & Briggs-Gowan, 2009: 708).

An American study indicated an estimated prevalence rate between 2.6-6.5% of SOR in school-going children, across multiple sensory systems including tactile, visual, auditory, movement and olfactory/gustation (Ahn et al., 2004). Another study noted that children with SOR were reported to have impaired participation and success in activities of daily living (Bar-Shalita, Vatine & Parush, 2008).

Children with SOR who are overwhelmed by sensory experiences may respond with withdrawal, defiant behaviour, anxiety or act in a controlling manner in an attempt to manage their sensory systems and prevent triggering the sympathetic nervous system response (Ben-Sasson, Carter & Briggs-Gowan, 2009). Whilst SOR is only one type of SMD it is relevant for children of all abilities in a school environment.

Sensory seeking behaviour, another distinct subtype of SMD, is associated with children who seek unusual amounts and intensities of sensory information (James et al., 2011). This craving for sensory experiences leads to an increased level of arousal resulting in disorganised and socially inappropriate behaviour, for example, disregard of physical boundaries, constantly moving, hyperactivity, impulsivity, restlessness, and risk-taking to name a few (James et al., 2011; Miller et al., 2007). This may interfere with the child's occupational engagement in activities of daily living, social participation and scholastic performance.

Sensory under-responsivity (SUR), another type of SMD, is associated with reduced awareness and detection of normal levels of sensory information (James et al., 2011). SUR is associated with behaviours such as a withdrawn nature, lethargic, apathetic, poor motivation to engage and low levels of self-efficacy (James et al., 2011; Miller et al., 2007). In a school environment, children with under-responsivity may present with difficulty in their ability to transition between environments and interact across contexts. Recent investigations have identified possible autonomic nervous system functioning involvement in SUR.

A systematic review by Koenig & Rudney (2010) established that children with SOR and sensory related motor dysfunction presented with difficulty in their social interactions and performance of daily occupations in comparison to children with SUR. Reynolds et al., (2008)

found complementary findings further suggesting a correlation between SOR and reduced performance in daily occupations. Elbasan, Kayikan & Duzgun (2012) found that visual and tactile discrimination, postural disruptions and dyspraxia were associated with sensory processing dysfunction and reduced performance in activities of daily living.

Wilbarger & Wilbarger (2012) likened sensory processing and behaviour to a continuum with unpleasant avoidant behaviours on one side and pleasurable experiences on the other. They further described that individuals with over-responsiveness were more likely to display anxiety, fear, aggression, sensory seeking or avoidance of sensory inputs. A study linked sensory seeking behaviours and under-responsivity to poor social skills, inattention, hyperactivity, impulsivity and atypical externalising behaviours such as aggression, low energy and emotional withdrawal (James et al., 2011). Findings in another study found similar observations that suggest anxiety may also be associated with sensory under-responsiveness, which may present as repetitive motor behaviours, fidgeting and restlessness (Lidstone et al., 2014; Rodgers et al., 2012).

Research conducted by Fox & Polak (2004) provided empirical evidence that showed a significant association between sensory processing difficulties and a range of behavioural problems in children who had been identified as at risk for conduct disorder. Similar observations were found in a study that established a high prevalence of sensory processing difficulties in a sample of young children with developmental and behavioural difficulties, with a high rate of comorbidity between sensory processing difficulties and behavioural problems (Gourley et al., 2013). In fact, the prevalence of SPD was 55.9%, which was substantially higher than previously reported (Gourley et al., 2013). Gourley et al. (2013) found a significant correlation between scores on the short sensory profile, the oppositional defiant disorder and externalising scales of the Child Behaviour Checklist in preschool children identified with sensory and behavioural difficulties. Similarly, another study examining 36 children with ASD, found associations between social skills and social responsiveness and sensory processing dysfunction (Hilton, Graver & LaVesser, 2007).

Empirical evidence has noted that children with inefficient sensory regulation present with a wide variety of difficulties across psychosocial domains such as internalising behaviours, externalising behaviours, emotional regulation, frustration tolerance and attention modulation (Bar-Shalita, Vatine & Parush, 2008). This disruption to the child's psychosocial development

significantly affects their ability to successfully engage, adapt and perform in activities of daily living (Bar-Shalita, Vatine & Parush, 2008). Rogers et al. (2003) examined toddlers with ASD and found that sensory reactivity was associated with difficulty in adaptive behaviours. Franklin and Deitz (2008) suggested that atypical or problematic auditory processing and sensory modulation abilities had a higher prevalence of behavioural disturbances as a result of reduced ability to produce appropriate adaptive behavioural responses.

Poor sensory regulation has a significant impact on a child's temperament and subsequently, the development of their personality (Dunn, 2001). A study examining sensory defensiveness and twins found that anxiety and temperament, particularly the 'fearful' temperament, indicated moderate associations ($p = 0.01$) to sensory defensiveness in both tactile and auditory systems (Goldsmith et al., 2006). Internalising behaviours such as anxiety appeared to be a key characteristic of the disorder that shared high prevalence rates with sensory defensiveness (Goldsmith et al., 2006).

Internalising and externalising behaviours are known to be associated with a child who presents with sensory under or over sensitivity amongst many other developmental and pervasive disorders (Gourley et al., 2013; Lidstone et al., 2014; Rodgers et al., 2012). Internalising behaviours such as anxiety and depression are not limited to young children with disruptions to their sensory processing abilities (Gourley et al., 2013). A study found significant associations between anxiety and depression in adults showing sensory defensiveness in comparison to typical adults ($n = 32$) (Kinnearley & Fuiek, 2006). A longitudinal study examining 55 participants aged 22, found that both Developmental Coordination Disorder (DCD) and ADHD were associated with atypical externalising and internalising behaviours, and a higher prevalence rate of criminal offences, substance abuse, lower levels of schooling and other psychiatric disorders later in life, in comparison to typical participants (Rasmussen & Gillberg, 2000). DCD affects an estimated 5–8% of school-going children, with a higher prevalence in boys than girls (2:1) (Hyde, Rigoli & Piek, 2016). DCD has been found to be associated with problems outside of motor skills, with an estimated comorbidity prevalence of 41% ADHD and 56% learning disabilities (Hyde, Rigoli & Piek, 2016). A recently proposed nosology for DCD identifies the imperative role sensory integration and the complex interaction amongst various levels of the CNS has on movement and coordination (Hyde, Rigoli & Piek, 2016). Internalising behaviours, namely self-esteem and anxiety, were also associated with DCD in comparison to typically developing peers (Hyde, Rigoli & Piek, 2016).

Evidence indicates that a high prevalence of school-going children with SPD present with behavioural, emotional and social difficulties. It is, however important to note, that whilst many associations exist between SPD and behaviour, not all children with behavioural concerns have SPD. Thus some children with atypical behaviour (for example diagnosed ADHD) may have normal physiological reactions to sensory experiences, whilst other children may have both atypical physiological reactions and behavioural responses to sensory experiences (Mangeot et al., 2001). Many of these studies have been conducted on children with known developmental and pervasive disorders, with minimal empirical evidence on the posited relationship between sensory processing and behaviour within the neurotypically developing child. In addition, research investigating SPD have mainly focussed on atypical behavioural patterns using psychometric analysis, whilst this is useful for clinical practice, the underlying neurophysiological mechanisms of SMD and SPD, as well as neurotypical presentations, are not sufficiently explained nor justified by the existing behavioural data.

Literature is on the increase with indications that a number of disorders are associated with sensory processing abilities and behaviours such as ADHD, obsessive-compulsive disorder (OCD), developmental coordination disorder (DCD), ASD, developmental delays, schizophrenia and anxiety disorders (Dunn, 1999; Ben-Sasson et al., 2007; Tomcheck & Dunn, 2007). Sensory processing abnormalities are common comorbidities known to occur in several developmental and pervasive disorders (Ben-Sasson et al., 2007; Tomcheck & Dunn, 2007). Research into sensory processing difficulties and disorders such as ADHD or Autism Spectrum Disorder (ASD) has found that these disorders appear to be associated with specific patterns of sensory processing that are clinically distinct (Ermer & Dunn, 1998). Research suggested there may be a pattern of sensory processing that is associated with externalising behaviour (Gourley et al., 2013). The ‘under-responsive/sensory seeker’ scale showed the strongest correlations with all measures of externalising behaviour. Tactile and auditory sensitivity specifically showed significant correlations with externalising behaviour (Gourley et al., 2013). Miller (2006) reported that in a group of children with SPD and/or ADHD, 60% presented with SPD and ADHD, 20% presented with SPD only, and 20% presented with ADHD only (Parham & Mailloux, 2010). Children with ADHD have varying patterns of sensory processing and behaviour (Parham et al., 2007).

Green et al. (2013) reported a study of 149 toddlers diagnosed with ASD assessed at two time points. A relationship was established that sensory over-responsiveness was predictive of anxiety, but anxiety did not predict sensory over-responsiveness (Green et al., 2013). Sensory over-responsiveness was stable across time and based on their results; they proposed it to be an early neurological indicator, which later manifests as anxiety. Green et al. (2013) found in an fMRI study of 25 ASD youth and 25 matched controls, greater activation in primary sensory areas of the brain that was positively correlated with parent-reported sensory over-responsiveness in the ASD group; and also noted increased activation in emotion regulation systems including amygdala, hippocampus and orbitofrontal cortex also supporting a link between sensory processing abnormalities and regulation of emotions such as anxiety.

Regarding prevalence, current statistics in America estimate sensory processing disorders to range between 5-10% in children (Ahn et al., 2004; Ben-Sasson et al., 2007). In addition, a study elaborated on previously established prevalence rates and noted that over-responsivity towards tactile and auditory sensory inputs had a noticeable impact on a child's academic performance and social participation and highlighted that sensory over-responsivity (SOR) and the relation to social and emotional difficulties has little empirical exploration to date (Ben-Sasson, Carter & Briggs-Gowan, 2009). The study further established that children with SOR indicated a higher prevalence of coexisting internalising and externalising behaviours, dysregulation difficulties and maladaptive social behaviours (Ben-Sasson, Carter & Briggs-Gowan, 2009). Several researchers have suggested possible risk factors associated with SPD: extremely low birth weight, prematurity, prenatal and delivery complications, maternal complications such as stress and illness, lower socioeconomic status, and living with a single parent (Ben-Sasson, Carter & Briggs-Gowan, 2009; Keuler et al., 2011). Such research emphasises the importance of identifying sensory challenges as early as possible in order to support a child's social-emotional and occupational well-being.

The role of neurological factors is imperative when considering the development of behaviour and sensory processing abilities and is an area on ongoing research and deliberation. Behavioural abilities have been strongly associated with the function of the prefrontal cortex and the amygdala (Kim, Kim & Kwon, 2001; Passamonti et al., 2012). When looking at dysfunction, the link regarding behaviour and sensory processing has been demonstrated through EEGs in children with sensory processing difficulties and suggested an impaired sensory gating (Davies & Gavin, 2007). Sensory gating is the neurological ability of the brain

to filter incoming sensory information. However, the underlying neural mechanisms of sensory gating and the link to behaviour is a phenomenon that remains rather unknown (Davies & Gavin, 2007; Simonoff, 2001).

Some neurophysiological factors that mediate behavioural responses to sensory information are, however well documented. The autonomic nervous system uses neuro-endocrine functions to regulate adaptive responses and changes in the environment through synchronised functions of the parasympathetic and sympathetic nervous systems (Kandell, Schwarts & Jessell, 2000; Schaaf et al., 2010). This allows for balance in self-regulation, response to a 'fight, flight or fright' response and recovery from a challenge (Schaaf et al., 2003). The polyvagal theory relates the autonomic nervous system to behaviour, emotion and social engagement and refers to behavioural adaptability. In fact, a study found that boys with fragile X syndrome and identified SPD, particularly sensory over-responsiveness, presented with a depressed parasympathetic nervous system – the system responsible for maintaining a calm, restful state of the body (Boccia & Roberts, 2000). Schaaf et al. (2010) found that children presenting with SPD had lower than normal vagal and parasympathetic activity levels. It was hypothesised that in children with SPD during environmental challenges requiring sensory processing, the parasympathetic nervous system response is disorganised resulting in atypical behavioural responses that may disrupt participation in daily occupations (Schaaf et al., 2010).

Other disorders also associate atypical sensory processing to atypical behaviour such as obsessive-compulsive disorder, cerebral palsy, down's syndrome, and many other neurological, physical and mental health issues (Parham et al., 2007). Few studies have examined whether or not sensory processing and behaviour profiling of the typically developing child may manifest differently across the spectrum of time, gender, socioeconomic status, developmental band, and reporter observations throughout childhood (Wakschlag et al., 2012).

According to the USA National Association of School Psychologists 2003 position paper, children who are at highest risk of being retained share certain demographic characteristics such as male gender, African or Hispanic ethnicity, young or immature age for their grade, show developmental delays, show inattention, behavioural or emotional concerns, English is not the child's home language, difficulty reading, frequently change schools, face poverty and

low socioeconomic status, live with a single-parent family, and live with a family uninvolved in their schooling (National Association of School Psychologists, 2003).

Dunn proposed that sensory processing profiles such as low registration, sensory sensitivity, sensory seeking, and sensory avoiding were strongly related to the concepts of temperament (Dunn, Saiter & Rinner, 2002). The "Difficult/Feisty" temperament indicated the highest mean scores for sensory processing systems. These findings are supported by research in Japan, which found strong associations between sensory processing systems and temperament in healthy, typically developing children (Nakagawa et al., 2016). Another study found that a "Slow to Warm up/Fearful" temperament was moderately associated ($p = 0.01$) with tactile and auditory defensiveness (atypical sensory processing) (Goldsmith et al., 2006). Thomas and Chess (2007), pioneers in defining temperament, suggested that children who present with a "Difficult/Feisty" temperament can be characterised by poor adaptability, negative mood, impulsive activity level, sensitive to sensory stimulation, overwhelmed by changes in routine, distractible, intense behaviours, inflexibly, not able to calm self or self-regulate behaviour, irregular biological rhythms (such as hunger and sleep cycles) and are frequently associated with acting out (Stephens, 2007). In addition, participants who presented with the "Difficult/Feisty" temperament were more likely to meet the threshold for clinical Defiance Disorders, Conduct Disorder, Oppositional Defiance, ADHD, hyperactivity and impulsivity features. Some literature indicates approximately 10–20% of children are born with a "Difficult/Feisty" temperament (Stephens, 2007), Another study conducted in India proposed that temperament was associated with Conduct Disorder, whereby a "Difficult" temperament was associated with Conduct Disorder and an "Easy" temperament was associated without Conduct Disorder ($p = 0.004$) (Sarkhel et al., 2006).

Literature to support, document and understand the mechanisms of how sensory processing and behaviour intermingle is poorly established. Even less so in the neurotypically developing child with the absence of diagnosis, despite this being relevant to current day practitioner observations.

These models and conceptual frameworks are imperative for understanding the spectrum of typical and atypical and the modernisation of the occupational therapy profession. Green et al. (2013) suggested that due to the intertwined overlap of sensory processing and behaviour features, a combined treatment intervention for sensory processing abnormalities and

behaviours such as anxiety should be employed for maximum success. Green et al. (2013) further suggested that parents be given information on behaviours as part of combined treatment interventions, that may develop later if sensory processing abnormalities were identified in young children.

The important study conducted by Davies & Tucker (2010) used a comprehensive assessment tool called the Sensory Processing 3-Dimension Inventory to evaluate multiple diagnostic features of sensory processing which included sensory modulation, sensory discrimination and sensory-based motor abilities. Since many studies evaluate only aspects of sensory modulation, discrimination or motor-based abilities, more studies like this are required to truly understand sensory processing as a continuum, with the presentations and associations of each pattern in various clinical conditions. In addition, it is important to provide clarity of associations among these patterns and differential associations in relation to occupational performance. Clarity in such operational definitions and research will assist clinicians in developing more accurate assessment and treatment specificity, as well as communication amongst other health care professionals, clients, parents, educators and offer validity to the growing occupational therapy evidence-based practice.

Despite the growing literature, given that sensory processing abnormalities and behavioural difficulties are common symptoms of many known developmental disorders; little empirical evidence supports the neurophysiological and functional relationship between sensory processing and behaviour in the typically developing child.

2.8 THE SOUTH AFRICAN CONTEXT

Whilst sensory processing is recognised in the South African population by allied health care professionals such as occupational therapists, the prevalence of sensory processing difficulties in South African children is largely unknown. American populations estimate SPD to be between approximately 5% and 10% (Ahn et al., 2004). The restricted empirical evidence to define the prevalence of sensory processing and behaviours in the South African child is, therefore of high priority and warrants the need for further investigation.

A study conducted in Gauteng, South Africa, observed sensory behaviours and anxiety

symptoms in remedial school-going children between the ages 8–10 years (n = 36) (Tauby, 2016). Participants presented with SMD and were receiving occupational therapy. The participants indicated high quadrant scores (atypical presentation) for low registration and sensory over-responsivity and were identified as being 'at risk' for anxiety disorders with elevated scores of anxiety. In addition, the internalising behaviour of anxiety showed correlation towards a sensory processing quadrant, namely sensory avoidance, and emotional behaviours correlated with anxiety. In conclusion, the study stated that children with SMD were at risk for presenting with anxiety disorder symptoms, and this should be kept in mind within a school environment (Tauby, 2016).

A study carried out in the Western Cape, regarding the South African child and adolescent population indicated the most common mental disorders were generalised anxiety disorder with an estimated prevalence of 11%, followed by major depressive disorder and posttraumatic stress disorder with an estimated 8% (Kleintjies et al., 2006). Another study examined anxiety features within a normal school population and identified that anxiety symptoms were higher than Western children in the Netherlands (Muris et al., 2002).

A study conducted in Gauteng, South Africa, examined sensory processing abilities in a population of mainstream school-going children identified as having SPD (n = 100). A substantial portion of participants presented within the atypical and "definite difference/more than others" for sensory registration (19%), sensory seeking (11%), sensory sensitivity (13%), and sensory avoiding (16%). In addition, 13% of participants indicated a "definitive difference" in emotional reactivity (Chemel, 2015).

The average South African classroom environment has limited sensory support strategies; thus, some children may find it more challenging to regulate their sensory needs throughout the day with the available sensory resources (Department of Basic Education, 2015; Reynolds et al., 2008). Many school curriculums foster an academic approach whereby children spend substantial periods of time seated at a desk, thus limiting free play and sensory experiences (Hutton, 2012). There is limited opportunity for a child to assume different postures, activate different types of vestibular sensory inputs, and engage in a variety of movements and positions in a classroom environment which is necessary to encourage the development of these sensory systems (Hardin, 2017; Miller & Almon, 2009). This is particularly true for the South African classroom context. This leads to the question of whether South African children have sufficient,

age-appropriate sensory experiences and support throughout their school day, in addition to whether or not their sensory needs are being met within the classroom and school environment. With a focus on academic achievement, supporting a typical sensory processing profile within the context of the classroom has not been highlighted as a priority by the educational sector in South Africa (Human Rights Watch, 2015).

Evidence-based practice is imperative to the ongoing evaluation and contribution towards the occupational therapy scope of practice and framework, not only on a global scale but particularly in the lesser researched South African context. Due to the unique cultural, environmental, political and social factors that contribute towards our demographic population, the need for further investigation of sensory processing and behaviour within the child and adolescent populations is of high priority.

2.9 SUMMARY OF LITERATURE

The literature reviewed for this study included topics of the theoretical and neurophysiological constructs of sensory processing, typical sensory integration functioning, atypical sensory integration functioning, the current understanding of sensory processing and behaviour, paradigms of behaviour, and internalising and externalising classifications. Sensory integration and classification of internalising and externalising behaviours were well supported by the literature review. The purpose of the study was to contribute to the knowledge base of the occupational therapy profession in these important areas of practice.

Children's first years in school are fundamentally important for their later learning. Success in the early years of school has implications for future achievement in school and beyond. Childhood sensory processing and behaviour development have a significant impact on the child, family and society – particularly the child's school environment where they spend a substantial portion of their time. Difficulties in these areas of development, or rather atypical functioning in a child's behaviour and/or sensory processing are commonly associated with poor academic achievement, occupational performance and psychosocial functioning (Coster & Frolek-Clark, 2013; Ogundele, 2018).

Based on the reviewed literature, gaps have been identified in evidence-based practice regarding sensory processing and behaviours in the spectrum of a typically developing child,

and the interaction these constructs may have on a child within the classroom environment. Additionally, there was limited evidence for the prevalence of sensory processing and behaviour within the South African population.

It is important for all healthcare professionals, especially occupational therapists who are primarily concerned with the occupational well-being of children, to be aware of the range of presentation, prevention and management of the common mental health and sensory processing tribulations in children be it of a typical or atypical appearance.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION TO THE CHAPTER

This chapter describes the research design and methodology of the research. The chapter is divided into the following sections: research design, methodology rationale, threats of design, strengths and weaknesses of design, research setting, participants, sample size and recruiting procedure, instruments and measures, ethical considerations and review, resources and funding, data collection procedures, data management and statistical analysis, and summary.

3.2 RESEARCH DESIGN

A prospective, non-experimental, cross-sectional study using a survey design was used. Data was collected once per participant and was quantitative, descriptive and correlational in nature.

An exploratory, correlational quantitative research design was also used to establish if a relationship or associations existed between variables (Kielhofner, 2006). Quantitative data was obtained through the use of two teacher completed rating scales. In addition, a survey research design was used to collect further quantitative data in the form of a demographic questionnaire to elicit parent-reported information from the sample population. This information was used to determine the following key dimensions: identifying the population of interest in order to appropriately sample that population; identify research aims and questions to systematically gather information; determine if correlations existed between variables, and establish statistical estimates that can be generalised to the population of this study (Forsyth & Kviz, 2006).

3.3 METHODOLOGY RATIONALE

This research design used a quantitative data collection approach. This allowed for the gathering of numerical data, to better understand the characteristics of the research participants with the aim of generalising it across broader population groups (Forsyth & Kviz, 2006). The quantitative nature of the data collected in this research was useful in understanding if relationships exist between variables and to gain insight into profiling the sensory processing

and behaviours within a sample population. As the research aimed to better understand neurotypically developing children, a quantitative demographic questionnaire and rating scales that indicate a spectrum between typical and atypical presentation were used to define sensory processing and behaviour.

3.4 THREATS OF DESIGN

Threats to internal validity include selection bias instrumentation. Internal validity was threatened in several ways. Due to the nature of the behavioural and sensory processing rating scales, a number of participating teachers selected participating children whom they had identified as displaying atypical behaviours or sensory processing disturbances and proposed they be used in the research to gain further insight into their presentations. This attrition was controlled by randomising the participating children's consent forms and handing the teacher rating scales for the randomised sample, which was free from teacher selection bias (Kielhofner, 2006). The rating scales are designed for teachers to use within the classroom environment, however it was noted that participating teachers at times lacked clarity in the definition of items within the rating scales. Due to the lack of qualitative opportunity, at times teachers found the quantitative rating scale difficult to express the child's unique and individual experiences within the classroom context. Therefore, the researcher relied on the judgement and observations of the participating teachers and correct scoring to ensure an accurate reflection of the child. In addition, although discouraged, teachers would occasionally omit item numbers whether by human error or uncertainty of the item. These factors were accommodated by the sound internal validity of the rating scales themselves and allowances for these common human errors in scoring (Parham et al., 2007; Sparrow, 2010).

Threats to external validity were considered from situational and contextual factors. Ecological and contextual factors were carefully considered in the methodology rationale to ensure external validity of this research (Kielhofner, 2006). External validity was considered from two distinct areas, namely population validity and ecological validity, which were both ensured in this design. As the research design ensured randomly selected participating children, within a meaningful ecological context, and the use of an appropriate sample size, this allowed for expressive statistical analysis. To ensure external validity was met, the research was conducted within the school environment, using rating scales that are applicable for the participating

children whereby both rating scales provide a scale between typical and atypical presentation, accommodating children that attend a mainstream school, which present as a typically developing child, and that was designed to be scored by teachers.

3.5 STRENGTHS AND WEAKNESSES OF DESIGN

The research design had strengths and benefits. The design of the research ensured that teachers had ample time to understand the learners in their class within the first eight to ten weeks of the year, and had four weeks to complete the questionnaire for the participating children in their class. This benefited the research design as teachers were able to provide insightful information on the rating scales for the participating children. Both rating scales were designed for teachers to complete within the child's primary classroom for which the research design allowed. The information retrieved from the rating scales was, therefore, indicative of the child's overall presentation within the context of the classroom. The research was able to meet the proposed number of participants; thus, sufficient quantitative data was obtained which can, therefore, be cautiously used to understand a broader population. The participants of this study were demographically representative of the South African context.

The design had potential weaknesses and challenges. Quantitative data may lack explanation or reasoning at times, making it challenging to understand the participant's qualitative experiences within the classroom environment (Kielhofner, 2006). The majority of participating teachers had not completed either of the rating scales before the research, and so ensuring a universal understanding and correct marking of the rating scales was a challenge. Understanding the rating scale items and correct scoring was imperative to the success of the research design. This attrition was controlled with the initial meetings, whereby the researcher took time in explaining the rating scales and the marking procedure. The feasible and convenient location allowed the researcher to have regular check-ins with participating teachers, whereby any questions could be answered or items and/or scoring explained. The rating scales were designed for teachers to be used in a classroom environment; thus, observations and scoring were applicable to teachers; layperson's terms are used in the rating scales which assisted the research design.

3.6 RESEARCH SETTING

3.6.1 Research Site

Two schools within Johannesburg, Gauteng were approached to participate in the research. These two schools fall within different areas of Gauteng classified as District 9, according to the Gauteng Department of Education. Upon review of initial methodology planning, four schools were scheduled to be approached; however, due to an overwhelmingly positive response rate in participation, only two schools were required to meet the proposed sample size. The two participating schools comprised of both a public and a private school, with non-bias towards gender, race, religion and non-specific socioeconomic status, thus representing a diverse demographic sample. The schools were chosen based on convenience sampling: for logistical, access and location purposes. The two participating schools were of an English language medium, mainstream, fee-paying, urban nature. The study was conducted on the school's premises, within the foundation phase classrooms of participating teachers.

3.6.2 Research Time

In accordance with the Gauteng Department of Education's research approval conditions, the research was conducted after school hours so that the regular school programme was not disrupted. The researcher, participating schools and teachers mutually agreed upon a two-week window for sending and receiving information letters and consent forms inviting children and parents to participate in the research whereby all forms were collected in February 2019. Data collection commenced in March 2019 and was concluded before the mid-year school holiday in July 2019.

3.7 SAMPLE SELECTION AND PARTICIPANTS

3.7.1 Population

The population for this research consisted of children aged between six to ten years, within the foundation phase of participating mainstream schools.

3.7.2 Inclusion Criteria

A. Participating children were aged between six years and ten years eleven months
B. Participating children were in the foundation phase of a participating mainstream school, where the foundation phase was considered as grade one–three

3.7.3 Exclusion Criteria

Participating children were excluded from the research if any of the following impairments and/or conditions were present, as diagnosed by a qualified health care professional able to make such diagnoses, a general practitioner or paediatric specialist:

A. A fixed diagnosis classified by the Diagnostic and Statistical Manual of Mental Disorders, for example, Autism Spectrum Disorder, Oppositional Defiance Disorder, conduct disorder or ADHD/ADD.
B. A genetic disorder such as Turner's syndrome or Down's syndrome.
C. A neurological condition such as cerebral palsy.

3.7.4 Sample Size and Recruiting Procedure

The sample size was determined using Cochran's Sample Size Formula. Two schools were used in this study, one public school and one private school. Based on the ethical and logistical guidelines of this research and feedback from the Gauteng Department of Education, ten children per class was set as the maximum number of participants per teacher and class. The public school had three grade one classes, four grade two classes and three grade three classes; the private school had three grade one classes, two grade two classes and three grade three classes. Thus the targeted number of children from the public school was 100 participants and from the private school was 80. Giving a total targeted population size of 180 participants. The targeted sample size (n) required 123 participants, where $p = 0.05$, confidence level of 95%, and precision (e) of ± 5% (Cochran, 1963). To ensure that the required minimum number of participants per class was achieved, the entire foundation phase of both schools were invited to participate, thus sending out 645 forms.

The method for recruitment of participants was as follows: After meeting with the two school principals whereby the researcher explained the nature and procedure of the study, both schools accepted the invitation to participate in the research. The researcher then met with the foundation phase teachers of both schools, explained the nature and procedure of the study and invited them to participate in the research. Participating teachers signed informed consent forms and were given a pack of research information invitations for the children in their class. These information invitations were sent home to invite prospective parents and children to participate in the research. Parents and children who wished to participate in the research sent back signed consent forms.

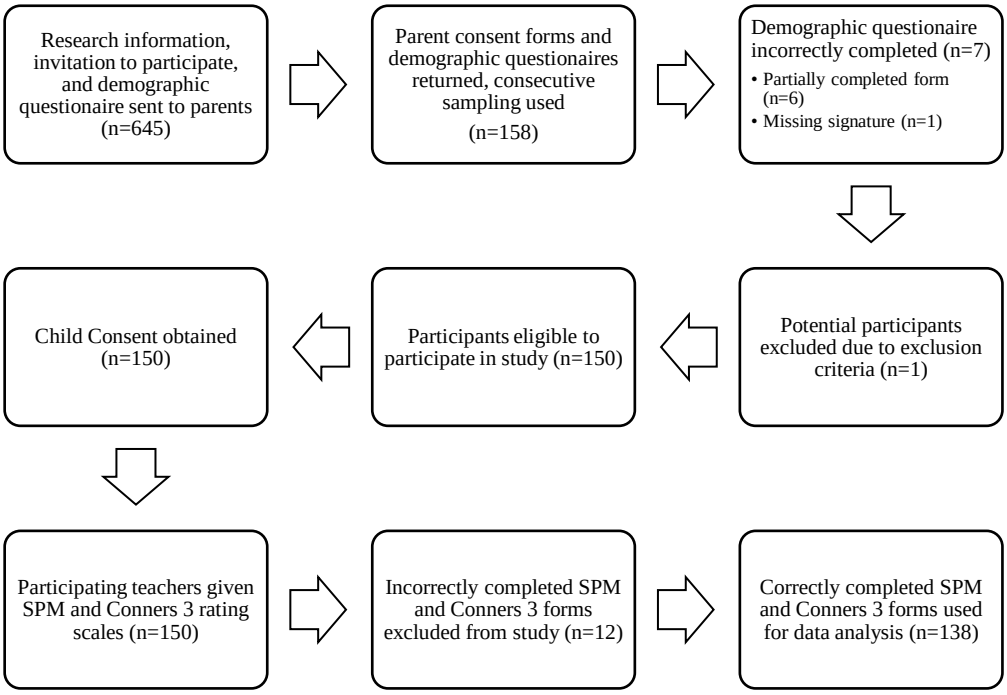

Figure 3. 1 Consort flow diagram of participants

A consecutive sampling strategy was used. As signed informed consent forms were returned, the participating child was added to the sample until a minimum total of 121 participants were reached. The researcher collected a total of 138 participants which succeeded the targeted sample size of 121 participants.

3.8 ETHICAL CONSIDERATIONS

The occupational therapy department at the University of the Witwatersrand, the Gauteng Department of Education and the University of the Witwatersrand Human Research Ethics

Committee - Medical (HREC) has reviewed and approved this research. The Gauteng Department of Education (GDE) granted the research to be carried out at schools within the educational District 9. The HREC clearance certificate M160955 (Appendix A) was valid from September 2016 to September 2021, and GDE research approval for data collection (Appendix B) was valid from February 2019 to September 2019.

Following approval from the respective committees, participant recruitment began with the distribution of an information letter and invitation to participate in the research to the two schools and associated teachers (Appendix C), as well as to parents and children (Appendix D). All letters used non-expert, layperson terms to ensure clarity for the reader. An informed consent form for the schools/principals (Appendix E), parents (Appendix F), children (Appendix G) and teachers (Appendix H) was provided with this letter to all potential participants notifying them of the nature of the research and participation. The consent forms assured participants that their participation was confidential, they could withdraw from the study at any time without consequences, and their participation was voluntary. The participants were informed that all data was confidential. Site approval and consent was given by the respective school principals and/or school governing bodies in writing. The nature and procedure of the research were given in writing to schools, children, teachers, and parents (Appendix I). All participants who wished to be involved returned their consent in writing. The manual of procedures has been stored in a locked cabinet and office. The manual of procedures includes all letters of approval from the respective boards and committees, research protocol, participant consent including child assent forms, participant codes, and completed rating scales for the SPM and Conners 3. Confidentiality has been protected throughout this research using participant coding.

Participants who were identified, by the observing teacher, as being at risk for atypical sensory processing and behaviours were contacted and advised accordingly.

3.9 MEASUREMENT TECHNIQUES AND INSTRUMENTATION

1. Demographic questionnaire (Appendix J):

The demographic questionnaire, predominantly comprised a tick-list response style, requested parents to provide information regarding demographic characteristics such as date of birth, gender, current grade, repeating a grade, brief developmental history, temperament style,

perceived school performance, and previously seeing an allied health care provider. Data collected from the parent questionnaires provided insight into extraneous variables (such as temperament style or perceived school performance) and were accounted for when comparing this to the teacher's observations in SPM and Conners 3 rating scale research data.

2. The Sensory Processing Measure (Appendix K):

The Sensory Processing Measure (SPM) was developed in the United States of America to measure sensory processing abilities and sensitivities in children aged five to twelve years old. Although the SPM has not been standardised in the South African population, the South African Institute of Sensory Integration (SAISI) acknowledges and encourages the use of the SPM as an appropriate assessment tool. The SPM has been used in South African research, albeit limited, and has yielded relevant results. The 'Main Classroom' form used for this research, was completed by participating teachers. The form was designed as a standardised diagnostic method to identify children who present with or without sensory processing disturbances (Parham et al., 2007).

The tool has three integrated rating assessment forms that evaluate sensory systems, praxis as well as social participation in a variety of environments, namely the school, home and community settings. For this research, the SPM 'Main Classroom' form was used to classify participant sensory processing abilities within the classroom environment. There are 62 items on the 'Main Classroom' form. Scoring of the Main Classroom form yielded eight scale scores namely, Social Participation (SOC), Vision (VIS), Hearing (HEA), Touch (TOU), Body Awareness (BOD), Balance and Motion (BAL), Planning and Ideas (PLA), and Total sensory system (TOT) functioning. Administration time was approximately 15 minutes.

The questionnaire completed by participating teachers, where child and parent consent had been received, asked teachers to rate the participant's behaviour on a Likert-scale based on "typical behaviour during the past month" using the following rating scale: "never", where the behaviour never or almost never happens; "occasionally", where the behaviour happens some of the time; "frequently", where the behaviour happens much of the time; and "always", where the behaviour always or almost always happens. The SPM assigns a numerical value (1 through 4) to each rating scale response, with higher scores representing more problematic or dysfunctional behaviours. The SPM makes use of standardised T-Scores and percentiles, where the T-Scores have a mean of 50 and a standard deviation of 10. Thus overall interpretations

provided by the SPM indicates that a T-Score of 40–59 represents "typical" sensory functioning, a T-Score of 60–69 represents "mild to moderate problems" in sensory functioning and a T-Score of 70 or above represents "severe problems" in sensory functioning. These classifications were used in the profiling of participant's sensory processing in this study. The test-retest reliability is >.94, and the internal consistency is >.80. The inter-rater coefficient of the SPM has been determined as 0.63 (p=.005). The SPM is founded upon internationally accepted sensory integration theory and provides norm-referenced standardised scores. Furthermore, within each sensory system, clinical information on the participant's sensory system vulnerabilities, sensory seeking behaviours and perceptual problems were examined.

3. The Conners 3 Teacher Form (Appendix L):

The Conners 3 'Teacher Form' was developed in the United States of America to assess cognitive, behavioural and emotional functioning as an instrument in understanding a child's neuropsychology in children aged six to eighteen years (Sparrow, 2010). The 'Teacher Form' rating scale measures a variety of behaviours observed in the classroom environment, namely: inattention, impulsivity, learning difficulties, aggression, self-esteem and interpersonal relationships. The Conners 3 provides a clear clinical application to identify children with internalising and externalising behavioural disturbances (Conner, 2008). Teachers and healthcare professionals have commonly used The Conners 3 rating-based scale in South African schools; professional healthcare bodies and organisations recognise it as an acceptable and relevant assessment tool in the South African context. The Conners has been found in South African research, although it has not been standardised to the population, however it has yielded relevant results.

For this research, the 'Teacher Form' was used and completed by teachers for participating children. Three domains were examined, namely behavioural, emotional and social abilities. There are 63 items on the 'Teacher Form' which considers Conners 3 content scales and Diagnostic and Statistical Manual (DSM-IV) symptom scales. Content scales include examination of Inattention (IN), Hyperactivity/Impulsivity (HY), Learning Problems/Executive Functioning (LE), Learning Problems (LP), Executive Functioning (EF), Defiance/Aggression (AG), and Peer Relations (PR). DSM-IV symptom scales include examination of ADHD Inattention subtype (AN), ADHD Hyperactive/Impulsive subtype (AH), Conduct Disorder (CD) and Oppositional Defiance Disorder (ODD). The ADHD Index (AI) scale describes if the child is more similar to children with a diagnosis of ADHD or to

children in the general population. In addition, the child's overall behaviour within the classroom, Global Index (GI) is provided.

Administration time is approximately 15 minutes. The questionnaire required teachers to rate the participant's behaviour on a Likert-scale based on "typical behaviour during the past month" using the following numerical rating scale: "0, not true at all"; "1, just a little true"; "2, pretty much true"; and "3, very much true". The Conners 3 makes use of standardised T-Scores and percentiles, where the T-Scores have a mean of 50 and a standard deviation of 10. Thus using the overall interpretations provided by The Conners 3 a T-Score of < 40 represents a "low score" indicating fewer concerns than typically reported, a T-Score of 40–59 represents an "average score" indicating typical levels of concern, a T-Score of 60–69 represents a "high average score" indicating slightly more concerns than typically reported, a T-Score of 65–69 represents an "elevated score" indicating more concerns than are typically reported, and a T-Score of > 70 represents "very elevated score" indicating many more concerns than is typically reported. The test-retest reliability is .83, and internal consistency is .90. Inter-rater reliability scored moderate to high, with coefficients from 0.52-0.94. Validity has been tested for factorial validity; relationships with other related measures as well as the ability to differentiate between individuals with ADHD or without a clinical diagnosis. All correlations significant, $p < .001$.

3.10 DATA COLLECTION PROCEDURES

Participants, including learners, teachers and the schools were coded to maintain confidentiality. Signed parent and child informed consent forms were returned to their respective teachers, and a collection period of two weeks was allocated to allow sufficient time for informed consent forms to be sent and returned. After which, the researcher met with the children from each class who wished to participate, where their parents had returned parent informed consent forms, to explain the nature and procedure of the research and gain child assent. The researcher then tallied the participating children from each class and provided the respective teacher with the two classroom rating scale forms namely the SPM and Conners 3, which were completed for each participating child in their class. Due to the nature of the rating scales requiring in-depth teacher observation, considering the time to complete the forms per participant, and that teachers would be required to complete these forms in their free time,

based on the ethical guidelines and feedback from the GDE, the number of participants was capped at a predetermined maximum of ten participants per class and per teacher.

The rating scales were collected after a mutually agreed upon collection period of four weeks, providing sufficient time for the teachers to observe the participating children within the classroom environment and mark the rating scale based upon these observations.

The researcher marked and scored the SPM and Conners 3 rating scales over a two-week period and captured this data in an excel spreadsheet ready for data analysis.

3.11 DATA MANAGEMENT AND STATISTICAL ANALYSIS

The researcher marked and completed the interpretation forms for both rating scales. This information was then captured into an excel spreadsheet. To ensure accuracy of this captured information, two colleagues and the researcher proofed each entry to reduce human error.

3.11.1 Data Analysis

To meet the above research questions, descriptive and inferential data analysis was used. Raw data was captured on an excel spreadsheet. To meet the first and second objectives, defining the sensory processing and behaviour profiles for the sample, the researcher scored and interpreted the SPM and Conners 3 using the SPM and Conners 3 scoring forms. This provided T-Scores for both the SPM and Conners 3 which was captured on the excel spreadsheet. The SPM data were categorised according to the classification system of "typical" (T-Score 40–59), "some problems" (T-Score 60–69) and "definite dysfunction" (T-Score 70–80). The Conners 3 data were categorised according to the classification system of "low score" (T-Score < 40), "average score" (T-Score 40–59), "high average score" (T-Score 60–64), "elevated score" (T-Score 65–69), "very elevated score" (T-Score > 70). The demographic questionnaire was analysed to categorise the information into age, gender, race, grade, parent-rated school performance, the presence of birth complications, temperament style, achievement of early developmental milestones, and if the child had previously seen an allied health care provider. Demographic variables were given a key which assigned numerical values to variables. The SPM, Conners 3 and demographic questionnaire were analysed through Statistica version 13.2,

examining descriptive data variables using frequencies, means, and medians. Microsoft Word was used to create graphs to illustrate the data.

To investigate whether certain demographic information is associated with sensory processing and internalising and externalising behaviours, Pearson's Chi-Squared test (distribution-free, non-parametric statistic tool) was used to examine group differences further. This was done by using T-Scores from the SPM and Conners 3 and assigned numerical values given to demographic variables.

To determine whether correlations exist between sensory processing and internalising and externalising behaviours, Pearson correlation coefficient (r) was used to measure possible statistical relationships and association, based on the method of covariance providing strength and direction of the parametric data, between T-Scores of the SPM and Conners 3. Statistical significance was accepted at $p < 0.05$. Further data analysis used the coefficient of determination (R^2) to describe the proportion of variance of one variable that is predictable from the other variable when describing variance between T-Scores of the SPM and Conners 3.

3.12 SUMMARY

A prospective, non-experimental, cross-sectional study using a survey design was used to collect data from 138 neurotypically developing participants between the ages six to ten years, collected once per participant. This was quantitative, descriptive and correlational in nature. The use of the SPM examined participant sensory processing, and The Conners 3 examined participant behaviour (internalising and externalising) within the classroom environment. The parent questionnaire provided insight into participant demographic characteristics. The choice of study design, along with the chosen rating scales provided a new perspective on sensory processing and behaviour of a neurotypically developing child within the classroom environment.

CHAPTER 4: RESULTS

4.1 INTRODUCTION TO CHAPTER

This chapter conveys the results of this study evaluating if correlations exist between sensory processing profiles and internalising and externalising behaviour profiles within the mainstream classroom in one hundred and thirty-eight children aged six to ten. Behavioural and sensory processing data was analysed according to results yielded from teacher completed classroom observation forms for The Conners 3 and Sensory Processing Measure.

Section 4.2 describes the reference data for the participants of this study, including investigation of the participant's demographic information. In Section 4.3 The sensory processing profiles of participants are examined, followed by investigation of behavioural profiling in Section 4.4.

Thereafter, in Section 4.5, investigation into whether certain demographic information is associated with sensory processing profiles and internalising and externalising behaviour profiles. Lastly, in Section 4.6, investigation of correlations between sensory processing profiles and internalising and externalising behaviour profiles.

In conclusion, a discussion in Section 4.7, considering whether or not the null hypothesis is accepted or rejected closes this chapter.

4.2 DEMOGRAPHIC PROFILE OF PARTICIPANTS

Table 4.1 characterises the demographic distribution of this research sample. A total of 138 children participated in this research, of which 73 were female (52.90%), and 65 were male (47.10%), distributed between six to ten years of age. From the parent questionnaire, the following demographic profiling was obtained:

Table 4. 1 Frequency distribution of participant gender, age, grade, and parent perception of school performance

Gender	n	Percentage (%)
Female	73	53
Male	65	47
Total	138	100

Age group	Distribution		**Grade**	Distribution		**Parent's perception of their child's school performance**	Distribution	
	n = 138	Percentage (%)		n = 138	Percentage (%)		n = 112	Percentage (%)
6 year old	28	20.29	One	40	28.99			
7 year old	46	33.33	Two	44	31.88	Above Average	61	54.46
8 year old	54	39.13	Three	54	39.13	Average	47	41.96
9 year old	10	7.25	Repeat	8	5.80	Below Average	4	3.58

Temperament	Distribution		**Compli-cations during birth**	Distribution		**Child seen by a health care provider**	Distribution	
	n = 121	Percentage (%)		n = 138	Percentage (%)		n = 138	Percentage (%)
						Occupational therapy	17	12.32
Easy/Flexible	101	83.47				Speech therapy	21	15.22
			Yes	16	11.59			
Difficult/Feisty	6	4.96				Play therapy	16	11.59
						Psychology	7	5.07
Slow to Warm up/Fearful	14	11.57				Other	4	2.90
			No	122	88.41	None	95	68.84

Note: n may differ in each section due to parent and teacher form completion/omitted data.

Total participants n = 138

Participants were equally distributed between grades 1–3; a low frequency of participants (5.80%) had repeated a grade within the foundation phase of education.

Parents were asked to indicate their perception of their child's school performance and temperament. Majority of parents (54.46%) believed their child was performing above average academically, with a small minority of parents (3.58%) who believed their child was performing below average academically. Majority of parents expressed that participants of this study were born with no birth or pregnancy complications (88.41%).

The majority of parents perceived their child to be of the "Easy/Flexible" temperament (83.47%), with fewer perceived as "Slow to Warm Up/Fearful" temperament (11.57%) and the minority perceived as "Difficult/Feisty" temperament (4.96%).

The majority of participants had never received any form of allied health care services (68.84%) with minority percentages receiving allied health care at some point in their early childhood, such as occupational therapy, speech therapy, play therapy or psychology.

Figure 4.1 describes the racial distribution of the sample. The largest racial group was African (60.15%), followed by Indian (18.12%) and Caucasian (13.04%), with the smallest groups being Coloured (3.62%), Asian (3.62%) and Other (1.45%).

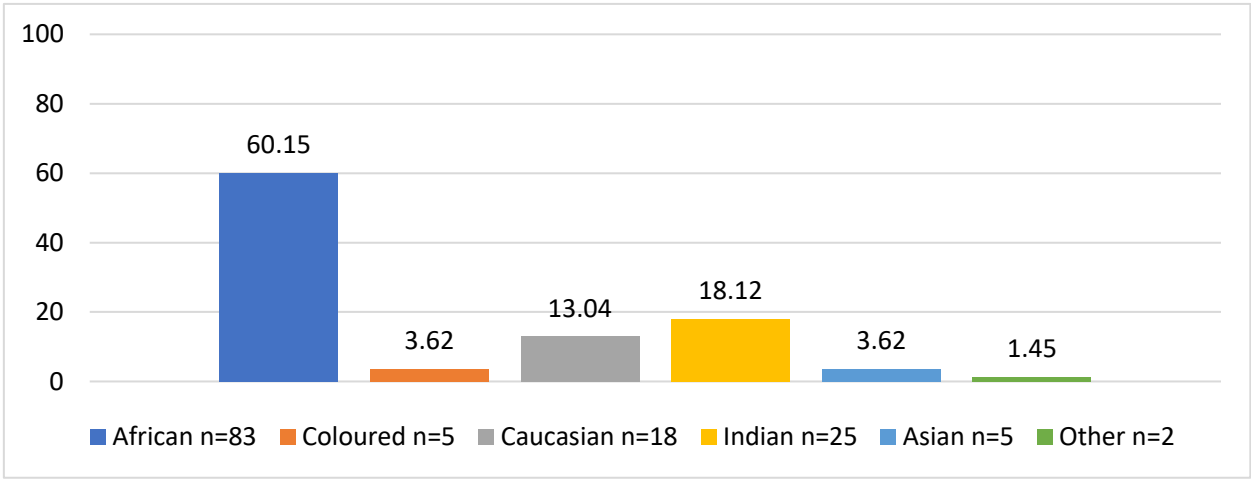

Figure 4. 1 Percentage distribution of race (n = 138)

4.3 SENSORY PROCESSING PROFILES OF PARTICIPANTS

Eight sensory processing systems, namely Social Participation (SOC), Visual (VIS), Hearing (HEA), Touch (TOU), Body Awareness (BOD), Balance and Motion (BAL), Planning and Ideas (PLA) and Total (TOT) are defined by three thresholds: "typical" range where sensory functioning is similar to that of typical children; "some problems" range where mild to moderate difficulties in the participant's sensory functioning is noted; and "definitive dysfunction" range where significant difficulties in the participant's sensory functioning are observed. Figure 4.2 depicts the percentage distribution of the participant's sensory processing thresholds in five sensory systems (VIS, HEA, TOU, BOD, BAL), overall sensory processing (TOT) and two integrative systems (SOC and PLA) and classified by the SPM:

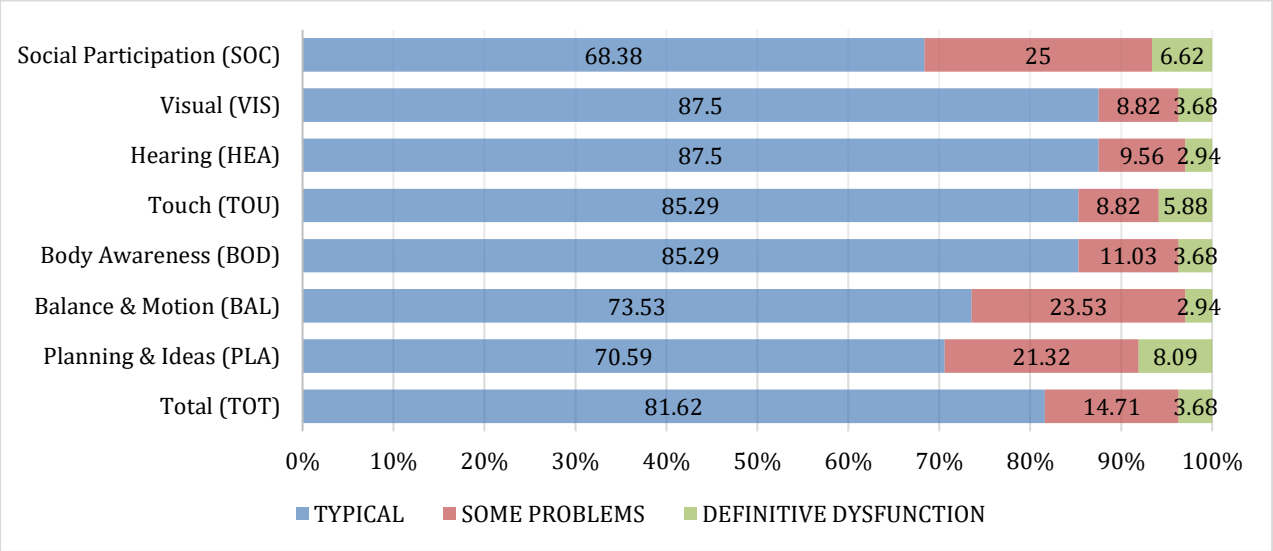

Figure 4. 2 Frequency of overall sensory system functioning thresholds. n = 136

Figure 4.2 illustrates that the majority of participants fell within the typical threshold range of sensory processing across all eight sensory processing systems. Overall, three sensory processing systems namely Social Participation (SOC), Planning and Ideas (PLA), and Balance and Motion (BAL) demonstrated the highest frequencies of red and green thresholds representing "some problems" and "definitive dysfunction" respectively. Regarding participants who met the threshold for "some problems" within their sensory processing systems, Social Participation (SOC) scored the highest (25%), followed by Balance and Motion (BAL) (23.53%), Planning and Ideas (PLA) (21.32%), and Total Score (TOT) (14.71%).

Regarding participants who met the threshold for the "definitive dysfunction" range, the highest frequencies were observed for Planning and Ideas (PLA) (8.09%), followed by Social Participation (SOC) (6.62%), and Touch (TOU) (5.88%).

When "some problems" and "definitive dysfunction" are combined to highlight sensory processing systems beyond the threshold of a typical range, the highest frequency is found within Social Participation (SOC) (31.62%), followed by Planning and Ideas (PLA) (29.41%), Balance and Motion (BAL) (26.47%) and the Total Score (TOT) (18.39%).

Table 4.2 depicts the percentage distribution of participants who met the threshold for atypical sensory processing responsivity and vulnerabilities.

Individual item scores on the SPM were examined and tallied separately to identify the frequency of over- or under-responsiveness, sensory seeking behaviours and sensory vulnerability in certain sensory systems. Participants who met the threshold for atypical sensory processing responsivity or vulnerability were recorded, whereby Table 4.2 is a summary of the tallied frequencies. Sensory processing responsivity is depicted as three sensory behaviour categories: over-responsive behaviours, under-responsive behaviours and sensory seeking behaviours. Overall, the majority of participants presented with typical sensory systems. Thus atypical sensory behaviours presented in the minority of participants.

From the three sensory behaviour categories, sensory seeking behaviours were the most observed in the classroom as having the highest frequency distribution overall, which comprised participants who met the threshold for combined Balance and Motion and Body Awareness (BAL+BOD) sensory seeking behaviours (28.26%). Fewer participants presented with isolated sensory seeking behaviours in Balance and Motion only (BAL) (13.77%) and Body Awareness only (BOD) (3.62%).

Regarding participants who demonstrated over- and under-responsive behaviours; over-responsive behaviours presented higher frequencies than under-responsive behaviours, with the exception of Hearing (HEA) which had higher under-responsive behaviours in the classroom. Overall, Vision (VIS) had the highest total frequency of over- and under-responsive behaviours (7.25% over-responsive; 5.80% under-responsive) followed by Multisensory

Processing, Touch (TOU), Hearing (HEA), and the lowest frequency being Olfactory and Gustatory.

Table 4. 2 Frequency distribution of SPM item responses showing sensory vulnerability

Sensory Systems	Frequency of participants n	Sensory responsiveness processing patterns			% Sensory Vulnerability
		% Over-Responsive	% Under-Responsive	%Sensory Seeking	
Vision (VIS)	10	7.25			
	8		5.80		
Touch (TOU)	4	2.90			
	2		1.45		
Hearing (HEA)	1	0.72			
	2		1.45		
Olfactory and Gustatory	1	0.72			
Multisensory Processing	4	2.90			
	3		2.17		
Balance and Motion only (BAL)	19			13.77	
Body Awareness only (BOD)	5			3.62	
Combination of Balance and Body Awareness (BAL+BOD)	39			28.26	
Postural Control	27				19.57
Ideation	40				28.99
Motor Planning	36				26.09
Perception	14				10.14

Note: n = 138

Table 4.2 illustrates that sensory vulnerabilities, gathered from examination of individual SPM item scores, demonstrated the highest frequencies comprised of Postural Control (19.57%), Ideation (28.99%), Motor Planning (26.09%) and Perception (10.14%); whereby these participants met the threshold of atypical sensory vulnerability in these sensory systems.

4.4 BEHAVIOUR PROFILES (INTERNALISING AND EXTERNALISING FEATURES) OF PARTICIPANTS

4.4.1 Internalising Behaviour Profiles

Table 4.3 illustrates the frequency of teacher identified internalising behaviours present in the classroom environment. The table indicates the eight screener items which examine two factors of internalising behaviours, namely anxiety and depression features. Table 4.3 provides statistical insight into the frequency of participants who reached the threshold of atypical symptoms that were 'more than typically reported for age and gender' for anxiety and depression features.

Table 4. 3 Frequency of participants who met the threshold for atypical internalising behaviours

Screener items of internalising behaviour	Frequency of participants n	Percentage of participants with atypical levels of internalising behaviours, observed by teacher in the classroom over the past month %
Anxiety		
Irritable	29	21.48
Worries	48	35.56
Trouble controlling worries	44	32.59
Nervous or jumpy	30	22.22
One or more anxiety feature observed	67	49.63
Depression		
Sad, gloomy or irritable	22	16.30
Loss of interest or pleasure	31	22.96
Tired, low energy	46	34.07
Worthlessness	22	16.30
One or more depressive feature observed	68	50.37

Note: Total n = 135. Participants may present with one or multiple anxiety/depression features. Internalising behaviours above describe participant behaviour over the last month at the time of answering the teacher-based rating scale.

Of the participants, 49.63% presented with one or more anxiety feature observed by the teacher in the past month within the classroom; including features such as “irritability”, “worries”, “trouble controlling worries” and being “nervous or jumpy”. Of the participants, 50.37% presented with at least one depressive feature observed by the teacher in the past month within the classroom; including features such as being “sad, gloomy or irritable”, “loss of interest or pleasure”, “tired, low energy” and feelings of “worthlessness”.

Regarding anxiety and depression features of internalising behaviour, the highest frequencies were observed in two anxiety features namely “worries” (35.56%) and “trouble controlling worries” (32.56%), and one depressive feature namely “tired, low energy” (34.07%).

Overall, the majority of participants presented within the “typical range” with regards to anxiety and depression features in relation to other typically developing children with consideration for typical expression of anxiety, mood shifts, age, gender, and other demographic markers and non-bias of The Conners 3.

4.4.2 Externalising Behaviour Profiles

The study examined 12 features of externalising behaviours and overall general conduct as defined by The Conners 3. Table 4.4 depicts the frequency of teacher identified externalising behaviours present in the classroom environment and provides statistical insight into the occurrence of participants who reached the threshold of atypical externalising behaviour that was “more than typically reported for age and gender” within a classroom environment.

Externalising behaviours with a T-Score of ≥ 60 indicate more severe, frequent presentations, disturbances, and concerns of the externalising behaviour in comparison to age and gender-matched peers.

Table 4. 4 Frequency of The Conners 3 overall rating scales based on T-Scores indicative of externalising behaviour concerns

Externalising behaviour	Frequency of participants n	Percentage of participants with atypical levels of externalising behaviours (T-Score of ≥ 60), observed by teacher in the classroom over the past month %
Inattention IN	28	20.74
Hyperactivity/Impulsivity HY	38	28.15
Learning Problems/Executive Functioning LE	34	25.19
Learning Problems LP	41	30.37
Executive Functioning EF	34	25.19
Defiance/Aggression AG	41	30.37
Peer Relations PR	39	28.89
Global Index GI	41	30.37
DSM-IV ADHD Inattentive AN	31	22.96
DSM-IV ADHD Hyperactive/Impulsive AH	41	30.37
DSM-IV Conduct Disorder CD	35	25.93
DSM-IV Oppositional Defiance OD	34	25.19
General Conduct Concerns	26	19.26

*Note: A T-Score of ≥ 60 describes the child as showing more severe/frequent demonstrations of the symptoms in comparison to age and gender-matched peers. Total n = 135

Overall, participants of this study largely reflected externalising behaviours representing that of a "typical range"; acknowledging that age-appropriate externalising features are present within a typical threshold. Approximately one-fifth of the participants met the threshold for concern in externalising behaviours, ranging from 19.26%-30.37% across these externalising behaviours. Four externalising behaviours demonstrated the highest frequency with 30.37%, namely Learning Problems (LP), Defiance/Aggression (AG), DSM-IV ADHD Inattention subtype (AN) and DSM-IV ADHD Hyperactive/Impulsive subtype (AH). Peer relations (PR) and generalised Hyperactivity/Impulsivity (HY) closely followed with 28.89% and 28.15% respectively.

Table 4.5 illustrates the DSM-IV symptom scales for three diagnostic behaviour classifications: Attention Deficit Hyperactive Disorder (ADHD – Inattentive, Hyperactive/Impulsive and combined Inattentive and Hyperactive subtypes), Conduct Disorder (CD), and Oppositional Defiance Disorder (ODD). Whilst none of the participants had been formally diagnosed with any of these disorders, Table 4.5 represents the frequency of participants who met the DSM-IV criteria for these disorders based on the classification symptom scales of the DSM-IV manual, as observed by teachers within a classroom environment, where DSM-IV features were endorsed at sufficient levels to be considered for a possible diagnosis of that particular disorder.

Table 4. 5 Frequency of DSM-IV symptom scales present in participants

DSM-IV symptom scales*	Frequency of participants n	Percentage of participants with atypical levels of symptom scale behaviours observed by teacher in the classroom over the past month %
DSM-IV ADHD Inattentive AN	14	10.37
DSM-IV ADHD Hyperactive/Impulsive AH	19	14.07
DSM-IV ADHD Inattentive and Hyperactive combined	9	6.67
DSM-IV Conduct Disorder CD	23	17.04
DSM-IV Oppositional Defiance Disorder ODD	20	14.81

*Note: The symptom scales score reflects how many DSM-IV symptoms were endorsed at sufficient levels to be considered for a possible diagnosis of that particular disorder. Diagnosis cannot be made on these observations alone. Total n = 135

Participants of this study reflected a population of typical externalising behaviours within a classroom environment. Examining participants who met the threshold for atypical behaviour in the DSM-IV symptom scales, the largest frequency was observed for Conduct Disorder (CD) (17.04%) and Oppositional Defiance Disorder (ODD) (14.81%) with lesser frequencies observed for ADHD Inattentive Subtype (AN) (10.37%) and Hyperactive/Impulsive subtype (AH) (14.07%). The lowest frequency was observed for combined DSM-IV Inattentive and

Hyperactive subtypes (6.67%). Between 6.67–14.81% of participants met the threshold for atypical behaviour with sufficient DSM-IV symptoms in these three diagnostic behaviour classifications, namely ADHD, Conduct Disorder and Oppositional Defiance Disorder, to be considered for a possible diagnosis of that particular disorder.

ADHD features and externalising behaviours are closely linked in their presentation within the context of a classroom. Table 4.6 depicts the ADHD Index Scale (AI), which further examines whether a child is more similar to children with an ADHD diagnosis or to typical children that represent the general population.

Table 4. 6 Frequency of ADHD Index Scale (AI)

Descriptive guideline	Probability score	Frequency of participants n	Behaviour observed in the classroom %
Very low: responses are very similar to those for the general population; a clinical classification is highly unlikely.	<20%	66	48.89
Low: responses are similar to those for the general population; a clinical classification is unlikely.	20–39%	20	14.81
Low borderline; responses are slightly more similar to the general population than to the clinical groups.	40–49%	0	0.00
Equal probability; this score is equally likely to occur for youth from the general population and youth in clinical groups.	50%	0	0.00
High borderline; responses are slightly more similar to the clinical groups than to the general population.	51–60%	22	16.30
High; responses are similar to those for the clinical groups; a clinical classification is likely.	61–79%	13	9.63
Very high; responses are very similar to those for the clinical groups; a clinical classification is very likely.	>80%	14	10.37

Note: The probability score indicates how similar the participant was to “ADHD population” or the “typical children population” and does not tell you how likely it is that a child has a diagnosis. Total n = 135

The ADHD Index Scale (AI) is stated as a probability score; thus higher scores are indicative of the child being more similar to children from the ADHD sample and lower scores indicate the child is more similar to the general population. The Index Scale (AI) ranges from very low probability of ADHD to very high probability of ADHD.

Of participants, the majority (63.70%) scored an ADHD Index Scale of ≤ 50%; therefore more similar to children with no ADHD diagnosis and are representative of typical children that represent the general population. The remaining participants constituted a substantial portion (36.30%), scored an ADHD Index Scale of > 51% and reached the threshold of being more similar to children with an ADHD diagnosis.

Table 4.7 examines teacher responses when asked to indicate their perception of participants overall school and social performance as a result of their behaviour within the classroom. When asked if there is a school impairment or social impairment, the majority of teachers (74.08%) responded with "not true" and "just a little true" indicating the participant's school and social performance is that of a typical range. In contrast, 25.92% of teachers responded with "pretty much true" and "very much true" indicating a perceived impairment in school and social performance as a result of the participant's behaviour within the classroom.

Table 4. 7 Frequency of teacher perception on participant school and social performance

Perceived performance	"not true"		"just a little true"		Typical Range Overall %	"pretty much true"		"very much true"		Atypical range overall %
	n	% Observed	n	% Observed		n	% Observed	n	% Observed	
School impairment	75	55.56	25	18.52	74.08	26	19.26	9	6.66	25.92
Social impairment	75	55.56	25	18.52	74.08	26	19.26	9	6.66	25.92

Note: n indicates the frequency of participants who presented in each category, made by teacher-based observations in the classroom. Total n = 135

Table 4.8 illustrates the frequency distribution of participants who met the threshold for typical or atypical Learning Problems (LP), Executive Functioning (EF), and combined Learning Problems and Executive Functioning (LE) abilities observed by teachers within the classroom environment. Participants predominantly presented within the average/low average category for Learning and Executive Functioning, indicating these participants were within a typical threshold, which reflects the typical developing child and general population.

Table 4. 8 Frequency of learning problems and executive functioning difficulties

Guideline scores*		n	% Observed in the classroom	% Participants with more concerns than are typically reported
Learning Problems LP	Very elevated	18	13.33	31.85
	Elevated	9	6.67	
	High average	16	11.85	
	Average & low Average	92	68.15	
Executive Functioning EF	Very elevated	10	7.41	25.19
	elevated	12	8.89	
	High average	12	8.89	
	Average & low average	101	74.81	
Learning Problems & Executive Functioning Combined LE	Very elevated	13	9,63	25.19
	Elevated	10	7.41	
	High average	11	8.15	
	Average & low average	101	74.81	

Note: n = 135

More concerns than typically reported included participants with a T-Score of ≤ 60

In contrast, 31.85% of participants reached the threshold for concern in Learning Problems (LP), and 25.19% of participants met the threshold for atypical Executive Functioning (EF) and combined Learning Problems and Executive Functioning (LE).

4.5 ASSOCIATION BETWEEN DEMOGRAPHIC CHARACTERISTICS IN RELATION TO SENSORY PROCESSING AND BEHAVIOUR (INTERNALISING AND EXTERNALISING FEATURES)

Associations were found to exist between demographic features in relation to behaviour and sensory processing profiles. Demographic information was received from parent completed demographic forms. Associations between demographic features in relation to sensory processing and behaviour profiles have been examined as follows: gender, repeating a grade, temperament, and seeing an allied health care professional.

4.5.1 Associations between Gender in Relation to Sensory Processing and Behaviour

Table 4.9 indicates that associations exist between gender in relation to sensory processing profiles and internalising behaviour profiles. Chi-Square test results revealed a significant difference between scores of female and male participants with regards to two SPM sensory processing systems, namely Vision (VIS) ($p = 0.007$) and SPM Total Score (TOT) ($p = 0.042$) and one internalising behaviour namely feelings of worthlessness ($p = 0.019$).

Table 4. 9 Associations between gender and in relation to sensory processing and internalising behaviours

Variables		Female			Male			Chi-Square		
		n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Internalising behaviours	Depression - Worthlessness	72	1.152	0.521	65	1.384	0.764	5.423	1	***0.019**
SPM Sensory Processing	SPM Vision (VIS)	73	46.534	10.013	65	49.446	9.342	7.393	1	***0.007**
	SPM Total (TOT)	72	49.875	9.537	64	52.078	8.676	4.099	1	***0.042**

Note: SD = standard deviation, df = degree of freedom, ***p-value significant at p < .05**

n may differ in sections based on teacher form completion and human error/omitted data

Upon further examination of this statistically significant difference, male participants presented with higher mean scores in these areas than females. No significant associations exist between externalising behaviours in relation to gender, as males and females presented with similar mean scores across all externalising behaviours.

Despite there being three significant differences between the gender groups, both female and male participants scored on average within the normal "typical" range for these variables when examined by gender.

4.5.2 Associations between Repeating a Grade in Relation to Sensory Processing and Behaviour

In relation to table 4.10, repeating a grade yielded significant statistical relevance in relation to behaviour and sensory processing profiles. Chi-Square test results revealed seven significant differences between participants who had and had not repeated a grade for sensory processing and externalising behaviour profiles. In this study, 5.80% of participants repeated a grade. Associations of sensory processing profiles included Social (SOC) ($p = 0.019$), Vision (VIS) ($p = 0.002$), Hearing (HEA) ($p = 0.004$), Touch (TOU) ($p = 0.017$), Body Awareness (BOD) ($p = 0.012$), Balance and Motion (BAL) ($p = 0.002$) and Total Scores (TOT) ($p = 0.001$). Fewer significant differences were observed for externalising behaviours, namely two behaviours: the Global Index (GI) ($p = 0.012$) and DSM-IV ADHD Inattentive (AN) ($p = 0.024$).

Table 4. 10 Associations between repeating a grade in relation to sensory processing and externalising behaviours

Variables		sample n	T-Scores of participants who did not repeat a grade			T-Scores of participants who did repeat a grade			Chi-Square		
			n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Conners 3 Externalising Behaviours	Global Index (GI)	135	113	53.132	13.098	8	65.500	14.402	3.016	1	***0.012**
	DSM-IV ADHD Inattentive (AN)	135	113	52.017	10.682	8	61.375	10.927	2.360	1	***0.024**
SPM Sensory Processing variables	Social (SOC)	138	116	53.094	11.750	8	59.750	9.082	5.463	1	***0.019**
	Vision (VIS)	138	116	46.948	9.362	8	58.750	5.063	9.121	1	***0.002**
	Hearing (HEA)	138	116	48.082	8.631	8	55.500	6.948	7.909	1	***0.004**
	Touch (TOU)	136	114	49.078	8.250	8	58.125	10.494	5.628	1	***0.017**
	Body Awareness (BOD)	136	114	48.578	9.196	8	56.625	7.089	6.221	1	***0.012**
	Balance & Motion (BAL)	136	114	50.526	10.617	8	60.375	4.438	9.141	1	***0.002**
	Total (TOT)	136	114	49.938	9.013	8	59.875	4.470	9.763	1	***0.001**

Note: ***p-value significant at p <.05.** SD = standard deviation, df = degree of freedom. n may differ due to teacher/parent marking error on form (missing data). RED: Atypical threshold met where T-Score is above 60 indicating "more concerns" than expected for age and gender.
n may differ in sections based on teacher form completion and human error/omitted data

Examining mean scores, participants who had repeated a grade presented statistically significant higher mean scores in these sensory processing and externalising behaviours in comparison to participants who had not repeated a grade.

Participants from both groups did not meet the threshold of concern and presented with mean T-Scores below 60 indicating typical presentation, with the following three exceptions from participants who had repeated a grade: one sensory processing system, Balance and Motion (BAL) (60.37%); and two externalising behaviours, the Global Index (GI) (65.50%) and the DSM-IV ADHD Inattentive (AN) (61.38%). This reveals that on average, these participants met the threshold for atypical presentation in these three areas, thus indicating "more concerns" than expected for age and gender.

Figure 4.3 illustrates the percentage distribution of participants who met the threshold for atypical internalising behaviours present in the classroom when comparing participants who did not repeat a grade to those that did repeat a grade. The threshold is defined by participants who demonstrated the behaviour consistently ("often" and "mostly") in their classroom environment, as perceived by their teacher. Figure 4.3 outlines that on average, participants who repeated a grade (red) presented with overall higher frequencies of atypical internalising behaviours in comparison to the lower frequencies of participants who had not repeated a grade (blue).

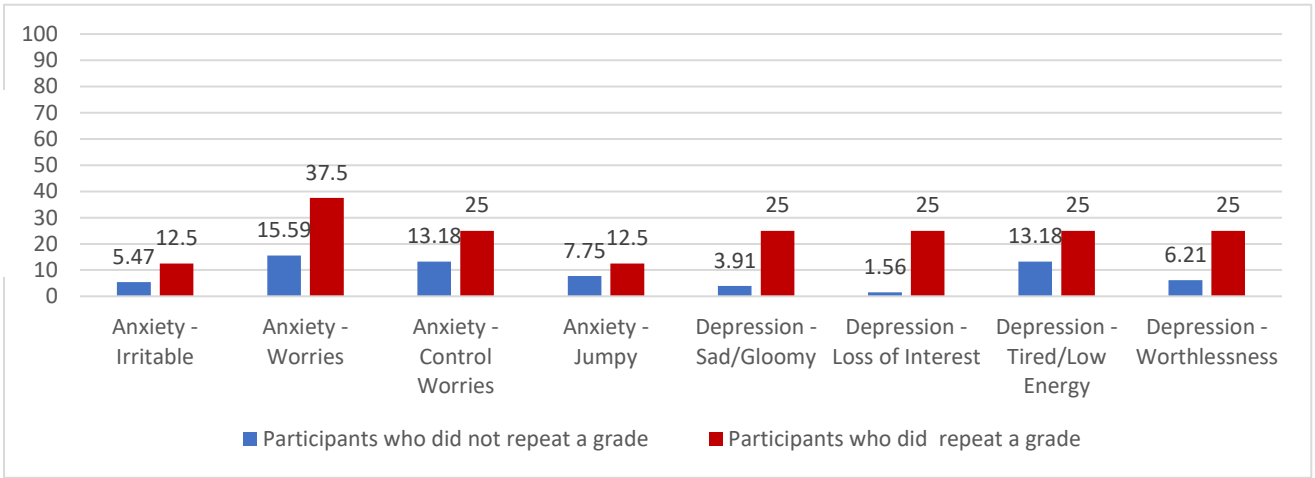

Figure 4. 3 Percentage distribution of internalising behaviours in participants who did not repeat a grade (blue) and who did repeat a grade (red)

Note: n differs for each variable. Refer to Appendix M: Table 4.15 for full statistical data.

The highest-scoring anxiety internalising features for both groups were "worries" and "controlling worries". The highest-scoring depressive internalising features were equally distributed amongst "sad, gloomy or irritable", "loss of interest or pleasure", "tired, low energy" and feelings of "worthlessness" for participants who had repeated a grade; in comparison to a high frequency of "tired, low energy" in participants who had not repeated a grade.

4.5.3 Associations between Temperament in Relation to Sensory Processing and Behaviour

4.5.3.1 Temperament and Sensory Processing

The association between temperament styles and sensory processing systems was determined using Chi-Square analysis. Table 4.11 indicate the associations between temperament and sensory processing systems.

Table 4. 11 Associations between temperament and sensory processing

SPM Sensory Processing System Variables	total n	Easy/Flexible			Difficult/Feisty			Slow to Warm up/Fearful			Chi-Square		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Social SOC	120	101	52.910	11.231	6	58.500	6.595	13	55.153	10.089	5.359	3	0.147
Visual VIS	120	101	47.940	9.471	6	51.333	9.373	13	45.076	6.448	2.256	3	0.521
Hearing HEA	120	101	49.584	8.879	6	53.000	8.831	13	50.538	7.556	2.988	3	0.393
Touch TOU	118	99	49.868	9.023	6	52.500	10.290	13	51.307	6.498	3.979	3	0.263
Body Awareness BOD	118	99	49.101	9.314	6	52.833	8.886	13	49.307	8.320	2.032	3	0.565
Balance and Motion BAL	118	99	51.555	10.596	6	54.833	10.028	13	51.076	10.103	0.907	3	0.823
Planning and Ideas PLA	118	99	51.404	10.657	6	56.500	10.348	13	59.846	8.989	10.440	3	***0.015**
Total sensory Processing TOT	118	99	50.777	9.209	6	55.000	7.211	13	51.384	5.188	4.035	3	0.257

Note: ***p-value significant at p <.05.** SD = standard deviation, df = degree of freedom. n may differ due to teacher/parent marking error on form (missing data).

The result generated in Table 4.11 indicates that Planning and Ideas (PLA), was the only sensory processing system which presented a statistical significance in relation to temperament

styles ($p < 0.015$), further revealing weak associations between other sensory processing systems and temperament styles. This indicates that whilst a significant relationship exists between PLA and temperament style, temperament did not associate strongly with sensory processing systems.

Figure 4.4 below defines the mean T-Score distribution between temperament styles and sensory processing systems. Overall, all three styles of temperaments, namely "Easy/Flexible", "Difficult/Feisty", and "Slow to Warm up/Fearful" presented within typical parameters in relation to sensory processing systems. Participants described as having "Difficult/Feisty" temperaments demonstrated higher mean scores across the sensory processing systems, with the exception of Planning and Ideas (PLA), where the temperament of "Slow to Warm up/Fearful" participants scored the higher mean score. Participants described as the "Easy/Flexible" temperament typically had the lowest frequencies in sensory processing systems, with the exception of Vision (VIS), where "Slow to Warm up/Fearful" had the lowest frequency.

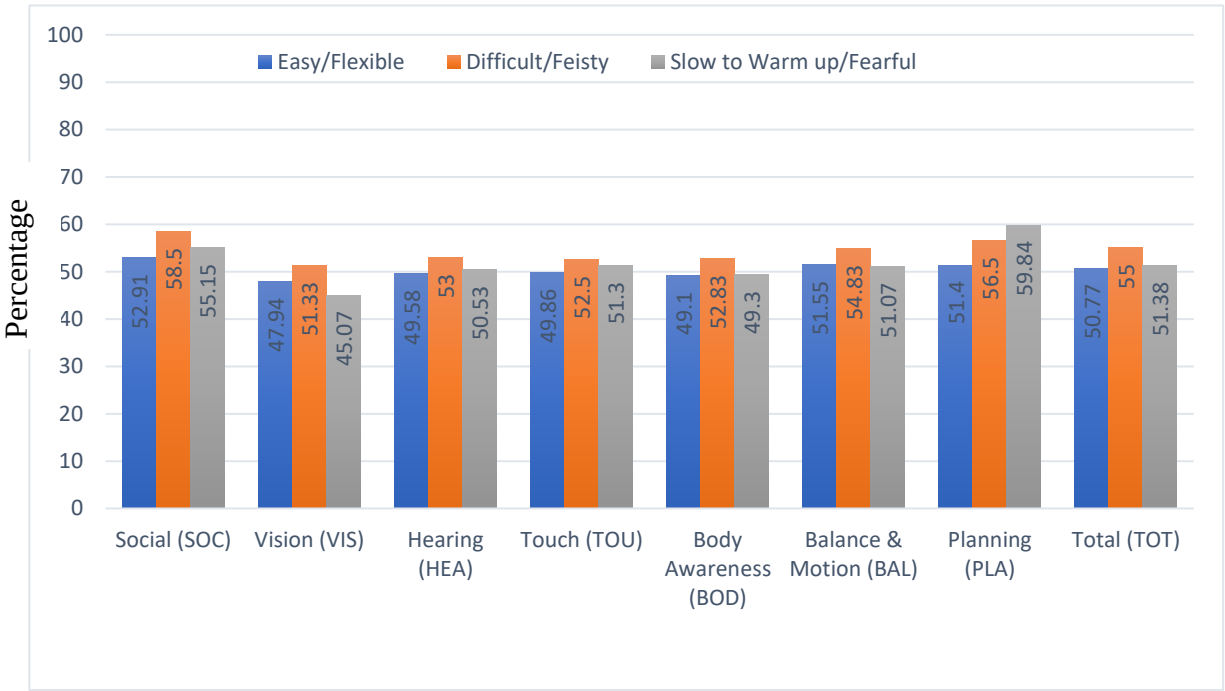

Figure 4. 4 Mean score distribution of temperament and sensory processing

Note: n differs for each variable due to teacher marking error on the classroom forms classified as 'missing data' – Refer to Table 4.11 above for full statistical data.

4.5.3.2 Temperament and Externalising Behaviours

The relationship between temperament styles and externalising behaviours was determined using Chi-Square analysis. The result generated in Table 4.12 reveals weak associations between temperament and externalising behaviours.

Table 4. 12 Associations between temperament and externalising behaviours

Conners 3 Behaviour Variables	Total n	Easy/Flexible			Difficult/Feisty			Slow to Warm up/Fearful			Chi- Square		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Inattention IN	118	100	50.680	9.201	6	54.500	14.152	11	54.909	10.153	3.599	3	0.308
Hyperactivity/ Impulsivity HY	118	100	52.910	11.575	6	66.333	17.682	11	54.181	14.770	1.764	3	0.622
Learning Problems/ Executive Functioning LE	118	100	50.840	10.230	6	53.333	13.366	11	56.454	11.299	3.432	3	0.326
Learning Problems LP	118	100	50.960	11.872	6	51.500	12.942	11	56.909	15.731	2.594	3	0.458
Executive Functioning EF	118	100	50.810	10.216	6	52.666	12.388	11	55.727	9.685	2.755	3	0.430
Defiance/ Aggression AG	118	100	54.890	14.313	6	72.500	20.423	11	57.909	19.232	4.484	3	0.213
Peer Relations PR	118	100	53.110	12.789	6	56.166	15.406	11	59.181	16.448	2.044	3	0.563
Global Index GI	118	100	52.520	12.653	6	63.166	19.508	11	59.363	16.329	4.809	3	0.186
DSM-IV ADHD Inattentive AN	118	100	51.410	10.114	6	56.500	15.501	11	56.909	10.231	4.299	3	0.230
DSM-IV ADHD Hyperactive/ Impulsive AH	118	100	53.220	12.462	6	67.333	20.146	11	54.818	14.777	3.884	3	0.274
DSM-IV Conduct Disorder CD	118	100	54.140	13.144	6	67.666	24.475	11	58.454	17.351	1.194	3	0.754
DSM-IV Oppositional Defiance OD	118	100	54.560	14.979	6	67.166	21.226	11	58.000	20.880	4.603	3	0.203

Note: ***p-value significant at p <.05.** SD = standard deviation, df = degree of freedom. n may differ due to teacher/parent marking error on form (missing data). RED: Atypical threshold met where T-Score is above 60 indicating "more concerns" than expected for age and gender. Total n = 118

Figure 4.5 portrays the relationship between temperament and externalising behaviours. All three styles of temperaments, namely "Easy/Flexible", "Difficult/Feisty", and "Slow to Warm up/Fearful" presented within typical parameters for externalising behaviours with the exception of participants perceived by their parents to have a "Difficult/Feisty" temperament which presented with the average highest mean scores of externalising behaviours, and met the threshold for atypical externalising behaviours (a T-Score above 60) for six behaviour groups: Defiance/Aggression (AG) (72.5), Conduct Disorder (CD) (67.66), DSM-IV ADHD Hyperactive/Impulsive subtype (AH) (67.33), DSM-IV Oppositional Defiance (OD) (67.16), Hyperactivity/Impulsivity (HY) (66.33), and the Global Index (GI) (63.16).

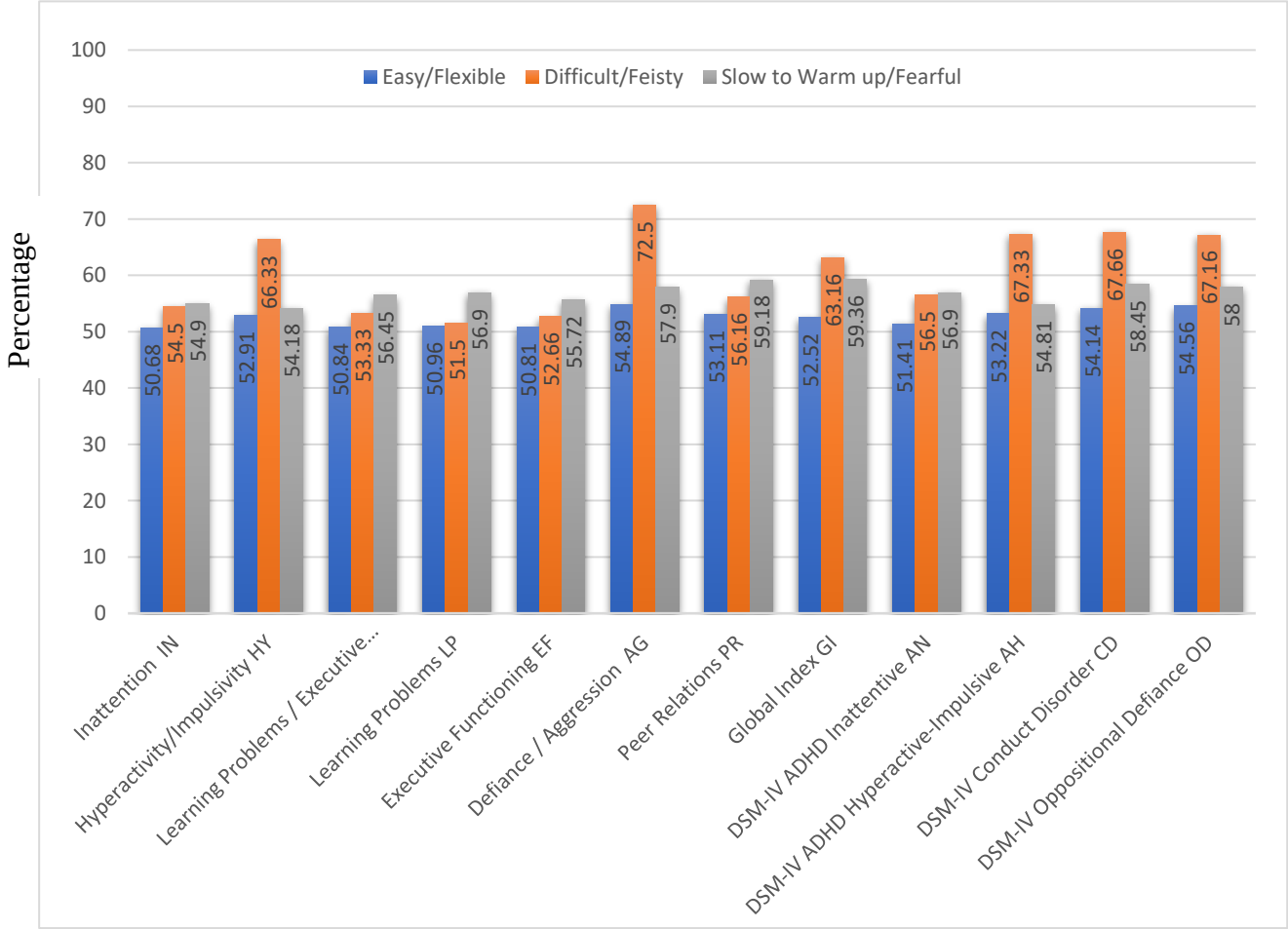

Figure 4. 5 Mean score distribution of temperament and externalising behaviours

Note: n may differ for each component due to teacher marking error on the classroom forms classified as 'missing data' – Refer to Table 4.12 above for full statistical data.

Participants perceived by their parents to have a "Slow to Warm up/Fearful" temperament had consistently higher frequencies than participants who were perceived as having an "Easy/Flexible" temperament which, importantly, presented as the lowest overall frequencies of externalising behaviours.

Table 4.13 indicates associations between temperament and internalising behaviours. Weak associations exist for all anxiety features. However, three significant associations exist between internalising behaviour features and temperament, namely overall depression (p = 0.040), sad/gloomy (p = 0.0006) and tired/low energy (0.046).

Table 4. 13 Associations between temperament and internalising behaviours

Conners 3 Behaviour Variables	total n	Easy/Flexible			Difficult/Feisty			Slow to Warm up/Fearful			Chi-Square		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Overall Anxiety	119	101	1.514	0.502	6	1.500	0.547	12	1.333	0.492	2.422	3	0.489
Anxiety - irritable	118	100	1.240	0.514	6	1.500	1.211	12	1.416	0.668	1.870	3	0.599
Anxiety - worries	118	100	1.560	0.856	6	1.666	0.408	12	2.083	1.240	2.551	3	0.466
Anxiety - control worries	119	101	1.465	0.794	6	1.166	0.547	12	1.833	1.029	3.066	3	0.381
Anxiety - jumpy	119	101	1.297	0.656	6	1.500	0.408	12	1.833	1.193	3.104	3	0.375
Overall Depression	119	101	1.554	0.499	6	1.166	0.547	13	1.153	0.375	0.250	3	***0.040**
Depression - sad/ gloomy	118	100	1.170	0.493	6	1.000	0.000	12	1.833	0.834	17.250	3	***0.0006**
Depression - Loss of interest	118	100	1.210	0.409	6	1.333	0.816	12	1.583	0.792	3.043	3	0.384
Depression - Tired low energy	119	101	1.445	0.805	6	1.666	1.211	12	2.000	1.044	7.990	3	***0.046**
Depression - worthless-ness	119	101	1.188	0.560	6	1.500	0.836	12	1.500	0.797	4.989	3	0.172

Note: ***p-value significant at p <. 05**. SD = standard deviation, df = degree of freedom.
n may differ due to teacher/parent marking error on form (missing data)

4.5.4 Associations between Seeing an Allied Health Care Professional in relation to Sensory Processing and Behaviour Profiles

Associations were found to exist, using Chi-Squared data analysis showing statistically significant differences, between externalising behaviours and sensory processing profiles in relation to participants who had seen an allied health care professional compared to those that had not. Mean T-Scores of participants who had seen an allied health care professional, such as an occupational therapist, speech therapist, play therapist or psychologist, were higher than the mean scores of participants who had not seen an allied health care professional. This was the case for participants who had seen an occupational therapist in relation to the following two sensory processing systems: Balance and Movement (BAL) ($p = 0.013$), and Planning and Ideas (PLA) ($p = 0.000$) and the following four external behaviours: Learning Problems/Executive Functioning (LE) ($p = 0.0002$), Executive Functioning (EF) ($p = 0.027$), Defiance/Aggression (AG) ($p = 0.038$), DSM-IV ADHD Inattentive (AN) ($p = 0.019$). Mean T-Scores for these components were within a typical range, with exception to Planning and Ideas (PLA), whereby participants who had seen an occupational therapist had a mean score of 60.59 indicating these children had reached the threshold for atypical performance in this sensory processing system. Refer to Appendix N: Table 4.16 for the full statistical table.

4.6 CORRELATIONS BETWEEN SENSORY PROCESSING AND BEHAVIOUR (INTERNALISING AND EXTERNALISING FEATURES)

Correlations were found to exist between sensory processing systems and behaviour. Specifically, in relation to externalising behaviours. Internalising behaviour correlations were found to be ill-defined regarding their correlational relationship to sensory processing systems due to their categorical and binary nature used to describe these internalising behaviours on the teacher-based rating scale.

Table 4.14 describes the correlations between sensory processing systems and externalising behaviours as Rho (r) correlation coefficient values, and Rho squared (R^2), denoting the coefficient of determination and representing the proportion of common variation in the variables.

Table 4. 14 Correlations between sensory processing systems and externalising behaviours

Conners 3 Externalising Behaviours	Sensory Processing Measure (SPM) systems															
	SOC		VIS		HEA		TOU		BOD		BAL		PLA		TOT	
	r	R^2	r	R^2	r	R^2	r	R^2	r	R^2	r	R^2	r	R^2	r	R^2
Inattention IN	+0.62	0.38	+0.47	0.22	+0.38	0.14	+0.19	0.04	+0.35	0.12	+0.50	0.25	+0.66	0.44	+0.49	0.24
Hyperactivity/ Impulsivity HY	+0.53	0.28	+0.42	0.18	+0.39	0.15	+0.09	0.04	+0.41	0.17	+0.49	0.24	+0.47	0.22	+0.47	0.22
Learning Problems/Executive Functioning LE	+0.66	0.44	+0.47	0.22	+0.36	0.13	+0.19	0.04	+0.34	0.12	+0.41	0.17	+0.69	0.48	+0.45	0.20
Learning Problems LP	+0.53	0.28	+0.37	0.14	+0.36	0.13	+0.16	0.03	+0.34	0.12	+0.43	0.18	+0.67	0.49	+0.40	0.16
Executive Functioning EF	+0.63	0.40	+0.51	0.26	+0.38	0.14	+0.23	0.05	+0.38	0.14	+0.46	0.21	+0.67	0.49	+0.50	0.25
Defiance/Aggression AG	+0.55	0.30	+0.38	0.14	+0.37	0.14	+0.16	0.03	+0.25	0.06	+0.38	0.14	+0.42	0.18	+0.41	0.17
Peer Relations PR	+0.56	0.31	+0.43	0.18	+0.42	0.18	+0.29	0.08	+0.36	0.12	+0.30	0.10	+0.45	0.20	+0.44	0.19
Global Index GI	+0.67	0.45	+0.50	0.25	+0.47	0.22	+0.16	0.03	+0.44	0.19	+0.49	0.24	+0.58	0.34	+0.54	0.29
DSM-IV ADHD Inattentive AN	+0.64	0.41	+0.45	0.20	+0.38	0.14	+0.22	0.05	+0.34	0.12	+0.49	0.24	+0.68	0.46	+0.49	0.24
DSM-IV ADHD Hyperactive/Impulsive AH	+0.57	0.32	+0.48	0.23	+0.43	0.18	+0.14	0.02	+0.44	0.19	+0.51	0.26	+0.51	0.26	+0.51	0.26
DSM-IV Conduct Disorder CD	+0.47	0.22	+0.44	0.19	+0.35	0.13	+0.14	0.02	+0.33	0.12	+0.37	0.14	+0.39	0.15	+0.42	0.18
DSM-IV Oppositional Defiance OD	+0.53	0.28	+0.37	0.14	+0.34	0.12	+0.13	0.02	+0.29	0.08	+0.37	0.14	+0.44	0.19	+0.38	0.14

Note: Rho values are the correlation coefficient (r), represents the linear relationship between variables. The correlation coefficient (r) is squared, resulting in value (R^2), denotes the coefficient of determination and represents the proportion of common variation in the variables. Data was analysed using a Pearson correlation/simple linear correlation analysis. Marked correlations are significant at $p < .05000$. n = 135

Strong Correlations in Red Moderate Correlations in Green. Weak Correlations in White.

The strongest overall correlation exists between the sensory processing system of Social Participation (SOC), with moderate positive correlations to all externalising behaviours with the exception of DSM-IV Conduct Disorder (CD). The highest correlations between Social Participation (SOC) and externalising behaviours are as follows: the Global Index (GI) (r +0.67, R^2 0.45), combined Learning Problems/Executive Functioning (LE) (r +0.53, R^2 0.44), DSM-IV ADHD Inattentive subtype (AN) (r +0.64, R^2 0.41) and Executive Functioning (EF) (r +0.63, R^2 0.40). The positive correlation indicates that as the T-Score for Social Participation (SOC) increases, so does the T-Scores of the externalising behaviours. The R^2 values above indicate that a percentage of variation in sensory processing systems, such as Social Participation (SOC), may be predicable from externalising behaviours as one of many contributing variables: 45% predictable from the Global Index (GI); 44% predictable from combined Learning Problems/Executive Functioning (LE), 41% predictable from DSM-IV ADHD Inattentive subtype (AN), and 40% predictable Executive Functioning (EF).

Correlations were also found to exist between the sensory processing system of Planning and Ideas (PLA), with moderate positive correlations to Inattention (IN) (r +0.66, R^2 0.44), combined Learning Problems/Executive Functioning (LE) (r +0.69, R^2 0.48), Learning Problems (LP) (r +0.67, R^2 0.45), Executive Functioning (EF) (r +0.67, R^2 0.45), the Global Index (GI)) (r +0.58, R^2 0.34), DSM-IV ADHD Inattentive subtype (AN) (r +0.68, R^2 0.46), and DSM-IV ADHD Hyperactive/Impulsive subtype (AH) (r +0.51, R^2 0.26). The R^2 values above indicate that a percentage of variation in sensory processing systems, such as Planning and Ideas (PLA), may be predicable from externalising behaviours as one of many contributing variables.

In this case, the highest percentages of variation were 48% predictable from combined Learning Problems/Executive Functioning (LE), 45% predictable from both Learning Problems (LP) and Executive Functioning (EF), and 46% predictable from DSM-IV ADHD Inattentive subtype (AN).

Few, more dispersed, correlations were found to exist.

Moderate positive correlations were revealed between two sensory processing systems and externalising behaviours, namely Vision (VIS) in relation to Executive Functioning (EF) (r

+0.51), and the Global Index (GI) (r +0.50); as well as Balance and Motion (BAL) in relation to Inattention (IN) (r +0.50), and DSM-IV ADHD Hyperactive/Impulsive (AH) (r +0.51).

Moderate positive correlations were found to exist between Executive Functioning (EF) and multiple sensory processing systems including Social Participation (SOC) (r +0.63), Vision (VIS) (r +0.51), Planning and Ideas (PLA), and Total (TOT) overall sensory processing scores.

The Global Index (GI), indicated moderate positive correlations between Social Participation (SOC), Vision (VIS), Planning and Ideas (PLA) (r +0.67) and Total (TOT) (r +0.50) overall sensory processing scores.

The DSM-IV ADHD Hyperactive/Impulsive (AH), indicated moderate positive correlations between Social Participation (SOC) (r +0.57), Balance and Motion (BAL) (r +0.51), Planning and Ideas (PLA) (r +0.51) and Total (TOT)(r +0.51) overall sensory processing scores. This correlates to the correlations found to exist between generalised Inattention (IN) and the moderate positive correlations between Social Participation (SOC) (r +0.62), Balance and Motion (BAL) (r +0.50), and Planning and Ideas (PLA) (r +0.66).

This indicates that many sensory processing systems and externalising behaviours showed a correlation in multiple arrangements. Some variables showed weak correlations between sensory processing systems and externalising behaviours which indicates that although a correlation exists between these sensory processing systems and externalising behaviours, they did not correlate strongly, thus indicating that perhaps other variables play a more significant role.

4.7 CONCLUSION

This chapter used descriptive statistics and correlations to describe the findings of the study acquired from the demographic parent questionnaire, SPM and Conners 3 to meet the objectives of the study. This information was based upon 138 participants.

The demographic information of the participants in this study represent children attending a mainstream school environment, within the foundation phase (grade 1–3) of education. The

study sample reflects a normally distributed, diverse population indicative of the South African context. Participants from the two school settings presented homogeneously regarding their overall similarity in demographic characteristics, as well as sensory processing and behaviour profiles.

Overall, whilst moderate ("some problems") and severe ("definitive dysfunction") disruptions were observed in the study sample, the majority of participants presented with "typical" or expected sensory processing profiles across the eight sensory categories. Observing the participant sensory processing profiles yielded three predominant sensory processing systems as "definitive dysfunction", namely Planning and Ideas (PLA), Social Participation (SOC), and Touch (TOU). Regarding the "some problems" range, again Social Participation (SOC), Planning and Ideas (PLA), and in addition Balance and Motion (BAL) were highlighted as sensory processing systems with more disruptions than what is expected for the participants' age, gender and setting.

The SPM allows for individual item score analysis; 'sensory vulnerability' in postural control (19.57%), ideation (28.99%), motor planning (26.09%) and perception (10.14%) was observed for participants. Whilst these 'sensory vulnerabilities' do not account for one sensory system solely, they underpin complex interlinked sensory processing profiles in the child, between systems and classroom setting as a whole.

Regarding sensory responsivity, 'sensory seeking' behaviours led with 28.26% in a combination of Body Awareness (BOD) and Balance and Motion (BAL). The Visual sensory system (VIS) had both the highest over-responsive pattern (7.25%) and under-responsive pattern (5.80%) indicating that these percentages of participants showed over- and under-responsiveness predominantly in the visual sensory system within the classroom.

Regarding internalising behaviours, the study sample showed elevated anxiety features, specifically "worries" (35.56%) and "trouble controlling worries" (32.59%); as well as elevated depressive features namely "tired, low energy" (34.07%). The majority of participants presented with age and gender appropriate internalising behaviour within the context of the classroom.

Regarding externalising behaviours, 30.37% of the study sample showed elevated Learning Problems (LP), Defiance/Aggression (AG), and sufficient observations to meet the DSM-IV ADHD Hyperactive/Impulsive criteria (AH).

Approximately one-quarter of the study sample met the threshold for the following DSM-IV classifications: ADHD Inattentive Subtype (AN) (22.96%), Conduct Disorder (CD) (25.93%), Oppositional Defiance Disorder (OD) (25.19%), and general conduct concerns (19.26%). Stemming from externalising behaviours, 31.85% of participants presented with Learning Problems (LP), 25.19% presented with Executive Functioning Difficulties (EF), and 25.19% with combined Learning Problems and Executive Functioning difficulties (LE). Overall, participants of this study collectively reflected externalising behaviours representing that of a "typical range".

Chi-Square test results revealed a significant difference between scores of female and male participants with regards to two SPM sensory processing systems, namely Vision (VIS) and Total Score (TOT) and one internalising behaviour namely feelings of worthlessness. Despite there being significant differences between the gender groups, both female and male participants scored on average within the normal "typical" range for these variables when examined by gender.

When comparing the demographic characteristics: participants who had repeated a grade presented with higher mean scores on the SPM and Conners 3 compared to those that had not. Statistically significant associations exist between repeating a grade and both sensory processing: Social Participation (SOC), Vision (VIS), Hearing (HEA), Touch (TOU), Body Awareness (BOD), Balance and Motion (BAL), and Total (TOT) sensory processing systems; and externalising behaviours: ADHD Inattention (AN) and the overall behaviour Global Index (GI).

A relationship exists between temperament and sensory processing: the "Difficult/Feisty" temperaments demonstrated on average higher frequencies for sensory processing systems in comparison to the "Easy/Flexible" temperament which typically presented the lowest disruption in sensory processing systems. However, when comparing all three temperaments to sensory processing systems, the overall presentation of participants fell within a typical range.

The relationship between temperament and externalising behaviours was observed as significant. The "Difficult/Feisty" temperament showed noteworthy associations to Defiance/Aggression (AG), DSM-IV ADHD Hyperactive/Impulsive subtype (AH), DSM-IV Conduct Disorder (CD), DSM-IV Oppositional Defiance (OD), and Hyperactivity/Impulsivity (HY).

Thus, the null hypothesis that sensory processing and externalising behaviour has no association with demographic characteristics, namely gender, repeating a grade and temperament style, is rejected.

Several moderate positive correlations exist between Social Participation (SOC) and Planning and Ideas (PLA) sensory processing systems and externalising behaviours, namely Inattention (IN), combined Learning Problems and Executive Functioning (LE), Learning Problems (LP), Executive Functioning (EF), general behaviour on the Global Index (GI), ADHD Inattentive (AN), and ADHD Hyperactive/Impulsive (AH). SOC had the highest number of correlations with additional correlations to Hyperactivity/Impulsivity (HY), Defiance/Aggression (AG), Peer Relations (PR), and DSM-IV Oppositional Defiance (OD). Fewer moderate positive correlations were also found to exist between externalising behaviours: Executive Functioning (EF) and the Global Index score (GI) in relation to sensory processing systems Total (TOT) and Vision (VIS). Lastly, BAL revealed moderate positive correlations in relation to Inattention (IN), and ADHD Hyperactive/Impulsive (AH). Thus, the null hypothesis that a correlation does not exist between sensory processing and behaviour (externalising features) are rejected for the following sensory processing systems: Social Participation (SOC), Visual (VIS), Balance and Motion (BAL), Planning and Ideas (PLA), and Total sensory processing (TOT); and accepted for the following sensory systems: Hearing (HEA), Touch (TOU), Body Awareness (BOD).

The null hypothesis that a correlation does not exist between sensory processing and behaviour (externalising features) are rejected for 11 of the 12 following externalising behaviours: Inattention (IN), Hyperactivity/Impulsivity (HY), Learning Problems and Executive Functioning combined (LE), Learning Problems (LP), Executive Functioning (EF), Defiance/Aggression (AG), Peer Relations (PR), Global Index (GI) of generalised behaviour, ADHD Inattentive Subtype (AN), ADHD Hyperactive/Impulsive (AH), and DSM-IV Oppositional Defiance (OD). The null hypothesis that a correlation does not exist between

sensory processing and behaviour (externalising features) are accepted for the remaining externalising behaviour, namely DSM-IV Conduct Disorder (CD).

The following chapter discusses the results presented in this chapter by linking the findings to local and international literature.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION TO CHAPTER

Chapter five discusses the results of this research. The research questions and hypotheses will be examined concerning the existing literature, to identify if the hypotheses formulated are supported or rejected based on the results yielded. This chapter comprises the discussion of sensory processing and behaviour profiles of the sample. The association between sensory processing and behaviour profiles in relation to the sample's demographic features is highlighted. Proceeding with the discussion, the correlations between sensory processing profiles and behaviour profiles are considered. In conclusion, the limitations of this research are provided.

5.2 DEMOGRAPHIC DATA

Referring to Table 4.1, a total of 138 participants were recruited. Participants who attended one of the two mainstream primary schools (one private and one government primary school), were distributed between the ages six (20.29%), seven (33.33%), eight (39.13%) and nine (7.25%) years of age, and were distributed between grades one (29%), two (32%) and three (39%). Female (53%) and male (47%) participants were similarly distributed by gender ratio. According to a census captured in 2016 by Stats SA (Department of Statistics South Africa), the racial distribution of this study is reflective of the South African population. Of participants, 5.80% had repeated a grade. This statistic is similar to that recorded by the Programme for International Student Assessment (PICA), that indicated in 2016, an average of 4.30% learners in grade one, two and three had repeated a grade (OECD, 2016).

The majority of participants presented with an "Easy/Flexible" temperament (83.47%), followed by "Slow to Warm up/Fearful" (11.57%), and "Difficult/Feisty" (4.96%).

The majority of parents believed their children were performing at an average (42%) or above average (54%) level, with the minority of parents who believed their child's performance was below average (4%). This was expected since participants presented with no known disability or diagnosis, and in addition 88.41% had no birth complications. Whilst the majority of participants had received no form of therapeutic intervention (68.84%), 12.32% of participants

attended occupational therapy, 15.22% attended speech therapy, and 11.59% attended play therapy. Literature suggests that within a typically developing population of children, the prevalence of therapeutic intervention should be lower in comparison to a population with disabilities (Law et al., 2000). However, the exact rates of referral to allied health care providers for children who face barriers to learning in a mainstream school environment, who would benefit from supportive or preventative therapeutic intervention without the presence of disability, is not well documented (Law et al., 2000). Since children within the mainstream school environment are being referred to allied health care providers for therapeutic intervention, this requires further exploration.

Whilst participants of this study did not have a formal or fixed diagnosis or disability; a noteworthy portion had received therapeutic intervention. It is possible that these children have been identified as being "at risk" for developmental, learning or emotional difficulties; thus the referral to an allied health care provider was made. From the current study, a total of 47.1% of participants have attended one or more therapies in the foundation phase of education (such as occupational therapy, speech therapy, psychology, or physiotherapy). A recent South African study recorded similar findings, indicating that in 100 neurotypical primary school children, 50% of children had received one or multiple therapies (Chemel, 2015).

Literature suggests that the referral rate of neurotypically developing children to allied health care providers may be as a result of the rise in environmental expectations on young children, increased academic demands, decreased amount of active play, poor quality of unstructured free play, high curriculum expectations, and exposure to stressful life events at a young age (Hutton, 2012; Miller & Almon, 2009). These extraneous factors play a role in a child's ability to engage efficiently and with satisfaction (Hutton, 2012; Miller, Anzalone, Lane, Cermak & Oesten, 2007). In addition, the high number of students per classroom has been a growing concern in the South African education sector (Marais, 2016). Many South African teachers face the challenge of adequately attending to each student's individual needs within larger classroom sizes (Marais, 2016). These may be contributing factors adding to the need for additional, collaborative and supportive allied services within a South African primary school setting.

Associations between demographic characteristics in relation to sensory processing profiles and behaviour profiles are examined later in this chapter.

5.3 SENSORY PROCESSING PROFILES OF PARTICIPANTS

The first objective of this study was to describe the sensory processing profiles in a sample of neurotypically developing children.

5.3.1 Typical TOT Sensory System Profiles

The majority, 81.62%, of participants fell within a typical profile for overall TOT sensory processing which was to be expected as participants were considered to be reflective of neurotypically developing children (refer to Figure 4.2). A typical TOT score is useful in understanding a child's overall sensory functioning, across sensory systems, within the classroom environment. The results of this study indicate that the majority of participants presented with age-appropriate overall sensory functioning. Typical TOT sensory functioning plays an essential role in the physical, cognitive, emotional and social development of a child (Miller et al., 2007). Typical sensory processing profiles are essential for perceiving, analysing, and organising constant sensory experiences within multiple sensory systems (Ayres, 1979). Typical sensory processing profiles allow for appropriate production of responses between the internal and external environments, between the child, the task, and their scholastic environment (Parham et al., 2007). This has important implications for a school-going child as it forms the foundation for successful engagement in occupations such as learning, reading, writing, mathematics, problem-solving, maintaining alertness, climbing on the jungle gym, eating lunch, and socialising to take place throughout the school day (Dunn et al., 2002; Miller, 2006; Parham & Mailloux, 2010).

5.3.2 Atypical TOT Sensory System Profiles

A substantial portion of participants presented with atypical TOT sensory system scores, namely 14.71% "some problems" and 3.68% "definitive problems" (refer to Figure 4.2). Research indicates that in children identified as having no developmental difficulties, approximately 3.20% presented with a "definitive difference" in the TOT sensory system which is similar to that of this research (Lidstone et al., 2014; Tomcheck & Dunn, 2007). The occurrence of sensory processing disruptions in typical child populations, otherwise known as idiopathic sensory processing disorder, is postulated at 5–10% which supports the findings of the current study (Ahn et al., 2004). However, according to the SPM manual and statistics for

neurotypically developing children, a higher percentage of participants from the current study met the threshold for atypical sensory processing systems than expected for the sample (Parham et al., 2007). This was also the case when compared to additional normative records cited by The School Companion, ADDES-3 and Sensory Profile (Chemel, 2015).

TOT sensory system scores have important implications. According to SPM conducted research, atypical TOT scores were highly associated with learning difficulties, sensory processing dysfunction, autism spectrum disorder, ADHD/ADD, speech and language impairments, visual processing impairments, developmental delay, motor disorders, and emotional and behavioural disorders (Parham et al., 2007). Children with higher TOT sensory system scores were at higher risk for developmental delays and learning difficulties (Parham et al., 2007). Since a total of 18.39% of participants met the threshold for atypical TOT sensory systems, consideration should be given to the available strategies used to support sensory needs within the classroom environment. In addition, further insight should be given to the impact this may have on a child's occupational performance within their school, home and community settings. This leads to the question of whether South African children have sufficient, age-appropriate sensory experiences throughout their school day, in addition to whether or not their sensory needs are being met within the classroom and school environment. With a focus on academic achievement, supporting a typical sensory processing profile within the context of the classroom has not been highlighted as a priority by the educational sector in South Africa (Human Rights Watch, 2015). Understandably, supporting sensory processing in a school setting may take a back seat for the immediate future in many schools, as other concerns have been raised as an immediate priority in South African education such as discrimination in accessing education, discrimination due to lack of reasonable accommodations, disparities in fees and expenses, violence and neglect, differences in quality of education, and lack of preparation for life after basic education (Human Rights Watch, 2015).

Despite the understandable need for supportive sensory strategies within a school context, careful consideration into the contributing factors associated with elevated TOT sensory scores requires further examination, particularly within the South African context.

Whilst TOT sensory processing scores are reflective of the child's overall sensory processing, some children may have specific sensory system scores that are elevated even when the TOT score is not.

5.3.3 Sensory System Profiling

The majority of participants presented with typical sensory system functioning as expected for this sample. Three sensory processing systems, namely Social Participation (SOC), Planning and Ideas (PLA), and Balance and Motion (BAL), demonstrated the highest frequencies of disruption (refer to Figure 4.2). SOC indicated the highest frequency of dysfunction, with 31.62% of participants presenting with atypical scores, followed by PLA with 29.41% atypical scores, and BAL with 26.47% atypical scores. According to the SPM norm references, these participants presented similarly to the clinical sample (with known sensory, learning and developmental concerns) and less like the neurotypical sample.

There are a number of reasons that may explain these findings. The SPM is a screening tool based on teacher-based observations and thus may require additional, more thorough clinical evaluation to determine true sensory processing difficulties (Parham et al., 2007). The average South African classroom environment has limited sensory support strategies; thus, some children may find it more challenging to regulate their sensory needs throughout the day with the available sensory resources (Department of Basic Education, 2015; Reynolds et al., 2008). Even more so for children who present with sensory processing difficulties. Whilst the South African Department of Basic Education has recognised the need for inclusive strategies for supporting sensory needs in the classroom environment; no recommended implementation plans have been provided as yet (Department of Basic Education, 2015). Many school curriculums foster an academic approach whereby children spend substantial periods of time seated at a desk, thus limiting free play and sensory experiences (Hutton, 2012). PLA and BAL are largely movement-based; however, there is limited opportunity for a child to assume different postures, activate different types of vestibular sensory inputs, and engage in a variety of movements and positions in a classroom environment which is necessary to encourage the development of these sensory systems (Hardin, 2017; Miller & Almon, 2009). Since children spend substantial portions of time limited to a desk and chair, providing opportunity for flexible seating such as posture cushions, standing desks, therapy balls, or rocking chairs has been identified to produce more engaged students when learning (Hardin, 2017). It is also possible that since some participants had previously received therapeutic intervention from an allied health care provider, whilst no formal diagnosis had been made, they were identified as “at risk” for underlying challenges affecting their sensory processing profiles.

Furthermore, whilst many applications have been made, sensory processing disorder (SPD) is not formally recognised by the Diagnostic and Statistical Manual (DSM) fifth edition, a manual that health care professionals use to make clinical diagnoses and referral to other health care professionals (Miller & Brout, 2015). Whilst the DSM recognises sensory processing dysfunction, sensory processing symptoms are accounted for under certain clinical diagnoses and does not have its own diagnostic classification as yet. In this case, it is not surprising that perhaps participants who met the threshold for concern have sufficient clinical features of SPD, but without a formal placement in the DSM, they have been overlooked (Miller & Brout, 2015). Moreover, SPD recognition has only recently come into fruition, particularly for occupational therapists within the mainstream school environment (Miller & Brout, 2015). Therefore, the following concepts may be possible: a child presenting with atypical sensory processing profiles may have an undiagnosed clinical disruption to their sensory processing abilities; the child may have an undiagnosed clinical comorbidity impacting on the presentation of their sensory processing thus warranting further investigation and management; or the child may have been incorrectly screened by their classroom teacher warranting further investigation by a trained health care professional and consultation with their primary caregivers (Miller & Brout, 2015).

Literature has supported the link between sensory processing and occupational performance in activities of daily living. Atypical sensory processing profiles specifically have been linked to impaired sensory arousal, inattention, impulsivity, emotional dysregulation and behavioural impairments (Lane, Reynolds & Thacker, 2010). Limited research and norm-referenced data exists for the neurotypical child. Mainstream primary schools service a variety of children with varying sensory needs and abilities. For this reason, how children within a mainstream school environment are supported holistically, including their sensory processing needs, and the impact this has on their occupational engagement and performance is important.

5.3.4 Sensory Responsivity

Regarding sensory responsiveness, sensory seeking behaviours were most observed by teachers in the classroom (refer to Table 4.2). The implications of this are that children identified with sensory seeking behaviours are more likely to continuously seek or intensify sensory experiences in their environment. This may result in fidgeting, seeking movement by rocking or wriggling, creating noise, chewing on non-food items, often resulting in disrupted

attention and engagement. A recent South African study using the Sensory Profile: School Companion, found that sensory seeking behaviours were identified more frequently by South African teachers in comparison to American teachers (Chemel, 2015). It is important to note that the SPM relies on teacher-based observations; thus true sensory modulation disruptions resulting in sensory seeking behaviours should be further confirmed by a thorough sensory processing evaluation (Parham et al., 2007). It is possible that since this sample is not homogenous for children with sensory modulation disturbances, other factors could exist such as emotional, behavioural, attentional, or learning difficulties which may better explain the sensory seeking behaviours observed. Research regarding sensory seeking behaviours present in neurotypical children is limited. Occupational therapy strategies for sensory seeking behaviours are well known, such as the use of weighted vests or blankets, seat wedges and cushions, ball chairs and other flexible seating options, as well as inclusion of sensory specific experiences throughout the school day (Case-Smith & O'Brian, 2010). However, the use and benefits of these strategies in neurotypical children who present with sensory seeking behaviours are largely undocumented.

In addition to responsivity, SOR was observed more than SUR across the sensory systems. Ben-Sasson, Carter & Briggs-Gowan (2009) described sensory responsivity such as SOR in a non-referred population of children: the prevalence was recorded as 16.50% where children with developmental issues were excluded (such as prematurity, birth complications or developmental delays). A prevalence of 5–16% of atypical sensory processing abilities (including modulation disruptions) within a general population was found (Miller, Milberger & MacIntosh, 2004; Ben-Sasson, Carter & Briggs-Gowan, 2009). Both groups of researchers support the presence of SOR and SUR seen in the current study examining neurotypical children. Tomchek and Dunn (2018) however, found a lower prevalence of SOR and SUR (3.2%) in a control group of neurotypical children. Again, since the current study sample was not homogenous for sensory modulation disturbances (like many other studies), other factors such as emotional, behavioural, attentional, or learning difficulties may better explain the observations (Ben-Sasson, Carter & Briggs-Gowan, 2009). In any case, the occurrence of responsivity within a neurotypical population are varying and limited research exists.

In respect of sensory vulnerabilities, the majority of participants presented with typical sensory processing profiles. However, some participants presented with "at risk" sensory vulnerabilities in the following sensory systems: Postural Control (19.57%), Ideation

(28.99%), Motor Planning (26.09%) and Perception (10.14%). According to the SPM norm references, these participants presented similarly to the clinical sample and less like the standardised neurotypical sample (Parham et al., 2007). This has significant implications for classroom-based engagement and learning, since postural control, ideation, motor planning and perception form the foundation on which a child may sit at their desk with adequate control, play, socialise, plan and execute tasks, read, write, perform mathematical tasks, and engage in visual analysis tasks to name a few. There is limited data and norm references on the occurrence of these sensory vulnerabilities within a neurotypical child population. This emphasises the need for future research within a neurotypical child population, to determine the occurrence of sensory vulnerabilities and the implications this has on a child's scholastic engagement.

Davies & Tucker further suggested that sensory integration research is significantly impacted on by the specific evaluation tools used. Since sensory processing tools vary significantly in what they measure, it would be difficult to produce a consensus regarding prevalence, factors and clusters across studies evaluated by such a variety of tools (Davies & Tucker, 2010). In addition, heterogeneity, demographics, and coexisting conditions vary significantly in the literature (Miller et al., 2007). For these reasons, research in this field is essential to the global and local growth of sensory processing information and prevalence rates, as well as to further establish appropriate tools for evaluation.

Certainly, the above raises the question of if the sensory needs of neurotypical school-going children are being adequately understood and met within their day-to-day interactions. Research, even in the South African context, has identified that sensory strategies support academic success. However, no formal implementation plans, or quality control strategies are being integrated into the academic and school framework. With limited data on typical sensory processing profiles in the classroom environment, can the health and educational sectors truly understand the impact that sensory processing has on a child's occupational engagement and performance? Holistic well-being, including sensory processing as part of a child's physical, intellectual, emotional, and social development has been recognised in supporting a child's educational experience (Department of Basic Education, 2015; Human Rights Watch, 2015). The implications this has on successful school engagement, and occupational performance, and how to support holistic health and well-being within the educational sector is an important consideration.

5.4 PROFILES OF INTERNALISING AND EXTERNALISING BEHAVIOUR OF PARTICIPANTS

The second objective for this study was to describe the behaviour profiles (internalising and externalising features) in a sample of neurotypically developing children. Behavioural profiles of internalising and externalising features have been considered separately.

5.4.1 Internalising Behaviour Profiles

Two features of internalising behaviours were observed, namely anxiety and depression features. In the current study, 49.63% of participants presented with one or more anxiety feature, which met the threshold for atypical levels of anxiety. Considerable frequencies of participants who met the threshold for atypical anxiety behaviours were observed: 21.48% "irritable", 35.56% "worries", 32.59% "trouble controlling worries", and 22.22% presented with as atypical levels for being "nervous or jumpy" (refer to Table 4.3). These findings are supported by international literature, which estimates anxiety levels in the child population to range between 3–24% in the USA (Settipania et al., 2012). In larger survey studies, prevalence findings have been suggested to range from 10–20% in youth experiencing debilitating anxiety (Costello et al., 2003). The high levels of anxiety found in this sample are of concern. Findings from a systematic review estimates 50–70% of children with atypical levels of anxiety do not receive intervention, which is highly associated with impaired performance in school, family and social engagement (Chavira et al., 2004; Egger & Burns, 2004; Kendall, Settipani & Cummings, 2012). Consideration to the reality that many South African children and families face which may contribute towards anxiety in young children, concern safety, crime, trauma, sexual abuse and neglect, and divorce rates is worth reflection (StatsSA, 2011). According to the South African Depression and Anxiety Group (SADAG), anxiety in children may also result due to risk factors such as continual fighting between parents, divorce or separation, difficult home circumstances, parental illness, as well as school or peer pressures (South African Depression and Anxiety Group, 2020a). These considerations have important implications for how childhood anxiety is understood and managed within a mainstream primary school environment, particularly in the South African context.

In the current study, 50.37% of participants presented with one or more depressive feature, which met the threshold for atypical levels of depression. Considerable frequencies of

participants who met the threshold for atypical depressive behaviours were observed: 16.30% sad, gloomy or irritable, 22.96% loss of interest or pleasure, 34.07% tired or low energy, and 16.30% experienced feelings of worthlessness (refer to Table 4.3). The presence of depression features in the current sample is high. Lower prevalence rates were found in international literature. A large meta-analysis of 51 published studies in the USA of children born between 1954 and 2004 found an overall prevalence rate of 3.8% of clinical depression; an update on literature was reevaluated after 2004 and found a lower prevalence rate of 2.7% (Boat and Wu, 2015). Depression prevalence seems to be lower in children in comparison to adults, with researchers citing similar prevalence rates of between 0.3–7.8% in children below the age of 13 years (Lima et al., 2013). Prevalence rates of depression in South African children are not well documented. This speaks to the relevance of this study: participants of the current study show substantial teacher-observed depressive features and may be at risk for clinical depression. SADAG stated that depression in youth could be as a result of isolation, loneliness, and bullying, further highlighting the impact of poor community, school and home integration as a major concern (South African Depression and Anxiety Group, 2020b). SADAG gave consideration to the association between rising depression rates in young children and the increased access and time spent on online platforms, stating their concern for the amount of time a child spends away from socialising in the real world, increasing their risk for social isolation and depression (South African Depression and Anxiety Group, 2020b).

Whilst the majority of participants were within a typical profile for internalising behaviours, a considerable prevalence of participants met the threshold for concern in both anxiety and depressive features. Again, whilst no clinical evaluation was conducted, these behaviours have been observed by teachers using standardised screening tools indicating these participants are more “at risk” for atypical behaviour profiles. This highlights the need for evaluation of the current strategies which aim to support typical behaviour profiles in order to aid scholastic success and a child’s holistic well-being (Eisenber et al., 2001). Literature states that children with atypical internalising behaviour profiles are at increased risk for the development of psychopathology later in life, such as clinical anxiety, depression, substance abuse and academic underachievement (Swendsen et al., 2010).

Given the high occurrence of teacher-observed anxiety and depressive behaviours in the classroom, and their known relationship to occupational impairment, further exploration and

consideration on how to support typical behaviour profiles within a school environment remains an esteemed priority.

5.4.2 Externalising Behaviour Profiles

5.4.2.1 Typical Externalising Behaviour Profiles

The majority of participants presented with typical externalising behaviour profiles (refer to Table 4.4). Of participants, 79.26% presented with age-appropriate Attention. Attention is key for successful learning within the classroom context and forms the foundation on which a child can engage in scholastic tasks (Case-Smith & O'Brian, 2010). Since attention is positively associated with executive functioning skills, it is not surprising 74.81% of participants presented with age-appropriate Learning and Executive Functioning abilities. Executive functioning skills allow for the production and implementation of behaviours required to achieve complex non-automated goals during a task (Jianghong, 2004).

Of participants, 71.11% presented with age-appropriate Peer Relations within the classroom context. With the majority of participants presenting with typical discipline, conduct and social-emotional behaviours.

Age-appropriate behaviour profiles allow a child to engage optimally in learning, problem-solving and executive functioning tasks. It provides the foundation on which they may control their emotions, conduct themselves in a socially and culturally appropriate manner, and form friendships. Behaviour is an inquisitive construct with varying definitions; however, all theorists agree that children require age-appropriate behaviour profiles to engage successfully in their daily occupations and social interactions (Case-Smith & O'Brian, 2010; Jianghong, 2004).

5.4.2.2 Atypical Externalising Behaviour Profiles

Of participants, 19.26%–30.37% met the threshold for concern in one or more of the twelve externalising behaviours. The prevalence of participants presenting with atypical externalising behaviours is high. Externalising behaviours have been viewed as a global health concern in children and adolescents (Jianghong, 2004). Age-appropriate behaviour is a key component of

psychosocial-emotional well-being. It forms the foundation on which a child's readiness to learn and participate in the classroom environment is built. The presence of externalising behaviours indicates behaviour problems that are manifested in a child's outward behaviour and reflect the child acting on their external environment negatively (Jianghong, 2004).

Externalising behaviours have been arranged into the following categories for further discussion:

5.4.2.3 Learning and Executive Functioning

A total of 30.37% of the sample presented with Learning Problems (LP); 25.19% presented with Executive Functioning (EF) deficits and 25.19% presented with combined Learning and Executive Functioning (LE) concerns. Executive functioning refers to the ability to generate, supervise, regulate and implement behaviours which are appropriate to achieve complex actions, in particular those that are not automatic and allow one to learn and adapt in novel scenarios (Miyake & Friedman, 2012). In the USA, approximately 91 000 children were surveyed in 2011. The survey established that an estimated prevalence of 8.0% of children presented with learning difficulties with 4% rated as mild learning disabilities and 4% rated as moderate-severe learning disabilities (Boat and Wu, 2015). These prevalence rates are significantly lower than the 30.37% of current participants who presented with Learning and Executive Functioning disruptions in the classroom which raises concern. Limited South African data is available on learning and executive functioning within a neurotypically developing child population. Further consideration of the challenges children face within the mainstream classroom environment, which may hinder learning and executive functioning to take place, beyond the teacher-based observations, is warranted.

5.4.2.4 Attention and Activity Levels

Of participants, 30.37% met the threshold for clinical ADHD Hyperactive/Impulsive combined subtype (AH), whereas 22.96% of participants met the threshold for clinical ADHD Inattentive Subtype (AN). In addition, 20.74% of participants presented with general Inattention (IN) problems, and 28.15% of participants presented with general Hyperactivity/Impulsivity (HY) features. The high percentage of participants who presented with attentional concerns based on teacher observations is of concern. ADHD has been considered as one of the most prevalent

disorders in childhood, with an estimated prevalence of between 3–5% of the school-age population (Willcutt, 2012). Attention forms the foundation on which a child learns, engages, attends to new information, and completes tasks independently (Elosúa et al., 2017; Lambek et al., 2011). Participants who met the clinical ADHD threshold for concern may be at higher risk for associated deficits in memory, executive functioning and learning abilities (Lambek et al., 2011). As a high frequency of participants met the threshold of concern regarding inattention, it would be expected that these participants may also experience difficulties in skills such as learning and executive functioning which require attention as a foundation. This may explain the higher than expected occurrence of inattention and learning difficulties in the current sample. This notion is well supported in the literature, reporting that alterations in prefrontal cortical regions are interconnected and associated with neuropsychological deficits, specifically between executive functioning, learning, hyperactivity, impulsivity and inattention (Geurts et al., 2004). A recent USA study found that 80% of children with diagnosed ADHD showed a deficit in one or more components of executive functioning and learning (Lambek et al., 2010) In addition, the study found that 50% of children from the typically developing control group also exhibited a deficit in one or more executive functioning and learning components (Lambek et al., 2010; Nigg et al., 2005). This finding supports that further investigation into "normal" age-appropriate attention, learning and executive functioning abilities in a typically developing population is required. More so within the South African child population.

Still, although participants of the current study are neurotypically developing children, the high prevalence of classroom Inattention and Hyperactivity, as well as Executive Functioning and Learning deficits, are higher than expected. A study evaluating attention in the classroom environment stated that limited flexible seating might contribute towards inattention, fidgeting and distractibility, since young children may have difficulty with sustained endurance in a traditional chair and desk setup (Hardin, 2017). Flexible seating facilitates small movement breaks allowing children to receive movement-based stimulation whilst completing educational tasks (Hardin, 2017). The traditional desk and chair set up may not be conducive to fostering attention and learning in the modern-day child. Since inattention features were significantly observed in participants of the current study, further investigation exploring classroom attention in typically developing children should be considered. In addition, evaluating possible contributing factors such as the duration of academic lessons, teaching methods and materials, ergonomics of tables and chairs, allowance of flexible seating,

opportunity for movement breaks, exposure to sensory stimulation, and the intensity of the workload should also be considered. In addition, the 2014 Healthy Active Kids South Africa Report Card indicated a general concern for South African children with regards to insufficient levels of physical exercise, healthy eating and maintaining a healthy weight (Draper et al., 2014). All of which are factors that may impact a child's ability to attend to tasks appropriately, learn, play and engage within the school environment.

5.4.2.5 Defiance, Aggression and Conduct Disorder

Of participants, 30.37% met the threshold for atypical Defiance/Aggression (AG), 25.93% of participants presented with features of clinical Conduct Disorder (CD), and 25.19% presented with features of clinical Oppositional Defiance (OD). The Global Index (GI), indicating general overall behaviour, was considerably high with a third of participants reaching the threshold for atypical overall externalising behaviour concerns (30.37%).

Literature agrees that aggression is a component of Conduct Disorder and may consist of physical or verbal acts with the intention to disrupt, harm or threaten another (American Psychiatric Association, 2013). Thus, it is not surprising that similar percentages of teacher-observed Defiance/Aggression and Conduct Disorder were observed in the sample since many of these observations overlap with each other. Aggression has been considered an important childhood behaviour due to its strong predictability for adult crime and violence (Farrington, 2001; Jianghong, 2004). The teacher-based observations of the current study are high. Recorded prevalence rates in the USA indicate lower rates of clinical Conduct Disorder (6.8%) and Oppositional Defiance Disorder (6.5%). It is important to note the current study is founded on teacher-based reports of classroom behaviours that are used for referral to health care professionals, and that further thorough behavioural evaluation would be required to determine true clinical prevalence rates.

Conduct Disorder refers to a persistent pattern of antisocial behaviours, whereby social norms are continuously broken, and aggressive acts are carried out towards others (Sarkhel et al., 2006). The DSM-IV cites Conduct Disorder as one of the most frequently diagnosed behavioural deficits for both in- and out-patient mental health centres in children, with prevalence rates in males recorded as 6–10% and females 2–9% (American Psychiatric Association, 2013). The estimated lifetime prevalence of Conduct Disorder in the USA is 9.5%

with a median onset of 11.6 years (Nock et al., 2006). Thus, it is possible that the participants of the current study are showing early observations of "at risk" behaviours for clinical Conduct Disorder at a later onset. A study in India recorded a prevalence of 4.58% for Conduct Disorder in typically developing children suggesting that under certain environmental and genetic predispositions some children may be more "at risk" for onset of Conduct Disorder than others (Sarkhel et al., 2006). An international meta-analysis study indicated worldwide prevalence among children and adolescents aged 6–18 years at 3.2%, suggesting this prevalence estimate does not differ significantly across countries despite different socioeconomic factors (Canino et al., 2010). The occurrence of Conduct Disorder and Defiance/Aggression behaviours observed in the current study are, however unexpected. Given the fact that "low risk", typically developing children were observed, it is surprising that a high prevalence of Conduct Disorder and Defiance/Aggression behaviours were found to exist. Minimal evidence exists to describe the prevalence of South African Conduct Disorder and Defiance/Aggression behaviours in children. However, a recent study reviewed multiple South African bodies which all noted variables that may impact on conduct and aggression such as early exposure to domestic violence, high crime rates, uncensored television and access to violent electronic games (Fitzpatrick et al., 2016). Further investigation into and understanding of underlying contributing risk factors of Conduct Disorder and Defiance/Aggression is warranted.

5.4.2.6 Peer Relations

The prevalence of participants presenting with peer relation difficulty was 28.89%. A high percentage of participants presented with teacher-based observations of poor social interaction and peer relations. Externalising behaviours such as ADHD, aggression and conduct problems are commonly associated with "antisocial" behaviours and poor peer relations (Jianghong, 2004). This may explain why participants who presented with elevated levels of inattention, aggression and conduct concerns were "at risk" for reduced peer relations. A study sampled 94 hyperactive boys who indicated a prevalence of 32% for antisocial disorders in adulthood, compared to 8% in a control group of typically developing children (Mannuzza, Klein & Addalli,1991). Literature indicates that young children with atypical externalising behaviour profiles including poor peer relations indicated higher prevalence and predictiveness for conduct problems later in life (Jianghong, 2004; Lilienfeld & Waldman, 1990; Mannuzza, Klein & Addalli., 1991). This indicated that whilst typical developing children may develop antisocial behaviours, children with inattention, hyperactivity, aggression and conduct

problems are more at risk for developing peer relation difficulties (Jianghong, 2004). In addition, children who present with executive functioning and learning difficulties may also become withdrawn from their environment and are more likely to present with deficits in their peer relations (Lambek et al., 2011). Positive peer relations in the foundation phase of school forms an important foundation and sense of belonging. Factors contributing to poor peer relations and hindering social interactions in the mainstream school environment requires further investigation.

With the above in mind, the implication of typical behaviour profiles is essential in creating an adaptable child, who presents with adequate foundations for cognitive, emotional, social growth and well-being (Eisenber et al., 2001; Jianghong, 2004). From an occupational therapy standpoint, typical behaviour profiles support positive occupational engagement and successful interactions with the child's environment (Case-Smith & O'Brian, 2010). Since participants of the current study presented with high teacher-observed internalising and externalising behaviours, further investigation is merited. This has implications for practice in understanding the neurotypical child's behavioural profile, implementing supportive classroom strategies, exploring South African childhood behaviour challenges and identifying behavioural barriers to a conducive learning environment. In summary of behaviour profiling, the following question is posed: despite a growing understanding of childhood internalising and externalising behaviours, are human resources, particularly those embedded within a school setting, servicing young children, adequately equipped to address these aforementioned childhood behaviours and prevalence rates? Even more so, is this the case for the South African school context.

5.5 ASSOCIATIONS BETWEEN DEMOGRAPHIC DATA AND SENSORY PROCESSING AND BEHAVIOUR OF PARTICIPANTS

The third objective of this study was to investigate whether certain demographic characteristics are associated with sensory processing and behaviours (internalising and externalising features). When analysing the demographic characteristics of this study sample, consideration of gender, grade, temperament, and having seen an allied health care professional were examined and considered separately.

5.5.1 Gender in Relation to Sensory Processing and Behavioural Profiling

Results indicated that male participants presented with higher disturbances in two sensory processing systems, namely in Vision (VIS) and Total Sensory processing (TOT) scores in comparison to female participants (refer to Table 4.9). It is important to note that whilst males presented with higher overall scores in VIS and TOT scores when grouped according to gender, both male and female groups presented with typical sensory processing profiles.

In a USA study investigating 239 children, sensory processing was compared between children with typical development, ADHD and ASD, and concluded that sensory features in typically developing children had no significant gender differences (Little et al., 2018). This literature supports the current findings that gender showed no significant differences when analysing sensory processing. Whilst gender differences were not observed in the current study, literature regarding atypical sensory processing has shown males as having more disturbances in their sensory processing than females (Reebye & Stalker, 2008). In a study of ASD, girls with autism indicated sensory sensitivity which was associated with connectivity between the salience network (modulation centers) and language cortical regions; in comparison to sensory sensitivity in boys which was associated with connectivity between the salience network and sensory cortical areas (Green et al., 2013). Both girls and boys with ASD differed on brain connectivity related to sensory seeking behaviours, whereby girls showed connectivity between modulation centers and the prefrontal cortex in comparison to boys that presented connectivity between the salience network to sensory regions as well as several interior brain areas (Green et al., 2013). This indicates that gender and sensory processing may be associated, but this evidence is supported in children with atypical development. Limited evidence has been gathered in larger samples within the neurotypical child population, thus warranting further investigation.

Regarding internalising and externalising behaviours, male participants presented with one higher internalising behaviour score, namely feeling worthlessness (depressive feature), in comparison to female participants. Externalising behaviour profiling was similar across male and female participants. Neither male nor female participants met the threshold for atypical internalising and externalising behaviour profiles when compared by gender. Literature has varying results regarding gender and behaviour differences. Research based in Australia, presented at the 14th European Conference for Developmental Psychology, investigated 2490

six-year-old school-going children, which stated that girls were more likely to display a more positive approach to learning and display more positive classroom behaviours with fewer externalising behaviours in comparison to boys (Walker & Berthelsen, 2009). For anxiety, some literature identifies an equal prevalence rate amongst young boys and girls, with anxiety disorders becoming more prevalent in females, by the time they reach adolescence (Rockhill et al., 2010). Another study found that girls showed more internalising emotions than boys, and boys showed more externalising emotions than girls particularly during middle school (King et al., 2016). Layard and Dunn (2009) suggested that a reason for this was that gender and internalising behaviours may differ considerably because these behaviours are less apparent in a classroom environment and are difficult to quantify with objective observations. Contrasting literature suggests that gender differences within a neurotypical child population are small in early childhood (Maughan et al., 2004). These differences may become more apparent in adolescent years.

It is interesting to note that despite no significant gender associations, the prevalence of internalising and externalising behaviours present within the classroom environment is still high. Few studies have examined whether or not sensory processing and behaviour profiling of the typically developing child may manifest differently across the spectrum of time, gender, socioeconomic status, developmental band, and reporter observations throughout childhood (Wakschlag et al., 2012). Perhaps this viewpoint explains that whilst sensory processing and behaviour differences may occur, gender differences are not the primary contributing or predictive factor and that behaviour is more likely to transgress differently across stages of the lifespan, environments, and under certain circumstances. In the typically developing child, these fluctuations in sensory processing and behaviour across the lifespan, environments and circumstances are perhaps not significant enough to reach an atypical threshold, despite gender differences.

5.5.2 Repeating a Grade in Relation to Sensory Processing and Behavioural Profiling

Results from this study indicate that significant differences exist between repeating a grade and sensory processing and behaviour. Chi-Square results indicated that participants from both groups presented with typical sensory processing and behaviour profiles overall, with the following three exceptions where participants who had repeated a grade met the atypical threshold of clinical concern: one sensory processing system namely BAL; and two

externalising behaviours, namely the Global Index (GI) and the DSM-IV ADHD Inattentive (AN) (refer to Table 4.10). Participants who repeated a grade had significantly higher mean scores in comparison to participants who had not repeated a grade. Thus, participants who had not repeated a grade were more likely to present with typical internalising behaviour profiles. Higher frequencies of atypical internalising behaviours (both anxiety and depressive features) were observed in participants who had repeated a grade in comparison to participants who had not repeated a grade (refer to Figure 4.3).

This sensory processing and behavioural profiling of children who have repeated a grade appear to be partially supported in the international literature. According to the USA National Association of School Psychologists 2003 position paper, children who are at highest risk of being retained share certain demographic characteristics such as male gender, African or Hispanic ethnicity, young or immature age for their grade, show developmental delays, show inattention, behavioural or emotional concerns, English is not the child's home language, difficulty reading, frequently change schools, face poverty and low socioeconomic status, live with a single-parent family, and live with a family uninvolved in their schooling (National Association of School Psychologists, 2003). Whilst many of these characteristics were not supported in the current research, consideration for the application of this literature into the South African context is still significant. Since children with inattention, behavioural or emotional concerns presented with higher disruptions to their sensory processing and behaviour, these children may be considered "at risk" for repeating a grade and are more likely to present with atypical sensory and behaviour profiles.

5.5.3 Temperament in Relation to Sensory Processing and Behavioural Profiling

All three groups of temperaments, namely "Easy/Flexible", "Difficult/Feisty", and "Slow to Warm up/Fearful" presented within typical parameters in relation to sensory processing systems (refer to Table 4.11). However, participants described as having "Difficult/Feisty" temperaments demonstrated higher mean scores (although still within a typical range) across the sensory processing systems, with the exception of PLA sensory system, where the participants of the "Slow to Warm up/Fearful" temperament scored the higher mean score. In clinical practice, this finding is relevant, as many fearful children indicate caution in their execution of motor planning and ideas (Ayres et al., 2005). Participants described as the "Easy/Flexible" temperament typically had the lowest frequency of disruptions in sensory

processing systems, with the exception of VIS sensory system, where "Slow to Warm up/Fearful" had the lowest frequency. In application to clinical practice, this finding is supported as children that are more fearful and cautious in motor-based tasks requiring planning and ideas, may gravitate towards tasks that require less gross motor planning such as visual perceptual tasks requiring visual analysis (Ayres et al., 2005).

Dunn et al. (2002) suggested that sensory processing mechanisms fortify the manifestations of temperament and personality (Dunn, Saiter & Rinner, 2002). Dunn proposed that sensory processing profiles such as low registration, sensory sensitivity, sensory seeking, and sensory avoiding were strongly related to the concepts of temperament (Dunn, Saiter & Rinner, 2002). The "Difficult/Feisty" temperament indicated the highest mean scores for sensory processing systems. These findings are supported by research in Japan, which found strong associations between sensory processing systems and temperament in healthy, typically developing children (Nakagawa et al., 2016). Participants of the current study indicate that the "Difficult/Feisty" temperament had higher mean scores for sensory processing. This observation differs from a study found that a "Slow to Warm up/Fearful" temperament was moderately associated ($p = 0.01$) with tactile and auditory defensiveness (atypical sensory processing) (Goldsmith et al., 2006). Even so, few studies investigate the relationship between temperament and sensory processing profiles in neurotypically developing children and warrants further exploration.

With regards to behaviour, all three groups of temperaments, namely "Easy/Flexible", "Difficult/Feisty", and "Slow to Warm up/Fearful" presented within typical parameters for externalising behaviours with the exception of participants with a "Difficult/Feisty" temperament which presented with the highest mean scores of externalising behaviours, and met the clinical threshold of concern for six externalising behaviour groups: Defiance/Aggression (AG), Conduct Disorder (CD), DSM-IV ADHD Hyperactive/Impulsive subtype (AH), DSM-IV Oppositional Defiance (OD), Hyperactivity/Impulsivity (HY), and the Global Index (GI). This finding is supported by Thomas & Chess (2007), pioneers in defining temperament, which suggested that children who present with a "Difficult/Feisty" temperament can be characterised by poor adaptability, negative mood, impulsive activity level, sensitive to sensory stimulation, overwhelmed by changes in routine, distractible, intense behaviours, inflexibly, not able to calm self or self-regulate behaviour, irregular biological rhythms (such as hunger and sleep cycles) and are frequently associated with acting out (Stephens, 2007). Another study conducted in India proposed that temperament was associated

with Conduct Disorder, whereby a “Difficult” temperament was associated with Conduct Disorder and an “Easy” temperament was associated without Conduct Disorder ($p = 0.004$) (Sarkhel et al., 2006). In clinical practice, these findings are relevant since participants of this study who presented with a “Difficult/Feisty” temperament were more likely to exhibit higher mean scores and reach the clinical threshold for atypical externalising behaviours than other temperaments. In addition, participants who presented with the “Difficult/Feisty” temperament were more likely to meet the threshold for clinical Defiance Disorders, Conduct Disorder, Oppositional Defiance, ADHD, hyperactivity and impulsivity features. Some literature indicates approximately 10–20% of children are born with a “Difficult/Feisty” temperament (Stephens, 2007), which is more than the 4.96% of participants in the current study. Further investigation of childhood temperament styles and the relationship this has with sensory processing and behaviour profiling may offer benefits in understanding children in the South African context.

5.5.4 Seeing a Health Care Professional in Relation to Sensory Processing and Behavioural Profiling

Associations were found to exist between sensory processing systems and externalising behaviours in relation to participants who had seen an allied professional compared to those that had not. Six associations between participants who had received occupational therapy services, in particular, were observed in relation to sensory processing systems and externalising behaviours (refer to Table 4.16, Appendix N). Two sensory processing systems which associated with repeating a grade included Balance and Motion (BAL) ($p = 0.013$) and Planning and Ideas (PLA) ($p = 0.000$). Four externalising behaviours included combined Learning Problems and Executive Functioning (LE) ($p = 0.0002$), Executive Functioning (EF) ($p = 0.027$), Defiance/Aggression (AG) ($p = 0.038$) and clinical DSM-IV ADHD inattentive subtype (AN) ($p = 0.019$). These associations make clinical sense, as occupational therapists commonly receive referrals for children requiring therapeutic intervention for motor, praxis and sensory, perceptual, psychosocial and cognitive performance skills in addition to addressing occupational performance areas (American Occupational Therapy Association, 2014). It would make sense that children who have previously seen a healthcare provider may have previously identified sensory, motor, emotional, learning or behavioural difficulties. In addition, participants of the current study who had seen an occupational therapist presented a mean score of 60.59 in the sensory processing system of Planning and Ideas (PLA), thus

reaching the threshold for atypical planning abilities. This makes clinical sense since children with planning and praxis difficulties are commonly referred to occupational therapists (Parham & Mailloux, 2010). However, since teacher observations were current at the time of the data collection, it would appear that these participants who reached the threshold for concern would benefit from further therapeutic intervention for consolidation of their planning abilities. Components of Planning and Ideas (PLA) includes, for example, being able to solve problems efficiently, perform a task in correct sequence, able to imitate movements, complete tasks from a model, play freely and organise one's self based on environment and resources available (Parham et al., 2007). Significant associations were thus anticipated and subsequently confirmed to exist between children who have seen an occupational therapist and children presenting with sensory, motor, perceptual, psychosocial and naturally occupation-based difficulties such as barriers to optimal engagement within, in this case, the school environment.

The above-mentioned demographic features have important implications for how the health and educational sectors can collaboratively support children within the mainstream primary school environment. Further investigation into the South African demographic context and sensory processing and behaviour profiling are essential for providing an up-to-date understanding of our children.

5.6 CORRELATIONS BETWEEN SENSORY PROCESSING AND BEHAVIOUR

The fourth objective of this study was to determine whether correlations exist between sensory processing and behaviour (internalising and externalising features).

Characteristics of sensory processing and behaviour disorders appear to have many common and at times identical descriptions on the rating scales used in the current study. Relating back to the theories of sensory processing and behaviour, children with impaired sensory processing and particularly sensory modulation disorders were found to exhibit ADHD type features, for example, inattention, restlessness, inhibition, and impulsivity (Dunn et al., 2002; Gourley et al., 2013; Tomcheck & Dunn, 2007). In addition, a high frequency of children who present with ADHD has associated comorbidities such as sensory processing disorders/difficulties (Shimizu, Bueno & Miranda, 2014). Whilst many children who present with sensory processing disorders have comorbid conditions with behavioural features, such as ADHD

amongst others, both conditions include difficulties in maintaining focus, attention, ability to attend to the task at hand and sitting still (Shimizu, Bueno & Miranda, 2014). It is evident that sensory processing observations can be likened to behavioural observations, such as ADHD and other clinical behavioural conditions. However, whilst an overlap in observations of human behaviour may occur, a clear differential, symptomatic, and diagnostic criteria exist in order to profile each condition (Parham et al., 2007; Sparrow, 2010).

Therefore, it was anticipated that participants of the current study who presented with typical sensory processing profiles would present with typical behaviour profiles. Likewise, that atypical sensory processing profiles may be more likely to present with atypical behaviour profiles, and thus sensory processing abilities would be correlated with behaviour. This hypothesis is supported by findings of the current study which identified that positive moderate correlations were found to exist between certain sensory processing and behaviour profiles, specifically, in relation to externalising behaviours. This indicates that on certain sensory processing systems and behaviours, lower sensory processing T-Scores were associated with lower behavioural T-Scores, and likewise higher sensory processing T-Scores were associated with higher behavioural T-Scores. In the current study sensory processing and externalising behaviours were found to correlate in the following manner (refer to Table 4.14):

The strongest overall correlation exists between the sensory processing system of Social (SOC), with moderate positive correlations to the following externalising behaviours: Inattention (IN), Hyperactivity/Impulsivity (HY), Learning Problems/Executive Functioning combined (LE), Learning Problems (LP), Executive Functioning (EF), Defiance/Aggression (AG), Peer Relations (PR), Global Index (GI), DSM-IV ADHD Inattentive (AN), DSM-IV ADHD Hyperactive-Impulsive (AH), DSM-IV Oppositional Defiance (OD). The Social participation (SOC) sensory processing system ascertains the child's sensory processing abilities in situations requiring social interactions. The current study data indicates the majority of participants presented with typical SOC abilities. This has important implications for evaluation, therapeutic intervention and providing supportive strategies within a classroom and school context. Maintaining typical SOC profiles within a classroom environment has important outcomes such as resolving peer conflict, handling frustration without aggression or outbursts, playing with peers in an appropriate manner, interacting with friends and engaging socially, maintaining appropriate 'personal' space and eye contact during conversation, and shifting conversation topics in accordance with peer interests. Literature supports this clinical

correlation, noting that sensory processing may affect the manner in which a child uses sensory information for social interaction, as well as behavioural, emotional and self-regulation, motor-based performance, and functioning in activities of daily living (Ben-Sasson, Carter & Briggs-Gowan, 2009; Gourley et al., 2013). Understanding the correlations between typical sensory processing systems such as SOC in relation to behavioural outcomes is key for understanding and supporting children within the context of the classroom.

It was further anticipated that participants who have difficulty with sensory processing abilities required for the SOC sensory system would have difficulty with the aforementioned externalising behaviours. Although there is considerable overlap between qualitative observations described by The Conners 3 and SPM for SOC, occupational therapists are cautioned to examine an individual's sensory events rather than behaviour alone; these reports are useful for screening a child's engagement and behaviour in a classroom environment, however should not be accepted in isolation (Parham et al., 2007; Sparrow, 2010). The current study data indicates 25% of participants had "some problems" and 6.26% had "definitive dysfunction", a total of 31.26% of atypical performance in the SOC sensory processing system (refer to Figure 4. 2). This indicates that over one-quarter of participants experienced atypical sensory processing abilities in SOC and simultaneously presented with difficulties regarding their learning, executive functioning, attention, impulsivity, peer relations, global/generalised behaviour, and ability to abide by norms and regulations. To enhance a child's SOC and externalising behaviour profiles and performance within the classroom, consideration to possible contributing factors should, therefore, be considered. This has important implications for school-based occupational therapists, for example creating support strategies for a child who presents with social isolation fostered by externalising behaviours such as defiance, poor behaviour, learning problems or high activity levels. Understanding that sensory and behaviour profiles have a correlational nature, extends the understanding of why children may act in a certain manner when under certain circumstances. Whilst it is not possible to predict causality from this data, it is evident that a relationship exists between sensory processing, in this case between SOC and the aforementioned externalising behaviours.

Further moderate positive correlations were found to exist between the sensory processing system of Planning and Ideas (PLA), with correlations to Inattention (IN), combined Learning Problems/Executive Functioning (LE), Learning Problems (LP), Executive Functioning (EF), the Global Index (GI), DSM-IV ADHD Inattentive subtype (AN), and DSM-IV ADHD

Hyperactive/Impulsive subtype (AH). The majority of participants presented with typical PLA sensory processing systems and subsequently typical externalising behaviours (refer to Table 4. 14). The current study indicates that 21.32% of participants had "some problems" and 8.09% had "definitive dysfunction" in the PLA sensory system with co-occurring externalising behaviours. More than one-quarter of participants presented with atypical sensory processing abilities in this system. Again, the ability to support or enhance a child's externalising profiles, for example, executive functioning and learning abilities by addressing a child's PLA sensory system is an important consideration highlighted by these correlations.

In addition, participants presented with atypical functioning in the following sensory vulnerabilities required for PLA: postural control (19.57%), ideation (28.99%), and motor planning (26.09%). This understanding has significant implications for clinical practice since the PLA sensory system and associated sensory vulnerabilities form key foundations in order for a child to sit at their desk, attend to the task at hand be it motor or attention-based, and sustain their engagement and participation. It is therefore unsurprising that if a child has difficulty in their PLA sensory system, acquiring new knowledge and attending to tasks may be challenging and may result in or contribute towards a barrier to learning, executive functioning, inattention, frustration and overt behavioural difficulties. PLA can then be used in supportive strategies in the classroom environment, since it comprises the neurophysiological sensory abilities required in order for the child to perform consistently in tasks, solve problems efficiently, perform tasks in sequence, complete multiple steps, imitating demonstrations, complete tasks from a model, be imaginative and creative, play freely, and organise self and materials in a task (Parham et al., 2007). Based on this, it is foreseeable that children with atypical scores in PLA, may present with atypical scores for DSM-IV ADHD Inattentive subtype and Hyperactive/Impulsive subtype, executive functioning and learning abilities (Gourley et al., 2013; Jianghong, 2004). In contrast, the same correlation suggests that the contrary relationship is true: a child with impaired externalising behaviours such as inattention, learning and executive functioning, and hyperactivity would be expected to have sensory processing difficulties in their ability to execute and form plans and ideas (Gourley et al., 2013; Jianghong, 2004; Parham et al., 2007). Again, whilst it is not possible to predict causality from this data, a symbiotic relationship between PLA and the aforementioned externalising features exists in both clinical practice and literature.

Moderate positive correlations were found to exist between Executive Functioning (EF) and multiple sensory processing systems including Social (SOC), Vision (VIS), Planning and Ideas (PLA), and Total (TOT) overall sensory processing scores. The majority of participants who presented with typical EF abilities also presented with typical SOC, VIS, PLA and TOT sensory processing systems. This highlights that children who have age-appropriate EF abilities are more likely to demonstrate typical sensory processing profiles. To enhance and support EF abilities in the classroom, consideration of a child's sensory systems is, therefore of importance. Likewise, to support the development of typical sensory systems, EF abilities should be supported. Of participants, 25.19% presented with atypical EF abilities. These participants were more likely to present with atypical sensory processing abilities in SOC, VIS, PLA and TOT sensory systems. In clinical practice, EF skills underpin many behaviours observed in the above-mentioned sensory processing systems. For example, in the SOC sensory system EF is required for maintaining appropriate eye contact and personal space, the child is able to look at the person speaking during instructions in the VIS sensory system, able to complete logical steps and reasoning in a task in the PLA sensory system, and general EF feeding into TOT multisensory processing abilities (Geurts et al., 2004; Miyake & Friedman, 2012).

The Global Index (GI), indicated moderate positive correlations between Social (SOC), Vision (VIS), Planning and Ideas (PLA) and Total (TOT) overall sensory processing scores. Participants who presented with typical general behaviour were more likely to present with typical development of their sensory systems. Of participants, 30.37% presented with atypical overall generalised behaviour and were more likely to present with atypical sensory processing abilities in SOC, VIS, PLA, and TOT sensory processing systems. This highlights that when considering general behaviour within the classroom environment, consideration for a child's sensory processing profile should be given. With regards to supporting general behaviour in a classroom, schools should, therefore, consider the value in stimulating and supporting sensory processing systems such as SOC, VIS, PLA and TOT systems in an effort to provide opportunity for organisation of sensory inputs, self-regulation and possible enhancements to overall behaviour. Further investigation into these relationships is needed.

DSM-IV ADHD Hyperactive/Impulsive (AH), indicated moderate positive correlations between Social (SOC), Balance and Motion (BAL), Planning and Ideas (PLA) and Total (TOT) overall sensory processing system scores. In addition, similar correlations were found to exist

between generalised Inattention (IN) and the moderate positive correlations between SOC, BAL and PLA. Of participants, 30.37% were found to meet the clinical criteria for DSM-IV ADHD Hyperactive/Impulsive subtype (AH), and 20.74% were found to meet the criteria for generalised inattention (IN). Whilst the majority of participants presented with typical sensory processing and behaviour profiles, the aforementioned participants were more likely to present with atypical SOC, BAL, PLA, and TOT sensory processing systems. Literature supports the understanding that children with attention difficulties are associated with disruptions to their sensory processing abilities (Geurts et al., 2004). This has important clinical implications when considering why some typically developing children present sensory processing and behaviour profiles in certain circumstances or environments in comparison to others. Lane (2010) indicated that ADHD and features such as inattention should be considered from numerous angles including both sensory processing and behaviours such as sensory over-responsiveness, anxiety, cortisol levels, and electrodermal responses (Lane et al., 2010). The study further suggested that a large overlap existed between attention, sensory processing and behaviour. In both conditions (SOR and ADHD), evidence suggested that bottom-up processing differences on a biophysiological level were linked to poor information processing associated with impairments in prefrontal cortex and hippocampal synaptic gating (Lane et al., 2010). Another study of 131 children indicated that 56% of children who presented with impaired inattention also indicated symptoms of impaired sensory processing and confirmed the correlation between attention and sensory processing (Roid & Miller, 1997). This links to the current study, supporting the finding that attention is associated with sensory processing systems that share involvement in cortical pathways and overt observations of behaviour. Implications in practice refer back to possible strategies to support a child's attention in a classroom environment by supporting sensory systems as one of the contributing components. Since sensory processing systems have a correlational relationship to attention (amongst other contributing factors), strategies such as flexible seating, increased physical activity and movement breaks, and other adjustments to allow for appropriate sensory opportunities within a classroom environment are key in supporting a child's holistic well-being.

It has been identified in recent research that sensory modulation impacts on a child's ability to attend to tasks, and that attention may be as a result of efficient modulation to sensory inputs such as tactile, visual, vestibular or auditory processing (Tomcheck & Dunn, 2007). Sensory registration may also impact on a child's ability to register sensory inputs efficiently in their environment and body. However, if a child has atypical registration, poor ability to attend to

information may result (Dunn, 2007). Such sensory processing disruptions may therefore present as overt behaviours. This is supported by the moderate positive correlations established in the current study and sample. It would be expected due to the nature of sensory processing and behaviour that other variables contribute towards the dynamic neurobiological and psychological relationship between such variables, and that sensory processing and behaviour have a correlational relationship but are not strictly causal to each other.

The majority of participants presented with typical sensory processing and behaviour profiles as expected from this sample. As literature primarily focuses on atypical functioning, this notion that typical sensory processing is correlated to typical externalising behaviour is crucial and warrants future investigation.

A substantial portion of the sample presented within atypical parameters. Based on the current study's data in addition to supporting research and literature, it is suggested that some children have identified behavioural difficulties which may be as a result of underlying sensory processing difficulties, which may make it difficult for them to attend to, sit still, endure motor and psychological tasks, and tolerate the sensory experiences within a school environment. In juxtaposition, perhaps these children may have significant and contributing emotional, social or conduct difficulties or have experienced trauma and emotional tribulations which have led to them developing atypical ways of responding to their environment (Ogundele, 2018).

Many weak associations were observed between sensory processing systems and externalising behaviours. Despite the majority of participants presenting with typical sensory processing and typical behaviour, strong correlations were not identified to exist between many of these variables. This indicates that whilst many significant correlations exist between sensory processing and externalising behaviour profiles, additional variables not examined in this study may have more relevant, stronger correlations or that multiple correlations of varying significance exist in synergy. Due to the elusive nature of human behaviour, particularly when examined without the presence of illness and disability, additional explanations for weak correlations are plausible: subjective observation-based rating scales, time of observation, child's home and personal circumstances at the time of observation, state of mind for both child and observer, extraneous environmental and interpersonal variables, teacher observation reliability, genetic contribution, and of course the unpredictable and at times perplexing human nature are noteworthy considerations (Davies & Tucker, 2010; Hutton, 2012; Miller et al.,

2007). Furthermore, participants of the sample were not homogenous, since the sample consisted of children with mixed demographic features and mixed presentations of behavioural and sensory abilities (discrimination, modulation, responsivity). Lastly, sensory processing and behaviour were based on a rating scale, and these observations may fluctuate based on different stimuli and scenarios experienced throughout the day, patterns may be time-scenario dependent and may not always be reflective in the rating scales.

Whilst it is not possible to predict causality especially in human behaviour, participants of the current study with typical sensory processing profiles were more likely to present with features of typical externalising behaviour profiles, whereas atypical sensory processing profiles were more likely to present with features of atypical externalising behaviour profiles. This statement is supported by numerous studies and literature (Ben-Sasson, Carter & Briggs-Gowan, 2009; Franklin & Deitz, 2008; Fries et al., 2005; Miller et al., 2007).

Internalising behaviour correlations of the current study were found to be ill-defined regarding their correlational relationship to sensory processing profiles due to the categorical and binary nature used to describe these internalising behaviours on the teacher-based rating scale. Understanding typical internalising behaviour has been highlighted as a priority since little evidence exists regarding what a neurotypical child's internalising behaviour profile looks like. Literature indicates childhood conduct and behavioural problems have been positively associated with an increased risk of other mental disorders (Kim-Cohen et al., 2003). Children diagnosed with Conduct Disorder amongst other behavioural disorders may present with coinciding behavioural disorders including 3–41% comorbid ADHD, 0–46% depression and 0–41% anxiety disorder (Boat & Wu, 2015). In a study, almost all respondents with ODD reported comorbid mood, anxiety, or drug disorders, but, for the most part, the ODD occurred prior to the onset of other symptoms (Boat & Wu, 2015). However, in many of these studies, children have been flagged as at risk or have a clinical diagnosis, with few indications of typical internalising behaviour profiles. Further investigation is warranted for future research as current literature has identified that correlations exist between internalising behaviours such as anxiety and depression, and sensory processing abilities; however, lack investigation in neurotypically developing children. Understanding the range of internalising behaviour features that are considered "normal" in neurotypically developing child is crucial in supporting a child's emotional, social, and occupational well-being.

The above discussion around the correlational nature of sensory processing and behaviour has important clinical implications. Since the nervous system reacts and changes over time in response to internal and external sensory experiences, a child's sensory processing and behaviour profiles will change in response to their sensory environment (Dunn, 2001). Therefore, by successfully meeting continuous sensory challenges a child learns to adjust and organise new behaviours, allowing for increased skill and motivation to engage in future more complex tasks (Miller et al., 2007). Understanding the correlational relationship between sensory processing and behaviour profiles in neurotypically developing children is key for supporting children within a mainstream school environment, but also encourages the development of supplementary strategies for children who may present with atypical sensory processing and behavioural profiling.

5.7 IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

Despite sensory integration and behaviour profiling gaining global interest, limited clinical, policy and evidence-based practice exist regarding the profiling of neurotypically developing children. Since occupational therapy services are rendered for the promotion of health and well-being for children with disability and non-disability needs, it is of concern that limited empirical evidence exists regarding the prevalence and profiling of sensory processing and behaviour in neurotypically developing children. In addition, the proposed relationship between sensory processing and behaviour within a mainstream school environment, to which so many paediatric occupational therapists service, requires further investigation. Even more so within the South African child population.

This study provides insight into the sensory and behaviour profiling of neurotypically developing children and identifies that the majority of participants presented with typical sensory processing abilities and behaviour. Still, a substantial prevalence of neurotypically developing children met the threshold for atypical sensory processing and behavioural profiles. This is of concern, as the impact of sensory processing and behavioural disruptions in the early foundation phase of education can have a significant impact on occupational performance. Understanding barriers to occupational participation within a school environment in neurotypically developing children is equally important as understand those in children affected by disabilities.

Whilst the focus of this research revolved around sensory and behaviour profiling within the classroom setting, further investigation and insight into how a child's profiling within their home and community settings would influence their profiling within a school setting, may offer important clinical relevance.

The results of this research may act as a platform for future research, to build a better understanding of the factors that play a role in sensory processing and behaviour profiling. This understanding will guide clinical practice to ensure an all-inclusive, modernised understanding of the neurotypically developing child population. This may assist with support strategies and identify the shortcomings in policies where children may not be adequately supported within the classroom environment.

Correlations between sensory processing and behaviour indicate that a relationship exists between certain sensory processing systems and behaviours. This has important implications for practice in terms of understanding a child's health and well-being and providing up-to-date literature within a typically developing sample. Occupational therapists can advocate for implementing modernised, relevant and all-inclusive classroom strategies that assist educators in managing and supporting children who fall within typical and atypical sensory and behaviour profiling. Furthermore, it is important to raise awareness of sensory processing and behaviour among educators in order to assist with support and interventions for "at risk" children. Limited research is available for the South African population, indicating a dire need for future high-quality research in this field.

Overall, the findings of this research have significant implications for better understanding the sensory processing and behaviour profiling concerning the Occupational Therapy Practice Framework (The American Occupational Therapy Association, 2014). The results also enhance understanding of assessment and therapeutic intervention considerations, school-based support and policy development. In addition, the results aid in the clarity of general collaboration with families and educators within a school-based setting. It further highlights the need for future research in sensory processing and behaviour profiling in relation to the neurotypically developing child. It is the aim of the occupational therapy profession to continually investigate and understand the relationship between the child, environment and meaningful engagement in occupations. Thus, this research aims to use this as a platform, to reflect on and implement appropriate strategies, to support growth, and facilitate change that may positively impact a

child's occupational performance.

5.8 LIMITATIONS AND DELIMITATIONS

Feedback on the parental consent forms indicated that some parents declined due to the nature of participation and observations required by the child's teacher. Many participants were excluded from the study as parent consent forms, demographic questionnaires, and teacher-based rating scales (SPM and Conners 3) were partially or incorrectly completed. Whilst teachers were limited to ten participants each, a large portion of teachers was unable to complete their allocated SPM and Conners 3 forms due to time and workload constraints. In addition, parent information packs explaining the study and an invitation to participate were sent home with children from participating schools and classes in their school diary, however many invitations remained in the children's diaries and were not received by parents. For these reasons, many eligible candidates were excluded from the study.

Despite specified exclusion criteria, a substantial portion of participants were subsequently identified as having met the threshold for concern regarding their sensory processing and behaviour. Given the participant's young age, it is possible that diagnoses (such as ADHD, clinical behaviours, or sensory processing disturbances) exist that have not been identified as yet which may have contributed to the results representing atypical sensory processing and behavioural abilities.

No measures were used to identify or cross-reference sensory processing and behaviour within a home or secondary environment, thus correlation between sensory processing and behaviour seen in the classroom environment cannot be transferred generally to other environments.

Whilst findings gathered by this study highlight that within a neurotypical developing population of school-going children, there is a substantial portion of participants who met the threshold for concern for atypical presentation in their sensory processing and behaviour abilities and that there is a correlation between certain sensory processing and externalising behavioural variables, the findings were based on a relatively small sample from two Gauteng schools of similar socioeconomic and demographic circumstances. For this reason, the results

of this study cannot be generalised to the greater South African context and should be interpreted with caution.

SMD, particularly responsiveness has been associated with behaviour in previous literature. However, the SPM does not specifically look at SMD or responsivity but rather general sensory processing in different systems. Thus, whilst individual items can be analysed for the presence of responsiveness and vulnerability, T-Scores or descriptive scores are not given to indicate if these observations are evident of SMD or other patterns of sensory integration dysfunction. Thus, descriptive information on participant modulation, sensory responsiveness and vulnerabilities were limited. The SPM is largely based on sensory modulation. The Sensory Processing 3-Dimension Inventory, a comprehensive assessment tool used to evaluate multiple diagnostic features of sensory processing including sensory modulation, sensory discrimination and sensory-based motor abilities could be considered for future research to reflect multiple aspects of the sensory processing continuum.

Lastly, as both the SPM and Conners 3 rating-based scales were developed internationally, limited research, literature and sensitivity are available for the South African context. It has been acknowledged that these rating-based scales are screening questionnaires, and whilst they offer valuable insight into a child's performance and observation of their interaction, a thorough assessment of a participant's individual sensory processing and behaviour would logically be more clinical. As suggested by the SPM, sensory profiles are intended to be used in conjunction with assessment to form a comprehensive evaluation of the child's needs. Whilst the SPM and Conners 3 have respectable construct validity; results should be interpreted with this in mind.

5.9 SUMMARY

This chapter discussed the results of this study as defined in chapter four with regards to sensory processing and behaviour profiles, the association between sensory processing and behaviour profiles in relation to demographic features, and explored the correlations between sensory processing and internalising and externalising behaviour profiles.

The majority of participants presented with typical sensory processing and behaviour profiles. Regarding sensory profiling, three sensory processing systems demonstrated the highest frequencies of disruption, namely SOC, PLA, and BAL sensory processing systems. Sensory seeking behaviours were most observed by teachers. The majority of participants presented with typical externalising and internalising behaviour profiles. Regarding externalising behaviours, a third of participants met the clinical symptom criteria for atypical Defiance/Aggression, Learning Problems, and ADHD. Just under half of the participants, presented with one or more atypical anxiety behaviours; and presented with one or more depressive behaviours. Demographic characteristics such as gender, repeating a grade, temperament, and seeing a health care professional showed statistically significant associations to sensory processing and externalising behaviours. Moderate positive correlations were found to exist between sensory processing and behaviour profiles, particularly regarding SOC and PLA sensory processing systems in relation to externalising behaviours such as Inattention, Hyperactivity, Learning Problems and Executive Functioning, and general behaviour.

Based on the results of the current study and supporting literature, it is evident that certain sensory processing systems correlated with certain externalising behaviours. Participants who presented with typical sensory processing profiles were more likely to present with typical behaviour profiles; likewise, participants who presented with atypical sensory profiles were more likely to present with atypical behaviour profiles. This is supported by pioneers in sensory integration and behaviour literature that emphasised that the ability to modulate and process sensory information is required for maintaining homeostasis within one's environment and that impairment of sensory processing abilities would lead to the manifestation of overt behaviours such as distractibility, anxiety and disruptive behaviours (Ayres, 1979; Gourley et al., 2013). The current study contributes new insight to the existing literature, fostering a forward movement in understanding sensory processing and behaviour profiling in neurotypical children. Whilst the exact causality and nature of correlation remain largely unknown, the evidence to support the neurophysiological-behavioural relationship between sensory processing abilities and behaviour is ever-growing.

The following chapter concludes the study, providing recommendations for future research and clinical practice.

CHAPTER 6: CONCLUSION

6.1 INTRODUCTION

This chapter summarises the previous chapters and central findings of this study. In conclusion recommendations for future research and clinical practice are reviewed.

6.2 CONCLUSION

Consideration of the strategies and provisions for neurotypical children within both the health and education sectors has emerged as a priority. Since children without a formal diagnosis within the mainstream school context are frequently referred for allied health care services to address developmental, physical, educational and social-emotional support, one must consider the factors that may impact on their occupational performance. The prevalence of neurotypically developing children who face barriers to learning and occupational success, internationally and particularly within the South African context, who would benefit from such supportive or preventative therapies without the presence of a disability is not well documented. It is the role of occupational therapists, especially those involved within a school setting, to assist children in reducing environmental and personal barriers to learning, and to achieve occupational success, satisfaction, meaning and optimal engagement (American Occupational Therapy Association, 2014). Understanding neurotypical sensory processing and behaviour profiling plays an important role in understanding and supporting children holistically.

The majority of participants presented with typical sensory processing and behaviour profiles. Regarding sensory profiling, three sensory processing systems demonstrated the highest frequencies of disruption, namely SOC, PLA and BAL sensory processing systems. Regarding sensory responsivity, sensory seeking behaviours were most observed, and SOR presented higher frequencies in comparison to SUR across sensory systems.

Regarding internalising behaviour, the majority of participants demonstrated typical profiles. However, high frequencies of participants met the threshold for atypical anxiety and depressive behaviours. The current study aims to reflect on the realities that children face in the South

African context that may impact on their internalising behaviour profiles. Given the high occurrence of anxiety and depressive internalising behaviours observed in a sample representing neurotypically developing children, further exploration into their social-emotional-mental well-being remains an esteemed priority.

Regarding externalising behaviours, the majority of participants presented within typical parameters. The prevalence of participants who met the threshold for concern in Learning Problems and Executive Functioning was high. One-third of the sample presented with behaviours that reflect clinical DSM-IV ADHD combined Hyperactive/Impulsive subtype. In addition, one third of participants met the threshold for atypical Defiance/Aggression within the context of the classroom. Several additional externalising behaviours were highlighted as areas of concern whereby more than one fourth of participants met the threshold of atypical presentation in generalised Hyperactivity/Impulsivity, Peer Relation difficulty, DSM-IV Conduct Disorder, and DSM-IV Oppositional Defiance Disorder. Understanding the modern-day child's behavioural profiling, which is minimally documented in research particularly within the context of South Africa and the mainstream school environment, offers many benefits which may contribute to supporting a child's social-emotional and occupational development. This research aims to contribute new insight and reflect on the current externalising behaviour profiling currently experienced by South African children.

Demographic characteristics such as gender, repeating a grade, temperament, and seeing a health care professional showed statistically significant associations to sensory processing and externalising behaviours.

Moderate positive correlations were found to exist between sensory processing and behaviour profiles, particularly regarding SOC and PLA sensory processing systems in relation to externalising behaviours such as Inattention, Hyperactivity, Learning Problems and Executive Functioning, and general behaviour. In addition, moderate positive correlations were found to exist between Executive Functioning and multiple sensory processing systems including SOC, VIS, PLA and TOT sensory processing systems. DSM-IV ADHD Hyperactive/Impulsive, indicated moderate positive correlations between SOC, BAL, PLA and TOT sensory processing systems. This is reflective of similar correlations found to exist between generalised Inattention and moderate positive correlations between SOC, BAL and PLA. This may be attributed to the current understanding in literature that sensory processing and behaviour is

correlational in nature, however many postulates and variables far beyond those crudely measured in this study, contribute towards human behaviour.

These results indicate that in a sample of typically developing children, the majority of participants presented typical sensory processing and behaviour profiles. However, some participants presented with atypical sensory and behaviour profiles. It is emphasised that the use of sensory and behavioural profiling is greatly beneficial in understanding how a child functions within a classroom environment, however the exact relationship between sensory processing systems and behaviour is complex, based on the child's individual experiences, and should be interpreted with caution and clinical judgement. Participants with atypical sensory processing and behaviour profiles were found to be "at risk" for impaired occupational success and engagement within the context of the classroom. Literature investigating the relationship between sensory processing and behaviour is increasing, however most studies are based on international populations and focus on children with impairments. The current study contributes new insight into existing literature, fostering a forward movement in understanding sensory processing and behaviour profiling in neurotypical children. Given South Africa's unique context, the need for high-quality literature, research and evidence-based practice is important to the continuation of the occupational therapy profession. The current study aims to contribute valuable insight to both the local and international literature on neurotypically developing children, sensory processing and behaviour profiling, and correlations between sensory processing and behaviour.

6.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Sensory and behavioural profiling of neurotypically developing children yields important information which may aid in understanding children within their classroom environment, how best to create optimal learning circumstances and reduce barriers to learning. It is an occupational therapist's role, particularly those involved in the school setting, to advocate and encourage collaboration between the health and educational sectors and to ensure that high-quality research in ongoing, with the aim of empowering changes to recognise, support and encourage a child's health, well-being and optimal engagement. The following recommendations are made for future research:

- Due to limited resources, a national study should be conducted to determine the profiles of neurotypically developing children's sensory processing abilities and behaviour (internalising and externalising). This study will require collaboration from occupational therapists who have access to mainstream schools within public and government sectors. Inter-provincial involvement is highly recommended to ascertain profiling across the unique South African context.

- It was highlighted during this study, data analysis and literature review that sensory modulation has a highly postulated involvement with behaviour. Thus, a sensory processing tool that looks explicitly at sensory modulation in more detail, for example, sensory responsivity, should be considered in future research.

- Use of a sensory modulation specific scale would be an effective measure for differentiating different subtypes of SMDs. Combination of examiner, teacher and primary caregiver observed reports would make for a more clinically sound presentation of the child's functioning within multiple contexts such as school, home and community.

- Recent studies have shown that parasympathetic nervous system dysfunction affects homeostasis abilities such as maintaining an optimal calm-alert state when processing everyday sensations which may negatively impact affecting his or her activity participation (Schaaf et al., 2010). For future research, the parasympathetic nervous system and sensory responsiveness should be considered, examining behaviours seen in children with sensory modulation difficulties. This will aim to build prevalence rates and profiling data which may aid occupational therapy interventions in assisting a child with sensory regulation.

- Consideration should be made towards excluding children from the sample who have previously seen or are currently attending allied health care services to prevent skewing of data results. Children without a formal diagnosis are commonly referred to allied health care services. These children may meet sufficient criteria for a clinical diagnosis have however, not been formally diagnosed by a medical practitioner, such participants may skew prevalence rates and profiling.

An important postulate should be considered, limited sensory processing and behaviour research has been conducted examining the prevalence rates and profiling within the neurotypically developing school-going population. Research within this population remains highly esteemed and is central in the development of up-to-date, evidence-based knowledge that maintains and validates the occupational therapy profession.

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APPENDICES

Appendix A: HREC Clearance Certificate

R14/49 Mrs Tamryn Paulsen (Whitmore)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160955

NAME: (Principal Investigator)	Mrs Tamryn Paulsen (Whitmore)
DEPARTMENT:	Occupational Therapy St Mary's Diocesan School for Girls, Glenstantia Primary School, Laerskool Paratus Primary and Brooklyn Primary School
PROJECT TITLE:	The Association between Internalizing and Externalizing Behaviours and Secondary Processing Patterns in Children Aged Six-Ten
DATE CONSIDERED:	30/09/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Lyndsay Koch
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	14/08/2017

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 in Room 10004,10th floor, Senate House/3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised 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 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 review 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

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix B: Gauteng Department of Education Research Approval Letter

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE AMMENDED RESEARCH APPROVAL LETTER

Date:	**05 February 2019**
Validity of Research Approval:	**04 February 2019 – 30 September 2019** **2017/11A**
Name of Researcher:	**Paulsen Whitmore T.C**
Address of Researcher:	**P O Box 25168**
	Monument Park
	Pretoria, 0105
Telephone Number:	**074 323 0049**
Email address:	**paulsen.tamryn@gmail.com**
Research Topic:	**The correlations between internalizing and externalizing behaviours and sensory processing patterns in the children age six-ten**
Number and type of schools:	**Three Primary Schools.**
District/s/HO	**Johannesburg East**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this*

05/02/2019

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

Appendix C: School/Principal Research Information and Invitation to Participate

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

To whom it may concern,

My name is Tamryn Paulsen; I am an Occupational Therapist currently completing my Master of Science in Occupational Therapy degree at the University of the Witwatersrand. As part of the degree requirements, I am currently performing research to investigate "The correlations between internalizing and externalizing behaviours and sensory processing patterns in children aged six to ten".

I would like to invite your school to participate in my research to further enrich the knowledge and understanding of the developing child.

Children's ability to adapt to and engage within their occupational settings is dependent on their ability to behave in a socially appropriate manner. A child's main occupational setting is the classroom and school environment, where they spend a substantial portion of their time engaging in educational and play activities. As a result, behavioural problems are most commonly identified within the school environment. As sensory processing is necessary for adaptive behaviour, it is possible that internalizing and externalizing behaviours seen in the classroom are related to the way in which children process sensory information. This has implications for how these behaviours are managed within the classroom and warrants further investigation.

The aim of this research is to identify if any correlations exist between a child's internalizing and externalizing behaviours and their sensory processing in the typically developing child.

Nature and procedure: The teacher will send home the parent information pack to all learners in their class, to invite parents to participate. If the parent returns a signed consent form, the teacher will complete two questionnaires: The Conners 3 and The Sensory Processing Measure. These questionnaires will be returned to the researcher. These forms will then be analysed to determine if any correlations exist between behaviour and sensory processing. Children who have been diagnosed by a pediatrician or the relative health care professional, with conditions such as ADD/ADHD, Autism Spectrum Disorder, a genetic disorder (i.e. Turner's syndrome) or a neurological lesion (i.e. cerebral palsy) will be excluded from this research.

Your assistance would be greatly appreciated. If you would like to be involved, please sign the principal consent form.

Should you have any questions, please feel free to contact me on Tamryn@innovaot.co.za.

For further information please contact the Occupational Therapy Department at the University of Witwatersrand on 011 717 3701. If you have any enquires please contact the Human Research Ethics Committee administrator and chair Professor P. Cleaton-Jones at 011 717 1234.

Kind regards,
Tamryn Paulsen
Reseach Protocol: M160955

Appendix D: Parent Research Information and Invitation to Participate

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Dear Parents,

My name is Tamryn Paulsen; I am an Occupational Therapist currently completing my Master of Science in Occupational Therapy at the University of the Witwatersrand. As part of the degree requirements, I am currently performing research to better understand "The correlations between internalizing and externalizing behaviours and sensory processing patterns in children aged six to ten".

I would like to invite you and your child to participate in my research to further enrich the knowledge and understanding of the developing child.

The aim of my research is to identify if any correlations exist between a child's behaviour and their sensory integration within five sensory systems - visual, auditory, tactile, proprioceptive, and vestibular functioning; within a classroom environment.

The nature and procedure of the research:

- I will be looking at children from several schools, within the foundation phase (grade 1 – 3).
- With your consent, the teacher will complete two questionnaires based on your child's general behaviour and sensory processing within the classroom using The Conner's 3 and The Sensory Processing Measure questionnaires.
- Using this data, I will then determine if any correlations exist between a child's behaviour and their sensory processing within the classroom environment.
- This information is essential in understanding the modern day child within the classroom context, and to further enrich the existing knowledge of the developing child.

Your assistance would be greatly appreciated. If you would like to be involved, please complete the parent consent form and demographic questionnaire in this information pack. The completed forms can be returned to your child's teacher.

Should you have any questions, please feel free to contact me on Tamryn@innovaot.co.za.

For further information please contact the Occupational Therapy Department at the University of Witwatersrand on 011 717 3701. If you have any enquires please contact the Human Research Ethics Committee administrator and chair Professor P. Cleaton-Jones at 011 717 1234.

Kind regards,
Tamryn Paulsen
Reseach Protocol: M160955

Appendix E: School/Principal Consent

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Principal Consent Letter

Thank you for your assistance in enriching the knowledge of the developing child, and helping me complete my Master of Science in Occupational Therapy.

Please sign below in acknowledgement of the following:

1. I give permission for the school to participate in the research entitled "The correlations between internalizing and externalizing behaviours and sensory processing patterns in children aged six to ten" conducted by Tamryn Paulsen from the University of the Witwatersrand, Occupational Therapy Department as part of her Master of Science in Occupational Therapy.
2. The Ethics Committee of the University of the Witwatersrand as well as The Gauteng Department of Education has reviewed and granted this research.
3. The schools participation is voluntary, there are no consequences should the school wish to withdraw from the research at any point.
4. The school is able to ask questions regarding the research at any stage.
5. Confidentiality will be maintained for all participants.
6. I have read the information letter provided and understand the nature and procedure of the research.
7. Research results may be provided on request.

I hereby give permission and consent for the above-mentioned school to participate in the research.

Signature: _____ Date: _____

School: _____

RESEARCHER

I herewith confirm that the above mentioned participant has been informed about the nature and procedure of the research.

Signature: _____ Date: _____

Appendix F: Parent Consent

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Parent Consent Letter

Thank you for your assistance in enriching the knowledge of the developing child, and helping me complete my Master of Science in Occupational Therapy.

Please sign below in acknowledgement of the following:

1. I give permission for my child to participate in the research entitled "The correlations between internalizing and externalizing behaviours and sensory processing patterns in children aged six to ten" conducted by Tamryn Paulsen from the University of the Witwatersrand, Occupational Therapy Department as part of her Master of Science in Occupational Therapy.
2. The Ethics Committee of the University of the Witwatersrand as well as The Gauteng Department of Education has reviewed and granted this research.
3. My participation is voluntary, there are no consequences should I wish to withdraw from the research at any point.
4. I am able to ask questions regarding the research at any stage.
5. Confidentiality will be maintained for all participants.
6. I have read the information letter provided and understand the nature and procedure of the research.
7. Research results may be provided on request.
8. I hereby give consent for my child's school teacher to complete two questionnaires, namely The Conners 3 and The Sensory Processing Measure for my child.

PARENT / LEGAL GUARDIAN DETAILS:

Full Name: _____

Signature: _____ Date: _____

CHILD DETAILS:

Full Name: _____

School Name: _____

Grade: _____

Teacher: _____

Appendix G: Child Participant Consent

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

As this research involves young children, it is important that they give assent.
Each child will be read the following in front of their parent,
guardian or class teacher to gain their consent.

Hello, my name is Tamryn.

I have asked your mom/dad/guardian, school and teacher to help me learn more about children and I wanted to ask if you could help me. I have asked your teacher to fill out two different forms (show The Conners 3 and The Sensory Processing Measure). These forms are going to help me understand more about what boys and girls do in their classroom. Is that okay? If not you can tell me now.

Child's response to participate: Yes ☐ No ☐

Your mom/dad/guardian will fill out a paper with some of your details like if you are a boy or girl, how old you are, and what grade you are in (show demographic questionnaire). Is that okay? If not you can tell me now.

Child's response to participate: Yes ☐ No ☐

PARTICIPANT

Child's Full Name: _____

RESEARCHER

I herewith confirm that the above mentioned participant has been informed about the nature and procedure of the research.

Signature: _____ Date: _____

Appendix H: Teacher Consent

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Teacher Consent Letter

Thank you for your assistance in enriching the knowledge of the developing child, and helping me complete my Master of Science in Occupational Therapy.

Please sign below in acknowledgement of the following:

1. I give my consent to participate in the research entitled "The correlations between internalizing and externalizing behaviours and sensory processing patterns in children aged six to ten" conducted by Tamryn Paulsen from the University of the Witwatersrand, Occupational Therapy Department as part of her Master of Science in Occupational Therapy.
2. The Ethics Committee of the University of the Witwatersrand as well as The Gauteng Department of Education has reviewed and granted this research.
3. My participation is voluntary, there are no consequences should I wish to withdraw from the research at any point.
4. I am able to ask questions regarding the research at any stage.
5. Confidentiality will be maintained for all participants.
6. I have read the information letter provided and understand the nature and procedure of the research.
7. Research results may be provided on request.

TEACHER / PARTICPANT

Full Name: _____

School Name: _____

Grade: _____

Signature: _____ Date: _____

RESEARCHER

I herewith confirm that the above mentioned participant has been informed about the nature and procedure of the research.

Signature: _____ Date: _____

Appendix I: Research Procedure

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Thank you for your assistance in helping me complete my Master of Science in Occupational Therapy.

<u>The Nature and Procedure of the Research:</u>

1
- The Schools and Teachers who would like to particiapte sign a consent form.
- Participating teachers send home a parent information pack to invite parents to participate.
- Parents who would like their child to particpate, return their signed consent to be included in the reseach.

2
- The researcher, Tamryn Paulsen will then provide the teacher with two questionaires per child, to complete for the children who have consented.
- The questionaires are in check list form for ease: The Conners and The Sensory Processing Measure.
- Once the teacher has completed the questionaires, the researcher will collect them.

3
- The school and teachers will be given the research findings, outcomes and interpretaion of the research.
- The reseach outcome is to better understand children in the foundation phase, and to determine if there are correlations between behaviour and sensory processing patterns.

Kind regards,
Tamryn Paulsen
Reseach Protocol: M160955

Appendix J: Demographic Questionnaire

Occupational Therapy
School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Thank you for taking the time to complete this page.
Please tick where applicable.

General Information

Date of birth: dd / mm / cccc

Gender: Female ☐ Male ☐

Race: African ☐ Coloured ☐ White ☐
Indian ☐ Asian ☐ Other ☐

School Information

Current Grade: Grade 1 ☐ Grade 2 ☐ Grade 3 ☐

Grades Repeated: Yes ☐ No ☐ Grade repeated: _____

School performance: Above Average ☐ Average ☐ Below Average ☐

Early developmental history

Birth complications: Yes ☐ No ☐

Temperament: Easy / flexible ☐ Difficult / Feisty ☐
Slow-to-warm up / Fearful ☐

Milestones – *Please give child's age* on the following milestones

Crawled: _____ Sitting: _____

Standing: _____ Walking: _____

Has your child seen on of the following allied health care professionals?

Occupational Therapist ☐ Speech & Language Therapist ☐

Psychologist ☐ Play Therapist ☐

Other ☐: _____ No / None ☐

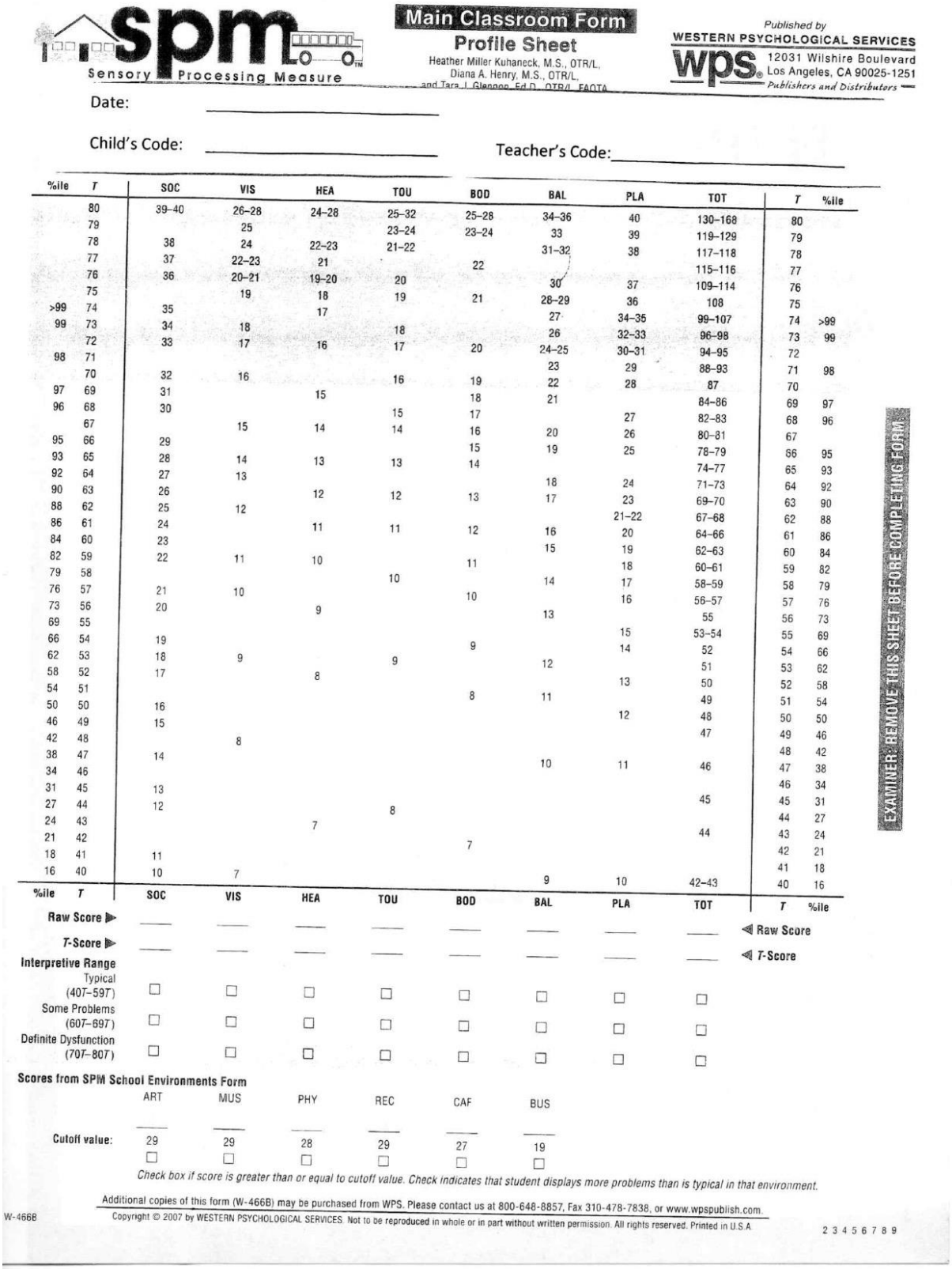
Has your child been formally diagnosed by a pediatrician, specialist or relative health care profession with any of the following conditions:

1. A fixed diagnosis classified by the Diagnostic and Statistic Manual of Mental Disorders for example Autism Spectrum Disorder, oppositional defiance disorder, conduct disorder or diagnosed ADD/ADHD.....Yes ☐ No ☐
2. A genetic disorder such as Turner's syndrome or Down's syndrome.....Yes ☐ No ☐
3. A neurological condition such as cerebral palsy .....Yes ☐ No ☐

Thank you for your assistance in helping me enrich the knowledge of the developing child, and complete my Master of Science in Occupational Therapy.

RESEARCHER TO COMPLETE: Participant code: _____
School code: _____

Appendix K: Sensory Processing Measure – Teacher Form: Main Classroom



spm Sensory Processing Measure

Main Classroom Form

Profile Sheet

Heather Miller Kuhaneck, M.S., OTR/L,
Diana A. Henry, M.S., OTR/L,
and Tara J. Glennon, Ed.D., OTR/L, FAOTA

Published by
WESTERN PSYCHOLOGICAL SERVICES
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Los Angeles, CA 90025-1251
Publishers and Distributors

Date: _____

Child's Code: _____ Teacher's Code: _____

%ile	T	SOC	VIS	HEA	TOU	BOD	BAL	PLA	TOT	T	%ile
	80	39–40	26–28	24–28	25–32	25–28	34–36	40	130–168	80	
	79		25		23–24	23–24	33	39	119–129	79	
	78	38	24	22–23	21–22		31–32	38	117–118	78	
	77	37	22–23	21		22			115–116	77	
	76	36	20–21	19–20	20		30	37	109–114	76	
	75		19	18	19	21	28–29	36	108	75	
>99	74	35		17			27	34–35	99–107	74	>99
99	73	34	18		18		26	32–33	96–98	73	99
	72	33	17	16	17	20	24–25	30–31	94–95	72	
98	71						23	29	88–93	71	98
	70	32	16		16	19	22	28	87	70	
97	69	31		15		18	21		84–86	69	97
96	68	30			15	17		27	82–83	68	96
	67		15	14	14	16	20	26	80–81	67	
95	66	29				15	19	25	78–79	66	95
93	65	28	14	13	13	14			74–77	65	93
92	64	27	13				18	24	71–73	64	92
90	63	26		12	12	13	17	23	69–70	63	90
88	62	25	12					21–22	67–68	62	88
86	61	24		11	11	12	16	20	64–66	61	86
84	60	23					15	19	62–63	60	84
82	59	22	11	10		11		18	60–61	59	82
79	58				10		14	17	58–59	58	79
76	57	21	10			10		16	56–57	57	76
73	56	20		9			13		55	56	73
69	55							15	53–54	55	69
66	54	19				9		14	52	54	66
62	53	18	9		9		12		51	53	62
58	52	17		8				13	50	52	58
54	51					8	11		49	51	54
50	50	16						12	48	50	50
46	49	15							47	49	46
42	48		8							48	42
38	47	14					10	11	46	47	38
34	46									46	34
31	45	13							45	45	31
27	44	12			8					44	27
24	43			7					44	43	24
21	42					7				42	21
18	41	11								41	18
16	40	10	7				9	10	42–43	40	16
%ile	T	SOC	VIS	HEA	TOU	BOD	BAL	PLA	TOT	T	%ile

EXAMINER: REMOVE THIS SHEET BEFORE COMPLETING FORM

	SOC	VIS	HEA	TOU	BOD	BAL	PLA	TOT	
Raw Score ▶	___	___	___	___	___	___	___	___	◀ Raw Score
T-Score ▶	___	___	___	___	___	___	___	___	◀ T-Score
Interpretive Range									
Typical (407–597)	☐	☐	☐	☐	☐	☐	☐	☐	
Some Problems (607–697)	☐	☐	☐	☐	☐	☐	☐	☐	
Definite Dysfunction (707–807)	☐	☐	☐	☐	☐	☐	☐	☐	

Scores from SPM School Environments Form

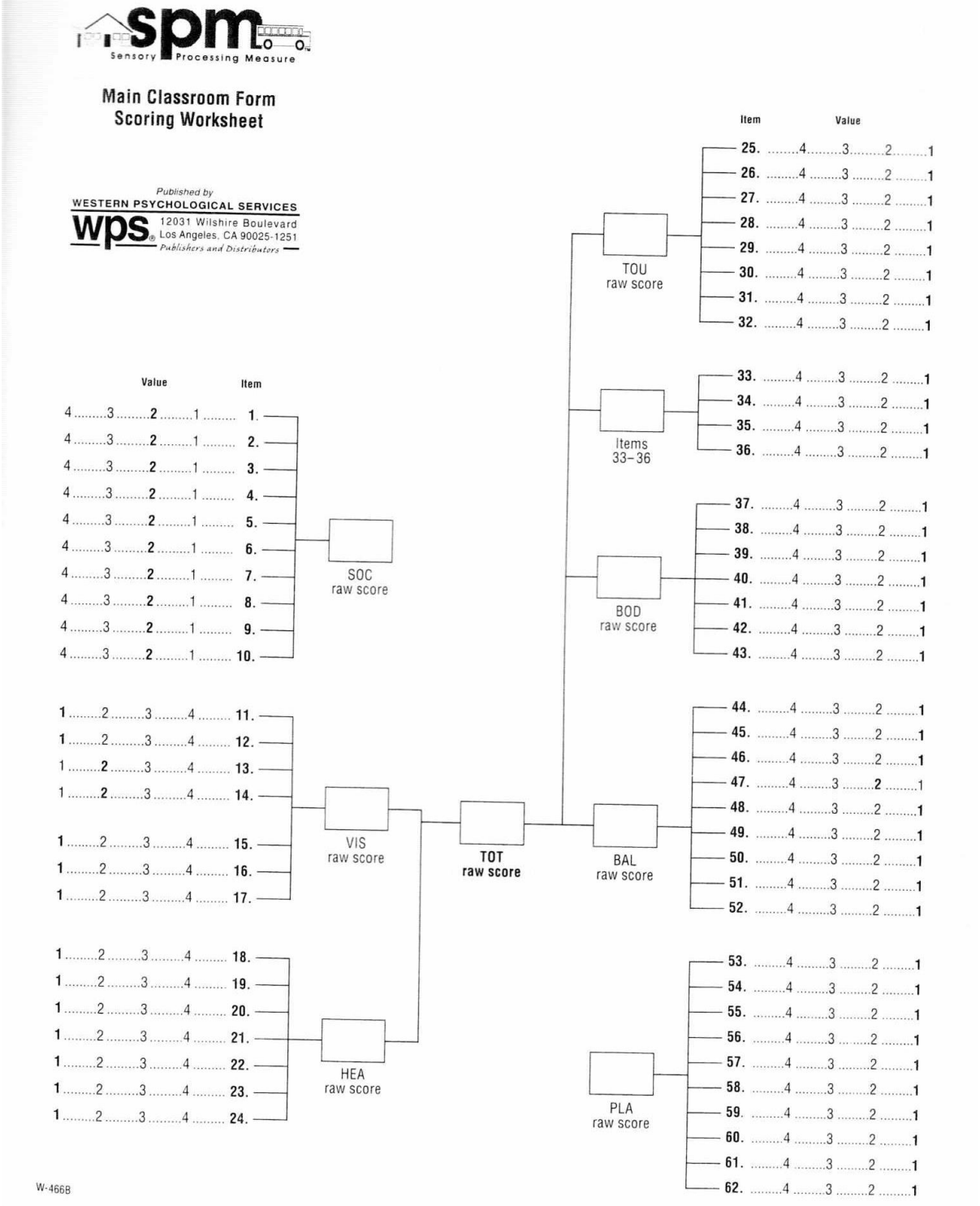
	ART	MUS	PHY	REC	CAF	BUS
	___	___	___	___	___	___
Cutoff value:	29	29	28	29	27	19
	☐	☐	☐	☐	☐	☐

Check box if score is greater than or equal to cutoff value. Check indicates that student displays more problems than is typical in that environment.

Additional copies of this form (W-466B) may be purchased from WPS. Please contact us at 800-648-8857, Fax 310-478-7838, or www.wpspublish.com.

W-466B

2 3 4 5 6 7 8 9


spm
Sensory Processing Measure
Main Classroom Form
Scoring Worksheet
Published by
WESTERN PSYCHOLOGICAL SERVICES
wps
12031 Wilshire Boulevard
Los Angeles, CA 90025-1251
Publishers and Distributors
Item
Value
25. 4 3 2 1
26. 4 3 2 1
27. 4 3 2 1
28. 4 3 2 1
29. 4 3 2 1
30. 4 3 2 1
31. 4 3 2 1
32. 4 3 2 1
TOU raw score
33. 4 3 2 1
34. 4 3 2 1
35. 4 3 2 1
36. 4 3 2 1
Items 33–36
37. 4 3 2 1
38. 4 3 2 1
39. 4 3 2 1
40. 4 3 2 1
41. 4 3 2 1
42. 4 3 2 1
43. 4 3 2 1
BOD raw score
44. 4 3 2 1
45. 4 3 2 1
46. 4 3 2 1
47. 4 3 2 1
48. 4 3 2 1
49. 4 3 2 1
50. 4 3 2 1
51. 4 3 2 1
52. 4 3 2 1
BAL raw score
53. 4 3 2 1
54. 4 3 2 1
55. 4 3 2 1
56. 4 3 2 1
57. 4 3 2 1
58. 4 3 2 1
59. 4 3 2 1
60. 4 3 2 1
61. 4 3 2 1
62. 4 3 2 1
PLA raw score
Value
Item
4 3 2 1 1.
4 3 2 1 2.
4 3 2 1 3.
4 3 2 1 4.
4 3 2 1 5.
4 3 2 1 6.
4 3 2 1 7.
4 3 2 1 8.
4 3 2 1 9.
4 3 2 1 10.
SOC raw score
1 2 3 4 11.
1 2 3 4 12.
1 2 3 4 13.
1 2 3 4 14.
1 2 3 4 15.
1 2 3 4 16.
1 2 3 4 17.
VIS raw score
1 2 3 4 18.
1 2 3 4 19.
1 2 3 4 20.
1 2 3 4 21.
1 2 3 4 22.
1 2 3 4 23.
1 2 3 4 24.
HEA raw score
TOT raw score
W-466B

Appendix L: The Conners 3 - Teacher Form

C30008

Conners 3™–Teacher

C. Keith Conners, Ph.D.

Instructions: Here are some things teachers might say about their students. Please tell us about *this* student and what he/she has been like in the ***past month***. Read each item carefully, then mark how well it describes this student or how frequently it has happened in the ***past month***.

0 = In the past month, this was ***not true at all*** about this student. It never (or seldom) happened.
1 = In the past month, this was ***just a little true*** about this student. It happened occasionally.
2 = In the past month, this was ***pretty much true*** about this student. It happened often (or quite a bit).
3 = In the past month, this was ***very much true*** about this student. It happened very often (very frequently).

Please circle only one answer for each item. It is important to respond to every item.
For items that you find difficult to answer, please give your best guess.

Student's Name/ID: _____

Age: _____ (Years) _____ (Months)

Gender: M F (Circle One)

Birth Date: _____/_____/_____ (Month / Day / Year)

Grade: _____

Teacher's Name/ID: _____

Class(es) Taught: _____

Time Known Student: _____ (Months)

Today's Date: _____/_____/_____ (Month / Day / Year)

MHS

CONNERS 3™ – Teacher

C. Keith Conners, Ph.D

In the past month, this was...	0 = Not true at all (Never, Seldom) 1 = Just a little true (Occasionally)	2 = Pretty much true (Often, Quite a bit) 3 = Very much true (Very often, Very frequently)			
1. Leaves seat when he/she should stay seated.	0	1	2	3
2. Gets overly excited.	0	1	2	3
3. Has a short attention span.	0	1	2	3
4. Fidgets or squirms in seat.	0	1	2	3
5. Cannot do things right.	0	1	2	3
6. Begins a task or project without making a plan.	0	1	2	3
7. Restless or overactive.	0	1	2	3
8. Threatens to hurt others.	0	1	2	3
9. Blurts out answers before the question has been completed.	0	1	2	3
10. Intentionally damages or destroys things that belong to others.	0	1	2	3
11. Has trouble getting started on tasks or projects.	0	1	2	3
12. Does not remember what he/she reads.	0	1	2	3
13. Excitable, impulsive.	0	1	2	3
14. Uses a weapon (e.g., a bat, brick, broken bottle, knife, or gun).	0	1	2	3
15. Is patient and content, even when waiting in a long line.	0	1	2	3
16. Cannot decide which things are the most important.	0	1	2	3
17. Acts as if driven by a motor.	0	1	2	3
18. Forgets instructions quickly.	0	1	2	3
19. Has trouble keeping friends.	0	1	2	3
20. Completes projects at the last minute.	0	1	2	3
21. Is cruel to animals.	0	1	2	3
22. Temper outbursts; explosive, unpredictable behavior.	0	1	2	3
23. Is easily distracted by sights or sounds.	0	1	2	3
24. Runs or climbs when he/she is not supposed to.	0	1	2	3
25. Fails to finish things he/she starts.	0	1	2	3
26. Talks out of turn.	0	1	2	3
27. Steals while confronting a person (e.g., mugging, purse snatching, or armed robbery).	0	1	2	3
28. Is perfect in every way.	0	1	2	3
29. Interrupts others (e.g., butts into conversations or games).	0	1	2	3
30. Has to struggle to complete hard tasks.	0	1	2	3
31. Steals secretly (e.g., shoplifting or forgery).	0	1	2	3
32. Is noisy and loud when playing or using free time.	0	1	2	3
33. Has forced someone into sexual activity.	0	1	2	3
34. Has no friends.	0	1	2	3
35. Physically hurts people.	0	1	2	3
36. Makes mistakes.	0	1	2	3
37. Doesn't pay attention to details; makes careless mistakes.	0	1	2	3
38. Is angry and resentful.	0	1	2	3
39. Gets over-stimulated or "wound up."	0	1	2	3
40. Lies to avoid having to do something or to get things.	0	1	2	3
41. Gives up easily on difficult tasks.	0	1	2	3
42. Appears to be unaccepted by group.	0	1	2	3
43. Is cold-hearted and cruel.	0	1	2	3
44. Is sidetracked easily.	0	1	2	3
45. Spelling is poor.	0	1	2	3
46. Mood changes quickly and drastically.	0	1	2	3
47. Argues with adults.	0	1	2	3
48. Disturbs other children.	0	1	2	3
49. Is sad, gloomy, or irritable for many days at a time.	0	1	2	3
50. Talks too much.	0	1	2	3
51. Tries to get even with people.	0	1	2	3
52. Has trouble with reading.	0	1	2	3
53. Has lost interest or pleasure in activities.	0	1	2	3
54. Skips classes.	0	1	2	3
55. Tells the truth; does not even tell "little white lies."	0	1	2	3
56. Is irritable and easily annoyed by others.	0	1	2	3
57. Fails to complete schoolwork or tasks (even when he/she understands and is trying to cooperate).	0	1	2	3
58. Becomes irritable when anxious.	0	1	2	3
59. Annoys other people on purpose.	0	1	2	3
60. Avoids or dislikes things that take a lot of effort and are not fun.	0	1	2	3
61. Has intentionally set fires for the purpose of causing damage.	0	1	2	3
62. Loses temper.	0	1	2	3
63. Does not understand what he/she reads.	0	1	2	3

Student's Name/ID: _____ Age: _____ (Years) _____ (Months) Grade: _____ Birth Date: _____/_____/_____ (Month / Day / Year)

Gender: M F (Circle One) Teacher's Name/ID: _____ Time Known Student: _____ (Months) Today's Date: _____/_____/_____ (Month / Day / Year)

64. Blames others for his/her mistakes or misbehavior.	0	1	2	3
65. Forgets things already learned.	0	1	2	3
66. Is good at planning ahead.	0	1	2	3
67. Seems tired; has low energy.	0	1	2	3
68. Gets into trouble with the police.	0	1	2	3
69. Does not seem to listen to what is being said to him/her.	0	1	2	3
70. Is selfish and self-centered with others.	0	1	2	3
71. Actively refuses to do what adults tell him/her to do.	0	1	2	3
72. Cannot grasp arithmetic.	0	1	2	3
73. Does not follow through on instructions (even when he/she understands and is trying to cooperate).	0	1	2	3
74. Interacts well with other children.	0	1	2	3
75. Cries often and easily.	0	1	2	3
76. Has difficulty waiting for his/her turn.	0	1	2	3
77. Fidgeting.	0	1	2	3
78. Is constantly moving.	0	1	2	3
79. Worries about many things.	0	1	2	3
80. Has poor social skills.	0	1	2	3
81. Is happy, cheerful, and has a positive attitude.	0	1	2	3
82. Has trouble controlling his/her worries.	0	1	2	3
83. Talks non-stop.	0	1	2	3
84. Demands must be met immediately – easily frustrated.	0	1	2	3
85. Does not seem sorry for misbehaving.	0	1	2	3
86. Gets bored.	0	1	2	3
87. Appears "on edge," nervous, or jumpy.	0	1	2	3
88. Is forgetful in daily activities.	0	1	2	3
89. Does not know how to make friends.	0	1	2	3
90. Has broken into someone else's house, building, or car.	0	1	2	3
91. Gets up and moves around during lessons.	0	1	2	3
92. Loses things (e.g., schoolwork, pencils, books, tools, or toys).	0	1	2	3
93. Is difficult to please or amuse.	0	1	2	3
94. Needs extra explanation of instructions.	0	1	2	3
95. Feels worthless.	0	1	2	3
96. Gets into trouble with teachers or school principal.	0	1	2	3
97. Has trouble concentrating.	0	1	2	3
98. Bullies, threatens, or scares others.	0	1	2	3
99. Needs help to break a complex task into smaller, more manageable pieces.	0	1	2	3
100. Inattentive, easily distracted.	0	1	2	3
101. I cannot figure out what makes him/her happy.	0	1	2	3
102. Acts in sneaky or manipulative ways.	0	1	2	3
103. Has difficulty organizing tasks or activities.	0	1	2	3
104. Is one of the last to be picked for teams or games.	0	1	2	3
105. Intentionally starts fights with others.	0	1	2	3
106. Forgets to turn in completed work.	0	1	2	3
107. Is fun to be around.	0	1	2	3
108. Has trouble changing from one task to another.	0	1	2	3
109. Behaves like an angel.	0	1	2	3
110. Is hard to motivate (even with highly desirable rewards).	0	1	2	3
111. Has trouble keeping his/her mind on work or play for long.	0	1	2	3

Think about your answers so far, then answer the next two items.

112. The student's problems seriously affect schoolwork or grades.	0	1	2	3
113. The student's problems seriously affect friendships and relationships.	0	1	2	3

Additional Questions:

114. Do you have any other concerns about this student? _____

_____

115. What strengths or skills does this student have? _____

_____

Appendix M: Table 4. 15 Associations between repeating a grade and internalising behaviours

Table 4. 15 Associations between repeating a grade and internalising behaviours

Variables		Children who did not repeat a grade				Children who repeated a grade				Chi-Square	df	P-value
		n	Mean	SD	Upper Quartile	n	Median	Lower Quartile	Upper Quartile			
Conners 3 internalising behaviours	Overall Depression features	116	2	1	2	8	1.00	1.00	1.00	4.810	1	0.028
	Anxiety - irritable	114	1	1	1	8	2.00	1.00	2.00	8.66	1	0.003
	Anxiety - control worries	115	1	1	2	8	2.00	1.50	2.50	6.35	1	0.011
	Depression - Loss of interest	114	1	1	1	8	1.50	1.00	2.50	3.858	1	0.049
	Depression - Tired low energy	115	1	1	2	8	2.00	1.50	2.50	6.684	1	0.009

Note: *p-value significant at p <.05 SD = standard deviation, df = degree of freedom. n may differ due to teacher/parent marking error on form (missing data).

Appendix N: Table 4.16 Associations between children who had or had not seen an allied health care professional in relation to externalising behaviours and sensory processing

Table 4. 16 Associations between children who had or had not seen an allied health care professional in relation to externalising behaviours and sensory processing

	Variables	Health care professional	Total n	Children who **HAD** seen a health care professional			Children who had **NOT** seen a health care professional			Chi-Square		
				n	Mean	SD	n	Mean	SD	Chi-Square	df	P-value
Externalizing Behaviours	Learning Problems/ Executive Functioning LE	OT	132	17	57.588	9.868	115	51.530	11.692	**8.961**	**1**	***0.002**
		ST		21	54.000	9.539	111	51.990	11.983	3.305	1	0.069
		PLAY		15	53.667	10.362	117	52.136	11.800	0.898	1	0.343
		PSYCH		7	54.571	10.799	125	52.184	11.691	1.557	1	0.212
	Executive Functioning EF	OT	132	17	56.058	9.370	115	51.260	10.863	**2.916**	**1**	***0.027**
		ST		21	52.619	8.529	111	51.738	11.172	0.483	1	0.487
		PLAY		15	52.266	8.631	117	51.829	11.046	0.423	1	0.515
		PSYCH		7	54.428	7.892	125	51.736	10.916	2.011	1	0.156
	Defiance/ AggressionAG	OT	132	17	55.294	19.924	115	56.086	14.479	**4.304**	**1**	***0.038**
		ST		21	54.380	16.007	111	56.288	15.096	1.864	1	0.172
		PLAY		15	55.933	18.679	117	55.991	14.790	0.330	1	0.565
		PSYCH		7	64.142	24.231	125	55.528	14.548	0.050	1	0.822
	DSM ADHD Inattentive AN	OT	132	17	58.000	9.656	115	51.669	10.716	**5.469**	**1**	***0.019**
		ST		21	54.333	9.451	111	52.135	13.740	0.509	1	0.475
		PLAY		15	55.466	10.602	117	52.102	10.769	1.880	1	0.170
		PSYCH		7	56.142	10.526	125	54.096	10.781	1.357	1	0.243
Sensory Processing	Balance and Movement BAL	OT	133	17	56.117	9.252	116	50.827	10.541	**6.120**	**1**	***0.013**
		ST		20	51.250	10.181	113	51.548	10.603	0.490	1	0.483
		PLAY		16	53.187	8.627	117	51.273	10.745	2.865	1	0.090
		PSYCH		7	58.00	3.958	126	51.142	10.642	**5.541**	**1**	***0.018**
	Planning and Ideas PLA	OT	133	17	60.588	8.085	116	51.241	10.870	**13.057**	**1**	***0.000**
		ST		20	51.250	10.150	113	52.176	11.149	1.506	1	0.219
		PLAY		16	54.937	8.978	117	52.094	11.222	1.670	1	0.196
		PSYCH		7	57.285	8.420	126	52.166	11.074	1.715	1	0.190

Note: *p-value significant at p <.05 SD = standard deviation, df = degree of freedom. n may differ due to teacher/parent marking error on form (missing data). RED: Atypical threshold met where T-Score is above 60 indicating "more concerns" than expected for age and gender. Total n = 118

Appendix O: Editing Certificate

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Academic Editing Services

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EDITING CERTIFICATE

February 18, 2020

To whom it may concern

Author: Tamryn Paulsen

Dissertation/Thesis title: Sensory Processing and Behaviour Profiling of Neurotypical Children

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Signed _____

at Durban **this** 20 **day of** February **2020**

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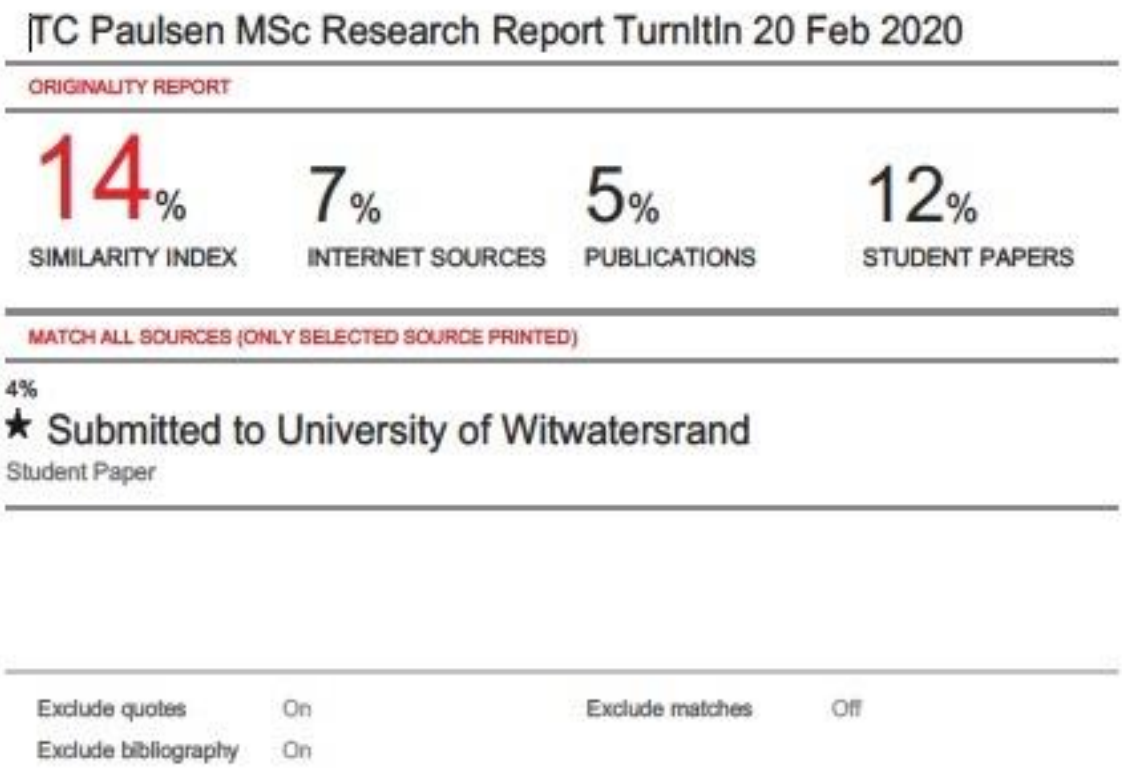
Appendix P: Turn It In Report



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