

**A PILOT STUDY EXPLORING THE EFFECT OF AN INTEGRATED LEARNING THERAPY
HOME PROGRAMME TOGETHER WITH OCCUPATIONAL THERAPY ON CHILD
DEVELOPMENT**

Elécia N. van Zyl

Student number: 763022

**Degree of Master of Science in Occupational Therapy
by coursework and research report**

1 December 2016

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

DECLARATION

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



Elécia van Zyl

1 December 2016

ABSTRACT

This research study investigated the possibility of using Integrated Learning Therapy as a home programme to enhance the outcomes of occupational therapy. Integrated Learning Therapy is a sensory based home programme developed by a South African (Dr S Kokot) for children with special learning and behavioural needs and was investigated to address the need for sensory based activities in home programmes within occupational therapy. Sensory-based activities include adult directed activities performed in the natural environment of the child with the aim of producing a short-term effect on self-regulation, attention or behavioural organisation.(1)

An alternate, randomised group intervention design, with blind time-interval recording was used to explore the effects that Integrated Learning Therapy together with occupational therapy had on enhancing the occupational therapy outcomes of children aged 5 to 11 years old. A sample of nine children were recruited in this pilot study. Each child participated in the ILT-OT stage and acted as his/her own control.

The results suggested that Integrated Learning Therapy presented together with occupational therapy showed a higher percentage of positive change in areas of dysfunction in comparison to when only occupational therapy was available. Change occurred predominantly in the sensory discrimination and sensory modulation abilities of children. The study indicated that earlier implementation of a home programme may be more beneficial than a delay in programme implementation.

ACKNOWLEDGEMENTS

I wish to acknowledge the following people for the roles they have played in the completion of this study:

- To my supervisor **Lyndsay Koch**, for insightfully guiding me through the research process and for helping me to stay within the correct topics.
- To **Joanny Rogers** and **Hannelie Labuschagné, occupational therapy colleagues**, for performing the re-assessments of participants.
- A special thank you to **Hannelie Labuschagné**, a friend and colleague, who was always ready to listen to my ideas and frustration and kept me motivated through it all.
- To the **parents** and **participants**, for their dedication to complete their home programme
- To my husband, **Gary Kemp**, for his support and belief in me. Thank you for encouraging me to pursue my passion for occupational therapy.
- To my **parents** and **sister**, who understood that my time was restricted, encouraged me to just keep going, and celebrated with me when my process was complete
- To my **friends** and **colleagues** who showed their interest in my research and motivated me to continue

LIST OF CONTENT

Declaration.....	ii
Abstract	iii
Acknowledgements	iv
List of Content	v
List of Figures	viii
List of Tables	ix
List of Nomenclature	x
List of Abbreviations.....	xii

Chapter 1: INTRODUCTION

1.1 Background to the study	1
1.2 Statement of the problem.....	4
1.3 Purpose of the study	5
1.4 Research question.....	5
1.5 Aim and objective of study.....	6
1.5.1 Aim of the study.....	6
1.5.2 Objectives of the study	6
1.6 Justification of the study.....	6

Chapter 2: LITERATURE REVIEW

2.1 The importance of education in occupational therapy.....	8
2.2 Addressing educational concerns within occupational therapy	9
2.2.1 Sensory integration theory on addressing educational concerns.....	10
2.2.2 Sensory integration intervention	12
2.2.2.1 Measuring the outcomes of sensory integration intervention	13
2.3 Home programmes as a supplementary part of occupational therapy intervention, including sensory integration	15
2.4 Integrated learning therapy as a sensory based home programme.....	22
2.4.1 Introduction to Integrated Learning Therapy	22
2.4.2 Theory supporting the ILT home programme	22
2.4.3 The ILT home programme compared to the Sensory Diet and Alert programme	24
2.4.4 The ILT process of programme implementation compared to Novak's recommended model for home programme implementation	26
2.4.5 Research on the use of the ILT programme	27
2.5 Brief summary of the key points in the literature review	28

Chapter 3: METHODOLOGY

3.1 Study Design	29
3.1.1 An alternate group intervention design, with blind time-interval recording	32
3.1.2 Population.....	34

3.1.3	Sample Size	34
3.2	Research Procedure	36
3.2.1	Listed procedure	36
3.3	Measurement Instruments	41
3.3.1	Measurement instruments used during the ILT-OT stage	41
3.3.2	Measurements and procedures during the OT-only stage	43
3.4	Measurement instruments used to measure the outcome of the ILT home programme	43
3.4.1	Bruininks-Oseretsky test of motor proficiency (BOT-2) short form	44
3.4.2	Sensory Profile Caregiver Questionnaire	45
3.5	Data Capturing	46
3.6	Data Analysis	47
3.6.1	Bruininks-Oseretsky Test of Motor Proficiency short form analysis	47
3.6.2	Sensory Profile Caregiver Questionnaire analysis	48
3.6.3	Determining change within groups over time	49
3.7	Ethical Considerations	51

Chapter 4: RESULTS

4.1	Demographics	52
4.1.1	Demographics of the sample	52
4.1.2	Demographics of Group A (ABA)	52
4.1.3	Demographics of Group B (AAB)	55
4.2	Measuring change within areas of dysfunction	58
4.3	Data derived from the change grids	59
4.3.1	Question 1: Does the ILT home programme together with regular occupational therapy intervention contribute to positive change in the developmental skills of children?	59
4.3.2	Question 2: If there is change, where does this change predominantly occur?	64
4.3.3	Question 3: When is the appropriate time to prescribe an ILT programme?	70
4.4	Results conclusion	73

Chapter 5: DISCUSSION

5.1	Introduction	74
5.2	Critique of the study	75
5.2.1	Problems with the sample size	75
5.2.2	Problems measuring change	76
5.3	Sample Demographics	80
5.3.1	Difficulty in meeting the sample	80
5.3.2	Discussion on sample demographics	80
5.4	Research questions discussed	83
5.4.1	Question 1: Does the ILT home programme together with regular occupational therapy intervention enhance occupational therapy outcomes in sensory processing and motor skills	83
5.4.2	Question 2: If there is change, where does this change predominantly occur (i.e. in which skills)?	88

5.4.3	Question 3: When is the appropriate time to prescribe an ILT programme (i.e. at what point in therapy should the ILT home programme be prescribed)?	90
5.5	Discussion conclusion	93

Chapter 6: RECOMMENDATIONS

6.1	Conclusion	94
6.2	Recommendations for therapy.....	95
6.3	Recommendations for research	95

REFERENCE LIST	96
----------------------	----

APPENDICES 103

A	Permission to conduct study: Dr S Kokot	103
B	Information package and procedures	104
C	Informed consent: parent participants	107
D	Informed consent: child assent.....	108
E	ILT parent questionnaire (Shortened form as an example)	109
F	Example of ILT Evaluation form	111
G	Bruininks-Oseretsky test of motor proficiency (BOT-2) short form	112
H	Sensory Profile Caregiver Questionnaire.....	114
I	Neurodevelopmental Chart	124
J	Example of Integrated Learning Therapy home programme activities	125
K	Sensory Integration Fidelity Measure	130
L	Home programme diary.....	131
M	Sensory Profile Interpretation grid	132
N	Group A (ABA) Change Grid: ILT-OT stage and OT-Only stage	133
O	Group B (AAB) Change Grid: OT-Only stage and ILT-OT Stage.....	134
P	Ethical clearance certificate from the University of the Witwatersrand's Ethical Committee of Research on Human Subjects.....	135

LIST OF FIGURES

Figure 3.1	An illustration of the alternate group study design with time interval recording	p.33
Figure 4.1	Change in both groups (combined) during the different stages (OT-only and ILT-OT stage)	p. 61
Figure 4.2	Change in each group's areas of dysfunction during each stage (Motor skills and sensory processing skills)	p. 63
Figure 4.3	Sensory Discrimination: Change in areas of dysfunction for both groups during each stage	p. 67
Figure 4.4	Sensory Modulation: Change in areas of dysfunction for both groups during each stage	p. 69
Figure 4.5	First phase (after the first six weeks) results for both groups: All areas (motors skills, sensory modulation and sensory discrimination.)	p. 71
Figure 4.6	First phase (after the first six weeks) results for both groups: Areas of dysfunction	p. 72

LIST OF TABLES

Table 2.1	A brief summary of the phases of Novak's model for home programme implementation	p.20
Table 3.1	Research procedure steps	p.36
Table 3.2	BOT-2 standard score key	p.47
Table 4.1	ILT assessment results Group A (ABA)	p.53
Table 4.2	Sensory Profile Caregiver Questionnaire Summary of Dysfunction for Group A (ABA)	p.54
Table 4.3	BOT-2 results for Group A (ABA)	p.55
Table 4.4	ILT assessment results for Group B (AAB)	p.56
Table 4.5	Sensory Profile Caregiver Questionnaire Summary of Dysfunction for Group B (AAB)	p.57
Table 4.6	BOT-2 results for Group B (AAB)	p.58
Table 4.7	Combined percentage of change during each phase	p.60
Table 4.8	Group A (ABA): Percentage of change in areas of dysfunction (motor skills and sensory processing) during each stage	p.62
Table 4.9	Group B (AAB): Percentage of change in areas of dysfunction (motor skills and sensory processing) during each stage	p. 62
Table 4.10	Group A(ABA): Motor skill change in areas of dysfunction during each stage	p. 64
Table 4.11	Group B (AAB): Motor skill change in areas of dysfunction during each stage	p. 65
Table 4.12	Group A (ABA): Change in sensory discrimination areas of dysfunction	p.65
Table 4.13	Group B (AAB): Change in sensory discrimination areas of dysfunction	p.66
Table 4.14	Group A (ABA) : Change in sensory modulation areas of dysfunction	p.68
Table 4.15	Group B (AAB): Change in sensory modulation areas of dysfunction	p.68

LIST OF NOMENCLATURE

Adaptive response	Meeting the demands of the environment in an appropriate manner.(2)(3)
Areas of occupation	The broad range of activities in which people participate. It is categorised into activities of daily living, instrumental activities of daily living, rest and sleep, education, work, play, leisure and social participation.(4)
Body functions	“The physiological functions of body systems.”(4)(pg. 635)
Gentle Enhancement[®]	“A belief that slow, steady, supportive practice over time provides the best results”(5)
Home programme	Activities/tasks prescribed by a professional to perform at home with adult supervision and/or assistance.(6)
Motor skills	Referring to motor patterns, muscle tone, posture, balance and equilibrium responses, hand-eye coordination, grasp, reach and object manipulation.(7)
Multisensory activities	“...client engagement in activities that provided two or more distinct sensory stimuli...”(1) (pg. 6)
Occupation	“Goal directed pursuits that typically extend over time, have meaning to the performance, and involve multiple tasks.”(4) (pg. 628)
Performance skills	“Abilities clients demonstrate when performing actions.”(4) (pg. 640)
Sensory discrimination	Ability to distinguish between differences in stimuli and is essential for interpreting sensory information accurately.(3)(8)

Sensory based activities	“...typically occur in the child’s natural environment and consist of applying adult-directed sensory modalities to the child with the aim of producing a short-term effect on self-regulation, attention, or behavioural organisation.”(1) (pg.2)
Sensory modulation	The brain’s ability to prioritise, regulate and organise the degree, intensity and nature of a person’s response to sensory input. It refers to the use of sensory information to organise behaviour.(3)
Sensory processing/ Sensory integration	Sensory processing/integration refers to the ability to register, modulate and integrate sensory stimuli through the central nervous system and use to meet appropriate motor or behavioural response, according to the environmental demand.(2)(9)
Sensory Processing Disorder	Sensory processing disorder is a neurological condition that exists when sensory stimuli are not organised in a manner conducive for meeting the demands of the environment.(9)
Single-sensory activity	“...client participation in an activity that provided a single sensory input, such as tactile, auditory, or vestibular stimulation.”(1) (pg. 6)

LIST OF ABBREVIATIONS

BOT-2	Bruininks-Oseretsky test of motor proficiency, 2 nd edition
GAS	Goal Attainment Scaling
ILT	Integrated Learning Therapy
ILT-OT Stage	Integrated Learning Therapy home programme together with occupational therapy intervention
OT-Only Stage	Occupationally Therapy Intervention in the absence of a home programme
OTPF	Occupational Therapy Practice Framework
RCT	Randomised Controlled Trial
SD	Standard deviation
SI	Sensory integration
SPD	Sensory Processing Disorder
SPCQ	Sensory Profile Caregiver Questionnaire
SPM	Sensory Processing Measure

Chapter 1

Introduction

This chapter introduces the background of the study, the research aims, and objectives.

1.1 BACKGROUND OF THE STUDY

Children identified with educational difficulties are often referred to occupational therapy for assessment and treatment of sensory processing difficulties, which may be part of a sensory processing disorder.(10) Sensory processing difficulties are hypothesised to be important contributors to poor educational performance. The sensory integration frame of reference is used widely by occupational therapists in South Africa to investigate and treat children with these difficulties. (11–13) A. Jean Ayres originally developed the theory of sensory integration. She hypothesised that the ability to learn is dependent on the ability to process sensation from movement and the environment and to then use this information to organise behaviour. Ayres further surmised that the absence of this ability would likely interfere with learning. In order to augment the processing of sensation in a child with learning difficulties, the child would need exposure to enhanced sensation while participating in a meaningful task. During this process, the child would experience an adaptive response, which would allow the child's ability to process sensation to improve, hence enhancing his/her ability to learn.(2)(12) The bases for implementing a sensory integration frame of reference into occupational therapy is that a child's ability to participate optimally in education would then enhance if his/her sensory processing ability improves.(13)(14) The sensory integration frame of reference has specific postulates of change. Some of these presuppositions indicate that improved sensory integration will contribute to improved awareness of movement in space, praxis and the ability to organise behaviour in space. It is from these conjectures if sensory processing improves, so too would motor skills. Additional postulates of change suggest the child's ability to self-regulate and be aware of sensory stimuli should also strengthen. It is, therefore predicted that sensory modulation and sensory discrimination will improve if sensory processing improves.(15)

To improve sensory processing by means of occupational therapy, children attend weekly intervention sessions usually lasting approximately one hour.(11) However, controversy exists as to whether or not this treatment dosage provides enough exposure to enhanced

sensation in order to achieve adequate sensory processing abilities. Limited research has been done on the ideal number and length of therapy that is required to improve sensory processing skills. A literature search yielded only a single study that focused on determining frequency of occupational therapy. This study investigated frequency of therapy with children with Autism and indicated that three one-hour sessions per week are necessary for improvement to be noted.(12) The intensity of treatment indicated in this study could limit accessibility to treatment in terms of cost as well as time required to attend treatment within families. Of course, children with Autism (16) display much more severe dysfunction in sensory processing than children receiving occupational therapy within the mainstream educational system. This makes it difficult to apply this evidence broadly, leaving occupational therapists with no evidence base for making decisions regarding the indicated dose (frequency) of occupational therapy.

Despite this lack of evidence, many occupational therapists prescribe sensory-based home programmes (1), such as the Alert (17) or Sensory Diet programmes (18). These are prescribed to increase intensity of therapy by allowing practice and consolidation of skills at home, without increasing the time and cost of individual therapy with an occupational therapist. Once again, research on the effectiveness of these particular programmes are limited. The difficulty in researching home programmes could be associated with the individual nature of the content of home programmes. This is because the activities within an occupational therapy home programme are usually prescribed independently, based on the child's needs, interests and context.(1)(17)(18) The individual nature of home programmes make it possible to measure the outcome of the programme (whether a child improved or not), but not necessarily the effectiveness of the content of a programme. However, to make evidence-based intervention decisions, research on the proficiency of the content as well as the outcome, is of utmost importance.

Research supporting the use of sensory based activities in both the Alert and Sensory Diet programmes investigated the effect of single strategies such as auditory stimulation (sample 40) (19), therapy ball chairs (sample 6) (20), weighted vests (sample 5) (21) and stability balls (sample 76) (22) on specified diagnostic groups and how these strategies influenced aspects contributing to educational performance. The use of weighted vests resulted in an increase in attention and less self-stimulatory behaviour.(21) The therapy ball chair contributed to improved in-seat behaviour.(20) Auditory stimulation improved arithmetic skills and stability balls improved on-task and in-seat behaviour.(19)(22) These strategies contributed to a positive effect in aspects that support educational performance for a specified child population; however, single sensory stimulatory approaches have also been

criticized in research. Watling et al. (2015), who reviewed 16 studies, identified limitations in the methodology of studies that included small sample size, lack of blind evaluation and limited description of the participants as well as the intervention. This review further criticized the current research by indicating that sensory-based intervention strategies are often researched, but none have been exposed to rigorous high-level design studies nor has replication of low-level-design studies occurred.

As a result, the efficiency of single sensory stimulation has not been concluded.(1) This review once again focused on children with Autism. The emphasis on Autism in current research makes it difficult to generalise findings to a population with sensory processing difficulties, but without the diagnosis of Autism, the severity of the difficulties is quite different. There is a paucity of information regarding the use of sensory-based home programmes with populations that show sensory processing difficulties within the mainstream educational environment.

The research problems within sensory-based programmes are not unique to this field of practice. In 2006, Novak identified a short fall in evidence that informs therapists of the efficiency of home programmes, the intensity with which a home programme should be implemented and characteristics of a home programme that will enhance adherence to the programme.(23)(24) Novak subsequently proposed a model of home programme development and implementation that attempts to direct home programme advancement.(24)(25) This is exactly the kind of information that therapists need to make good decisions.

Current research does not provide a useful evidence base to assist occupational therapists in making sound decisions on implementing home programmes. Nor does the research provide information on the recommendation of sensory-based home programmes; how to prescribe it to complement individual therapy and to increase weekly exposure to enhanced sensory experiences. Research on different types of strategies that indicate the content, characteristics and implementation of the programme is required.

After her review of the current state of home programme research, Novak then proposed a model of home programme development and implementation that included the following steps: effective relationships, goal setting, construction of programme, support and

evaluation. These will be replicated during this study, which attempts to direct home programme development.(24)(25)

The Integrated Learning Therapy (ILT) home programme is a sensory-based home programme, developed by a South-African (Dr S Kokot), specifically for children with learning and behavioural concerns often related to educational difficulties. Research on the ILT programme indicated improvement in mathematical skills, reading, spatial awareness as well as the developmental age of children.(26) The programme offers a variety of sensory-based activities, which are structured and prescribed by the therapist to do at home. This creates standardisation in how the programme is prescribed and implemented. Research supporting the use of the ILT programme as a whole within an educational setting (to improve educational performance) is beginning to emerge (27-29) providing some data suggesting that the programme may be effective. However, once again research into the use of the ILT home programme is limited and needs further investigation.

While evidence supporting the use of the ILT home programme in a school environment,(26) begins to emerge; and the established requirement for evidence based home programme augmentation within occupational therapy increases, the question of whether or not the ILT home programme will bring about positive changes in the sensory processing skills of children receiving OT has arisen.

1.2. STATEMENT OF THE PROBLEM

Within occupational therapy, sensory-based home programmes are prescribed to increase a child's exposure to enhanced sensory stimulation, whereby learning and improvement in the occupation of education can occur. This method is already common practice; however, research investigating the influence thereof is limited. Uncertainty about the influence of sensory-based home programmes, leaves a requisite for recorded knowledge concerning occupational therapy outcomes. Recorded outcomes, particularly related to sensory processing and motor skills, are required since they are anticipated to change according to the postulates of change within the sensory integration frame of reference. Furthermore, additional evidence is necessary regarding the types of activities that should be included in home programmes, when it should be implemented, the length of time for which it should be prescribed; and how frequent and long home programme activities should be performed. Information suggests that activities should form part of a child's daily routine, but research comparing the influence of activities performed as part of a routine or in addition to the daily

routine is not available. To inform and support practical decision-making for occupational therapists in practice, there remains a need to investigate the effect sensory-based home programmes has all in all on child development. A need to investigate the characteristics, timing and implementation process of a home programme that contributes to positive change in child development also exists.

From literature, ILT offers a sensory-based home programme with some evidence supporting the effectiveness thereof within a school environment. Although the programme is advertised and used as a home programme, information on the effect of the ILT programme when performed by parents within the home environment is still not published and positive results are limited to parental report.(30)

1.3 PURPOSE OF THE STUDY

The purpose of this research study is to explore whether the ILT home programme (sensory-based home programme) implemented together with occupational therapy can enhance occupational therapy outcomes in sensory processing and motor skills. The timing of implementation of a sensory based home programme will be investigated, i.e., with the onset of therapy or later during the therapy process.

1.4 RESEARCH QUESTION

This research project had three main research questions:

1. Does the ILT home programme together with regular occupational therapy intervention enhance occupational therapy outcomes in sensory processing and motor skills?
2. If so, where does this predominantly occur (i.e. in which skills)?
3. When is the appropriate time to prescribe an ILT programme (i.e. at what point in therapy should the home programme be prescribed)?

1.5 AIM AND OBJECTIVES OF STUDY

1.5.1 Aim of the study

The aim of this study was to describe the change that may occur in the developmental skills (sensory processing and motor skills) of children, aged five to eleven years, when they participate in an ILT home programme together with weekly occupational therapy; and to investigate issues such as timing of intervention.

1.5.2 Objectives

- 1.5.2.1 To determine whether the use of an ILT home programme together with weekly occupational therapy intervention will enhance occupational therapy outcomes in the developmental areas of motor skills and sensory integration skills (sensory processing and sensory modulation) of children aged five to eleven years.
- 1.5.2.2 To investigate whether the ILT home programme together with occupational therapy influences development in specific sensory integration areas or motor skills when children aged five to eleven years participate in both.
- 1.5.2.3. To investigate the timing of the implementation of the home programme during therapy

1.6 JUSTIFICATION FOR THE STUDY

Adhering to the call for evidence based practice as part of best practice principles within occupational therapy,(31)(32) the effect a sensory based home programme has on the development of motor skills and sensory integration skills (sensory processing and sensory modulation), should be investigated. This research study will contribute to knowledge on the timing of home programme implementation and knowledge on the effect that a sensory-based home programme presented together with occupational therapy has on the outcomes of occupational therapy. The study will provide support for the use (or absence thereof) of a sensory based home programme with occupational therapy.

The research study and the associated aims and objectives will assist in broadening the knowledge base of the process of home programme development and implementation and will attempt to elaborate on aspects of timing of home programme implementation, which will

contribute to evidence based practice within occupational therapy.(24)(33) The research study will add to the literature by investigating the effect a sensory-based home programme has on the outcome of motor skills and sensory integration in an undefined group of children aged five to eleven years.(12)(34)

CHAPTER 2

LITERATURE REVIEW

This section will review and discuss how occupational therapists address educational concerns through the sensory integration frame of reference and home programmes.

2.1 THE IMPORTANCE OF EDUCATION IN OCCUPATIONAL THERAPY

Within occupational therapy, education is an area of occupation which people participate in at different stages of their lives. Occupations (all things people do) are tasks that are goal-directed and typically extend over time. There is meaning to the performance thereof and it involves multiple tasks.(35) The domain of occupational therapy focuses on enabling people to engage optimally in occupations that they want to or need to do.(4) Occupational therapists will intervene when the performance of educational tasks is not optimal.(4)(36)

When intervention with children experiencing education related concerns occurs, occupational therapists aim to promote children's participation through engagement in occupation. During this process, children are guided and assisted in succeeding in the tasks they want and need to master. Success in education, the same as any other domain of occupation, is deemed important to sustain as it contributes to promoting the health and well-being of children. The statement made by Eleanor Clark Slagle: "Man, through the use of his hands, as they are energised through mind and will, can influence the state of his own health," supports the need for children to perform optimally in education.(4)(37) From this statement, it is deduced that children who participate optimally in education can influence the state of their own health and well-being.(36)(38)

Education forms a large part of what children do and has a big influence on their development and occupational identity. By means of participation in education, children develop patterns of occupation and begin to evaluate themselves as occupational beings. Many factors, both internal and external, contribute to the child's participation in education. A child's physical and cognitive abilities may influence educational performance, as does the environmental aspect; such as the area in which the child resides and attends school. Family dynamics as well as their view on the importance of education together with their socio-

economic standing may influence optimal educational performance. Optimal educational performance is not only about the marks on a child's report card, for example, reading and math skills. It also includes a child's ability to follow school rules, classroom routines, adjusting to time demands and extra-mural activities, the ability to adjust in groups, to authority figures and make friends. Should a child have difficulties in any of these aspects, the cause thereof should be determined and if deemed appropriate addressed by an occupational therapist.(4)

2.2 ADDRESSING EDUCATIONAL CONCERNS WITHIN OCCUPATIONAL THERAPY

Occupational therapists form part of a multi-disciplinary team involved in addressing educational concerns. The team can consist of the child, parents, teachers, speech therapist, educational psychologist and physiotherapist to name but a few.

Within occupational therapy, the cause of concern for poor educational performance can be related to (although not limited to) a delay in performance skill development and immaturities/difficulties within body functions, and therefore within the child's abilities. Delays in performance skills refer to a delay in sensory perceptual skills, motor and praxis skills, cognitive skills and emotional regulation skills. Immaturities/difficulties within body functions refer to mental functions (cognition and perception), sensory functions, pain, neuro-musculoskeletal and movement functions.(4) As this project focuses on the development of performance skills and body functions, this section of the literature review will also focus on addressing these components.

To overcome these causal factors, children can receive centre-based, home-based or school-based weekly therapy sessions, lasting approximately one hour, aiming to improve specific performance skills or body functions. Improvement in these two aspects can contribute towards bettering a child's ability to meet the demands of an educational setting.(10)(39)

The weekly therapy sessions, planned to improve body functions and performance skills, are based on an understanding of normal human development as a dynamic system. Normal development occurs through a dynamic interactive process of maturation of the nervous system and body, plus interaction with the environment. A process of learning to perform age appropriate tasks and a variety of external influences may interact with a child to either hinder or promote development. Therefore, development is viewed as an open, interactive system wherein genetic activity, neural activity, behaviour and the environment dynamically collaborate to contribute to a child's development.(40)(41)

For effective intervention, occupational therapists acquire knowledge about the characteristic patterns of development of body functions and performance skills. It is through this knowledge with reference to a child's development trends and environmental factors affecting these trends, that when strategically viewed, an intervention plan to promote development of body functions and performance skills is created. The outcome of this intervention plan should then allow the child to master age-appropriate educational tasks.(40)(41)

2.2.1 Sensory Integration theory on addressing educational concerns

One theory that has gained prominence in occupational therapy within educational settings is that of sensory integration. A. Jean Ayres first described sensory integration as the "neurological process that organises sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment." (2)(pg. 3) It originated from Ayres's attempt to explain behaviours she observed in children with learning difficulties and hypothesised that adequate processing and integration of sensory information (vision, audition, olfactory, taste; particularly vestibular, proprioceptive and tactile stimulation) is necessary for adaptive behaviour to occur. Adaptive behaviour or responses refer to the occurrence of effective use of the body in the environment. A. Jean Ayres's work led her and others to expand the sensory integration frame of reference, which rests on seven basic theoretical postulates:(15)

- a) Learning and behaviour rest upon a foundation that includes sensory integration
- b) Sensory integration occurs as a developmental process
- c) The result of successful integration and organisation of sensory information is enhanced development and adaptive responses

- d) Sensory integration occurs when a “just-right challenge” is presented
- e) Children have an internal drive to seek for participation that is meaningful in their environments
- f) Neuroplasticity allows for enriched experiences to contribute to change in the nervous system
- g) Participation in daily activities, including physical and social engagement relies on sensory integration.(15)

With the seven postulates as background, Fisher and Murray attempted to bring sensory integration into the occupation context of occupational therapy and developed the sensory integration self-actualisation model. The model combines the Model of Human Occupation and the process of sensory integration.(2)

During this spiralling process of sensory integration (also called the spiralling process of self-actualisation), sensation is taken in from the physical and social environment as well as from production feedback (body that informs how it felt to move) and outcome feedback (actions that produce a change in the environment). All of these sensations give rise to the planning and organisation prior to an adaptive response occurring. An adaptive response implies that an individual has met the demands of the task. With each adaptive response that occurs, inner drive and sensory intake is affected and the spiralling process continues.(2) As adaptive responses gain complexity, the brain attains a more organised state and its capacity for sensory integration becomes more efficient. For this reason, the process of learning to meet educational demands is hypothesised to be a process of sensory integration (implying adaptive responses are successful). When body functions (specifically sensory functions) are optimally developed (at a specific age), age appropriate performance skills and occupational participation can be mastered.(2)(3)

Sensory integration can be divided into two aspects: sensory discrimination and sensory modulation. Sensory discrimination allows one to distinguish between differences in stimuli and is essential for interpreting sensory information accurately; the development of praxis, movement and perceptual skills along with aptitudes such as stereognosis.(3)(8)

Sensory modulation refers to the brain’s ability to regulate and organise the degree, intensity and nature of a person’s response to sensory input in a graded and adaptive manner (the

use of sensory information to organise behaviour). Modulation reflects the ability to select and acknowledge appropriate information at a specific time and act on that information in a manner that corresponds to the demands of the external environment. Modulation also allows a person to ignore unimportant stimuli while focusing on relevant stimuli. Poor modulation results in behaviour or participation in performance skills that does not match environmental demands or expectations.(3)

Dysfunction within sensory integration theory speculates a decrease in the ability to distinguish sensory information accurately and a decrease in the ability to process sensation. This limits the child's ability to produce appropriate actions based on sensory information; consequently affecting learning and behaviour.(15) Dysfunction can occur in either sensory discrimination or sensory modulation (or both), and is termed Sensory Processing Disorder.(9)

2.2.2 Sensory integration intervention

Provision of occupational therapy intervention based on the sensory integration frame of reference addresses a Sensory Processing Disorder. Intervention rest upon the assumption that enhanced sensation, as part of a meaningful activity yields an adaptive interaction and improves the ability to process sensation, thereby boosting learning and behaviour. For these adaptive interactions to take place, occupational therapists construct therapeutic activities, which provide enhanced sensation. In particular, enhanced vestibular, proprioceptive and tactile sensation is provided by means of active participation in goal-directed activities that carries meaning to the child. During the intervention process, play activities selected gradually increase the complexity of adaptive responses necessary to achieve mastery of an activity. If a behavioural change occurs during intervention, the hypothesis is that the change is a result of improved sensory integration or enhanced neural functioning.(1)(3)(11-13)(15)

Although a sensory integration approach already began in 1972, with the development of the theory by Jean Ayres, controversy around the effectiveness thereof remains. May-Bensen et al. (2010) reviewed 27 studies to investigate the efficiency of sensory integration after identifying a lack of consensus in research on it. May-Bensen et al.'s (2010) review suggested that sensory integration treatment might be efficacious in promoting "sensory

motor skills and motor planning; socialisation, attention, and behavioural regulation; reading-related skills; participation in active play; and achievement of individualised goals. Gross motor skills, self-esteem, and reading gains may substantiate from three months to two years.” (pg. 403) May-Bensen et al. (2010) does report that replication of findings with sound methodological studies are, however needed.(42) Watling et al. (2015) performed a systematic review from six systematic reviews on the effect sensory integration has on children with Autism and identified that factors such as difference in use of terminology; e.g., sensory processing as opposed to sensory integration, contribute to conflicting information corresponding to the effectiveness of sensory integration intervention. Watling identified that a wide variety of outcomes measures used in different studies make it difficult to compare results to compile an overall efficacy study.(1) Furthermore, Schaaf et al.’s review (2014) reported that currently studies performed do not account for treatment fidelity and did not provide information on intervention to contribute to replication of the study.(12)

A single high quality study (randomised controlled pilot study) found, viewed the effect of sensory integration against an activity control (arts and crafts, puzzles, blocks, reading stories and interactive games) and a no treatment group (waiting list for sensory integration). The study findings suggested that sensory integration might be more effective than both the activity control and control group in treating children with sensory modulation disorder. Measurement tools that were used included Goal Attainment Scaling (GAS), Short Sensory Profile and Internalising (CBCL) and on Attention and Cognitive/Social composite. On the GAS the sensory integration group made significantly greater gains ($p < 0.001$) compared to the no treatment and activity control groups. Attention of the sensory integration group also improved significantly more than the activity control group ($p = .07$) and the no treatment group ($p = 0.30$). (32)

2.2.2.1 Measuring the outcome of Sensory Integration intervention

Contributing to the difficulty of gathering evidence for effectiveness of sensory integration intervention is that which lies in measuring the change brought on by sensory integration intervention. Deficits in sensory integration (discrimination or modulation) cannot be measured with physiological measures but the effect thereof is observed in behaviour of children.(1)(2) Thus, behavioural changes that occur over time are considered to illustrate the changes brought on by sensory integration. However, occupational therapists remain interested in measuring change that intervention brings on in areas of occupation that are

meaningful to children and their parents. Subsequently, Goal Attainment Scaling (GAS) is used to measure these changes. At present GAS is considered more accurate in detecting small changes in targeted areas of function than standardised measures because of the adaptability of the scale to the individual.(34) However, the use of GAS relies on a well-trained clinician and can become time consuming when goals are set and measured. With the variation in GAS that can occur, it becomes difficult to generalise research results. (1)(34)

In an occupational therapy practice, it is common practice to perform reassessment on standardised tests (apart from GAS) at six to twelve month intervals, to ensure affordability thereof to the family as well as to ensure enough time for the measured skills to demonstrate change. Occupational therapists are held accountable by an ethical obligation stated by the Health Professions Council of South Africa to perform necessary assessments only, thus frequent reassessment on standardised assessment tools, at an additional cost to the family, can be seen as a possible financial conflict of interest.(43) It is anticipated that standardised test scores demonstrate improvement after a six-month period, and it would then be less of a conflict of interest. Considering that sensory integration (discrimination and modulation) are observed via child behaviours, parents are sometimes prepared under the circumstance the behaviours could increase prior to becoming less, with the initiation of therapy. The initiation of treatment contributes to a change in routine, exposure to a new 'unusual' environment and new demands. As these children are already vulnerable in their ability to adapt to change, due to their sensory integration difficulties, it is anticipated that difficulties with sensory discrimination and modulation can increase.(44-46) These difficulties can present themselves as preoccupied behaviour, fatigue, and loss of interest in usual pastimes. Sometimes they can temporarily lose their independence with self-care skills, and become emotionally over reactive.(45-48) The anticipated temporary deterioration (negative changes) is usually not documented, as standardised assessments are performed six to twelve months after the onset of intervention. Trends of change brought on by intervention become difficult to measure when standardised assessments are done six to twelve months apart. The ability to compare trends of change with other intervention strategies using GAS in the interim becomes complicated.

Unfortunately, even with promising results for the use of sensory integration, a weekly (hour-long) occupational therapy session aiming to improve sensory integration is often not an adequate intervention strategy. In 2014, C Schaaf et al. identified that children with Autism

require an hour of sensory integration intervention three times a week.(12) Again, the emphasis on Autism in current research makes it difficult to generalise these findings to a population with sensory processing dysfunction, but without the diagnosis of Autism, as the severity of the dysfunction is quite different. Nevertheless, with cost and accessibility being barriers to therapy, the intervention intensity (“dose”) can seldom be intensified to three sessions per week.(32) Therapists attempt to overcome this barrier to treatment by recommending home programmes. Home programmes, aiming to compliment active intervention within the home environment, are regularly prescribed to assist in achieving desired therapy goals.(49)(50) From a sensory integration frame of reference, sensory-based home activities would be recommended. Sensory-based interventions refer to activities that typically occur in the child’s natural environment and consist of activities guided by an adult to produce a short-lived impact on self-regulation (sensory integration), attention or appropriate behaviour.(1)

2.3 HOME PROGRAMMES AS A SUPPLEMENTARY PART OF OCCUPATIONAL THERAPY INTERVENTION, INCLUDING SENSORY INTEGRATION

The following section elaborates on occupational therapy home programmes as part of intervention; discussing why home programmes are prescribed, what justifies the use of home programmes, current research on the effectiveness of home programmes and the current limitations occupational therapists may have when prescribing a home programme.

The use of occupational therapy home programmes is supported by two principles: (a) to improve access to therapy by decreasing the cost of frequent therapy and the availability of a clinician, and (b) the acknowledgement that parents know their children best, have their best interests at heart and that children function optimally with the support of their family. (24)(51)(50)

The inclusion of family in the intervention process is supported by Emde et al. (2000) and Robertson(52) who identified specific motivations for development that arise from an established care-giving relationship:

The motivations that arise from family participation include:

- a) activity, in which a child is motivated to engage in activities and master his/her environment

- b) self-regulation, enabling him/her to determine their sleep cycle, wakefulness and alertness
- c) socialising, in which a child is encouraged to adapt to the demand of initiating, maintaining and ending interactions with other people
- d) to self-determine which experiences were enjoyable and which were less enjoyable.

Subsequently the recommendation of home programmes as part of occupational therapy has become a routine practice as a factor of a family-centred approach, to encourage a child's inner motivation to develop his/her skills.

Home programmes are not considered a typical task of formal education performed by children, but share similarities with homework. Home programmes and homework are prescribed for performing at home with parental supervision. The aim of both is enhancement or stimulation of certain pre-determined body functions or performance skills. As Segal and Hinojosa rightly state: "A home programme is considered an "additional" activity that has to be integrated into the family's life."(53)(pg. 51) In this way, parents can be included in and influence the treatment process.(24)(41)(50)(54) The danger, however, is the burden of therapy can be shifted to the parents in a home programme leaving them to take over the role of therapist to the detriment of their role as the parent. Taken that into consideration, home programmes should include activities that are playful and easy, and should not create difficulties within the parent and child relationship.(49)

Within occupational therapy, where treatment is provided from a sensory integration frame of reference, either a Sensory Diet or the Alert programme can be recommended as a home programme to assist in improving sensory integration abilities. The rationale for the Sensory Diet home programme stems from the perspective that children need a certain amount of sensory stimulation to enable them to meet the demands of their environment. From this perspective, the timing, intensity and the duration of the sensory-based activities (encountered during the day) are essential to promote sensory integration abilities. When a Sensory Diet is developed, the therapist will develop/identify activities that need to be introduced into the child's daily routine. Activities are ideally self-selected (thus the therapists select from a child's preferred choice of activities) and should be meaningful to the child who performs them. The aim of these sensory activities are to enhance the child's sensory experience throughout the day, whereby short-lived changes in arousal, body awareness or muscle activity may lead to an improved ability to make appropriate adaptive responses. The

sensory activities may need to be repeated during a day, and can include changes to families' routine, leisure time and play activities, or changes to the child's environment. The intricacy of developing a Sensory Diet is reliant on advanced clinical reasons as well as knowledge about a family- and client-centred approach.(18)

The rationale for recommending the Alert programme stems from the belief that a child must be at the optimal level of arousal in order to meet the presented environmental demands. The Alert programme aims to make a child aware of his/her level of arousal and aims to teach them how to self-regulate during the day. Arousal levels can be adjusted by oral motor, vestibular, tactile, visual and auditory input. The required adjustment to the arousal level will determine what sensory stimuli are presented. The uniqueness of a child's sensory system thresholds will determine which sensory system(s) are used to increase arousal levels and which sensory system(s) can be used to lower arousal levels. Initially adults are required to support a state of optimal arousal by implementing activities when needed, but the aim is to enable children to manage a state of optimal arousal independently.(17)

Both these programmes rest upon advanced clinical reasoning skills and in-depth knowledge of the sensory systems inducing the sensory threshold of each sensory system. Compilation and the masterful implementation of these programmes will rely on a well-established relationship between the therapist, parents and the child and adequate teamwork between these role-players will be required for both these programmes to be beneficial. Both these programmes rest upon the parents' understanding of the benefits of sensory integration and parental ability to monitor the children through the course of a day to ensure implementing of the required sensory activities or at least supervising the particular child when he/she performs the required activities. The implementation of both these programmes may run the risk of placing a parent into the role of a therapist.(17)(18)

Literature on the use of home programmes in conjunction with occupational therapy in a paediatric population is limited and diverse in nature. Studies have been done with diverse diagnoses, age ranges and methods of prescribing home programmes, making it difficult to collapse results into one conclusion. Only one study investigated the use of home programmes in addition to occupational therapy while other studies focussed for example on parental perception of home activity programmes(49), or the effect of a home programme

while on a waiting list for occupational therapy. There were also differences in what was being measured – not all studies measured child outcomes, as some focussed on parental perceptions of home programmes.(6)(49) Furthermore, no specific research on the effect of home based sensory activities, including the Sensory Diet and Alert programme, in conjunction with occupational therapy could be identified.

The results of studies seem to indicate that the inclusion of a home programme during the therapy process may be beneficial for child development, although much more research is needed. These studies attribute the change to the effect of the home programme and some studies acknowledge that improvement can be due to an increase in family involvement. (6)(55) Tang et al. (2011) investigated the effect of adding a home programme in addition to weekly occupational therapy on infants (mean age 12.5 months) with an undefined developmental delay.(23) Their results indicated an overall positive effect on child development as measured with the Comprehensive Developmental Inventory for Infants and Toddlers test with improvement detected in motor, cognition, social and language development. In the same study, the Paediatric Evaluation of Disability Inventory showed improvement in all domains except for a sub domain of self-care with caregiver assistance. However, study limitations reported that therapists actively involved in the treatment and re-evaluation were not blinded to participant groups and that the study did not have a true control group. Furthermore, uncertainty remains on the duration a programme should last to achieve positive change that remains over time.

Novak et al. (2009) investigated the effect of prescribing only a home based programme with children diagnosed with cerebral palsy. Their results indicated positive results on GAS and on the Canadian Occupational Performance measure. This study was a randomised controlled trial and identified that a home treatment programme performed for 16.5 minutes per session, 17 times per month allowed for improvement in function, parent satisfaction and quality of movement in children with Cerebral Palsy.(25)

A single study investigated the outcome of a home based intervention programme, a year after a randomised controlled trial. This study focused on children with Autism and developmental delay. A year after the study, the gains made during the intervention had remained.(55) The other studies done on home programmes in occupational therapy

investigated parental perceptions on home programmes and did not measure child outcomes.(49) Thus, research on the effect of home programmes prescribed together with occupational therapy is scarce. The research on only home programme intervention, provide positive results for specific diagnostic groups, and early studies suggest that results are lasting. However, further research is needed on the influence a home programme in conjunction with occupational therapy has on child development.

One concern regarding the recommendation of home programmes is the ability to control adherence to a home programme. With poor adherence, change that is observed or measured cannot be attributed to the implemented programme. A single study identified methods to improve adherence to a home programme as monitoring the programme, giving positive feedback as a therapist and facilitating the child's motivation throughout the programme increases compliance to the programme. Providing written information about the programme, a detailed explanation how to perform each task was included to improve adherence.(56)

From these studies, some light was shed in terms of benefits of home programmes, intensity of daily treatment and how to facilitate adherence to a home programme. However, the researcher was left with the following criticisms and limitations surrounding the implementation of home programmes, arising from these studies:

- Clarity on the duration a programme must be implemented to make measurable gains was vague and varied between eight and twenty weeks in these studies.
- Information on the length of time that should be spent per day in participating in the home programmes was not provided consistently. One study recommended 16.5 minute per day, 17 days per month over two months and another recommended 15 minutes per day over 20 weeks.
- The content of the home programmes was not described in these studies and thus it is difficult to evaluate the type of activities prescribed.
- Research has not begun to shed light on the reasons why home programmes are effective apart from a consistency in reports about developmental delay, Autism and Cerebral Palsy research that indicate that these children improve in a wide range of areas when families are involved in their treatment programmes.

These criticisms are similar to the concerns expressed by Novak in 2006 in critique on the use of home programmes. Novak identified that there is little to assist therapists to design, implement or evaluate home programmes for children from an evidence base perspective.(24) From Novak's review, "occupational therapy research related to home programmes has to date focused on topics such as parental compliance with prescribed programmes and qualitative analysis of the effect of home programmes on parental interactions and associated stressors. This information although helpful for informing therapists or parental perspectives, does not guide a design for home programme implementation." (24)(pg. 253) Current research does not guide therapists on structuring the content of home programmes either. In addition to these concerns, J. Roberts et al (2011) reported "current research does not provide adequate information about the comparative effectiveness of home-based and centre-based models of early intervention service delivery in terms of outcomes for children and their families in relation to cost benefit."(57)(pg. 1554)

Many questions on home programme design and implementation remain. In an attempt to address some of the concerns, Novak proposed a model which attempted to direct how home programmes should be designed and implemented. This model is to date, the only attempt at structuring home programme development, implementation and evaluation.(24)

Table 2.1: A brief summary of the phases of Novak's model for home programme implementation:

Phases	Aim of the phase
Phase 1: Effective relationship	Establish a collaborative relationship with the parents, enabling them to be active in the process of caring for their child.
Phase 2: Goal Setting	Establish mutually agreed upon goals.
Phase 3: Construction of programme	Select home programme therapeutic activities.

Phase 4: Support	Implement the programme at home, with ample support during the implementation phase; which includes face-to-face sessions, telephone calls, positive reinforcement, identifying improvements the child has made.
Phase 5: Evaluation	Evaluating home programme outcomes from a family's perspective and observations on goal attainment. Ideally standardised assessment measures should be used.

Each phase has defined inputs assisting in meeting the aim of that phase and a defined output that occurs, or is met if a phase is successfully implemented.(24)(25)(58) This model begins to provide structure to the process of home programme implementation that can be used in various occupational therapy settings. However, there remains a need for guidance on the content of home programmes, the length of time a programme should last per day to be effective and the duration that a programme should last. Thus, from literature we gather that home programmes are prescribed, almost as a standard practice and research suggest that home programmes have positive effects, yet limited research on the effectiveness of home programmes is available and limited guidelines exist about what should be included in a home programme. The consensus does however remain that a home programme should be directed at the individual needs of the client, be it the family or the child, at all times.(24)(34)(51) It is with these questions that the ILT programme (sensory-based activity programme) was investigated as a possible home programme to be used together with occupational therapy intervention.

2.4 INTEGRATED LEARNING THERAPY AS A SENSORY BASED HOME PROGRAMME:

This section provides general information on the construct of the ILT home programme. ILT theory on development and the ILT approach to intervention is compared to current occupational therapy views and current research supporting the use of the ILT programme is summarised.

2.4.1 Introduction to ILT

Integrated Learning Therapy (ILT) was developed by a South African, Dr SJ Kokot, and training to become an ILT practitioner is offered to psychologists, therapists, teacher and interested parents. It is not compulsory to have a tertiary degree to receive training. The training is performed by the programme developers, Dr SJ Kokot [(B.A. Hons(Psych), B.Ed.(School Guidance), M.Ed (Counselling), D.Ed., Senior Teacher's Diploma., SAC Dip(Diet & Nutrition Advisor)] and Mr ML Kokot. [(B.Sc., MSc. (Analytical Chemistry), M.B.L.] presents specific modules within his field of expertise. Training consists of the introductory level one course (15 hours), with additional reading and examination material. The introductory course is followed by the level two course, which includes a theory manual and practical course. The theoretical manual is completed through a long distance study programme. The practical component includes a five-day programme, where the Neurodevelopmental evaluation scale is taught and case studies are completed as a long distance training module for accreditation. The course is accredited by the education, training and development practice sector of South Africa.(28)

2.4.2 Theory supporting the ILT home programme:

ILT treatment is implemented through a remedial movement programme as well as recommendations for lifestyle changes (dietary recommendations) aiming to improve neurodevelopmental irregularities. The term 'neurodevelopment' refers to the process of development of the central nervous system as seen in the maturation of motor skills, sensory processing abilities, language abilities, social skills and cognitive skills. The term is comparable to the terms 'development of body functions, performance skills and sensory integration', commonly used in occupational therapy and how these mature over time.(30)(59)

As in sensory integration theory, ILT is based on Jean Ayres's belief that the integration of sensory stimuli is crucial to development and learning. To remediate neurodevelopmental concerns, ILT relies on the performance of sensory-based activities implemented through active participation in skilled movements. The movements and activities require active participation from the child, and are presented according to the principle of *Gentle Enhancement*TM (HANDLE) to avoid stressing vulnerable systems. *Gentle Enhancement*TM implies that activities are carefully selected to enhance stressed systems in a non-threatening manner and activities are stopped when physiological stress is detected. High repetition of an activity is not anticipated, but rather the emphasis is on stress free repetitions over an extended period i.e. 21 to 42 days. This emphasis is based on the hypothesis that neural-reorganisation occurs with the implementation of the individualised treatment programme developed from the pre-compiled activities. Neural-reorganisation and improved sensory integration, should translate into better performance in specified areas of dysfunction. However, as with sensory integration, neural reorganisation or improved sensory integration abilities can only be assumed from changes in behaviour, and it is not directly measurable. ILT further emphasises the importance of nutrition to enhance neurodevelopment and clients are encouraged to implement certain dietary recommendations e.g. vitamin supplements and Omega 3 and 6 supplements, or to consult with a dietician.(60)(61)

Occupational therapy supports the view of the importance of movement and enhanced sensory exposure in development.(62) However, repetition of skilled movement patterns in an unchanging environment are not viewed as an integrated therapy approach, nor does it facilitate participation in occupation through play, the primary occupation of a child. The occupational therapy belief that participating in meaningful occupations (thus play) brings about lasting change in an individual is not supported when skilled repetitive movements occur daily over a three to six-week period.(63)(64) Furthermore, with the repetition of movements performed with success, the spiralling process of sensory integration, where adaptive responses that are more complex should be elicited, does not occur as the difficulty level of the required adaptive responses do not increase.(2) Accordingly, from a sensory integration theory perspective, if adaptive responses that are more complex do not occur, learning and development will not come about due to therapeutic intervention. The concept of gentle enhancement is acknowledged by occupational therapists as we are in agreement concerning the negative effects the autonomic nervous system can have on learning and development. Within occupational therapy, using a sensory integration treatment frame of reference, additional proprioceptive input is provided to allow for calming of the autonomic

nervous system should physiological stress be detected. Thus, an activity is not stopped, but rather adapted to accommodate the child at that point in time, allowing him/her the opportunity to learn how to self-regulate their autonomic nervous system.(65)

Research on neural-reorganisation, apart from sensory integration measured through behavioural changes, has been conducted on an adult population with hard neurological lesions. At present, these research results are the only research results available to evaluate the anticipated neural-reorganisation theory. Research from the adult population focused on neurological rehabilitation (i.e. recovery after a stroke).(66) The research indicated that recovery after a neurological lesion includes the repetition and practice of specific movements, within the context of a functional task. It supports the notion that the brain continues to remodel the neural circuitry in order to encode new experiences that enables behavioural change. It further supports the emphasis placed on the repetition of skilled movement that is required to achieve neural reorganising (supporting the use of a daily programme). However, it does not support the notion of generalisation of skills i.e. training swallowing does not automatically generalise to trained language abilities. Thus, from this perspective, an ILT home programme aimed at improving body functions through repetitive movements will not automatically create improved application of body functions to enhance jungle gym play skills.(66) This same critique can be given to occupational therapy sensory integration frame of reference: practice of play on suspension equipment in a sensory rich environment will not automatically translate into skilled play on jungle gym equipment at school. Both approaches should therefore ensure that carry-over of body functions translate into performance skills.

2.4.3 The ILT home programme compared to the Sensory Diet and Alert programme

In contrast to the development of the Sensory Diet and the Alert programme, the ILT programme is compiled from pre-developed activities, and it does not require in-depth clinical reasoning. The implementation of the programme does not rest upon an in-depth understanding of a child's sensory needs and sensory threshold, but rather requires watchful monitoring of their physiological responses during the completion of the activities, to ensure *Gentle Enhancement*TM. These responses are easy to detect i.e. red ears, changed rate of breathing, flushed cheeks or loss of visual focus. These responses are less daunting for parents to monitor than the level of arousal during the day, as required by the Alert programme.(18)(61)

Each ILT activity was developed to address a specific sensory system or combinations of sensory systems. Activities aim to strengthen weak systems with a bottom-up approach, implying that systems that are lower in the hierarchy are strengthened first. Activities are pre-analysed and classified according to the sensory system the activity will strengthen. For example, the activity 'pancake', where a child is rolled in a blanket, is classified to work on the tactile system and the proprioceptive together with the vestibular system. A single activity can thus address two or sometimes three systems simultaneously. The activities are not aimed at influencing self-regulation as with the Alert programme. Nor is it developed in a way to provide continuous exposure to enhance sensation throughout the day (Sensory Diet). It is developed to address specific areas of concern in sensory systems. The programme does not require of parent/caregivers to monitor the child's sensory needs or alertness during the day nor is it implemented during the daily routine. It is performed as an additional activity at a self-selected time of convenience for the child and parent/caregiver. Thus, the demand on the parent during the daily routine is less, however as it is presented as an additional task during the day, adherence may fluctuate if a convenient time is not consistently identified. It contradicts the current trend of home programmes, where the inclusion of home programmes in a daily routine is recommended to improve adherence.(17)(18)(24)(49)(56)(61)

The ILT home programme is therapist-directed, where the parent and the child cannot select activities they prefer and parents need to take responsibility to ensure that the programme is performed. The parent is not involved in the process of programme development, which may negatively influence adherence as it may place strain on the formation of a collaborative relationship if the roles were not clearly defined. However, this is similar to the Sensory Diet and Alert programmes. An ILT activity takes only a few minutes to complete and a set of activities (six to nine activities selected by the ILT practitioner) lasts a maximum of 20 minutes per day, if done consecutively.(17)(18)(60)(67) Some activities are performed with basic equipment for example a blanket, a special loopy straw or hula-hoop. The equipment is easy to come by, but as practice etiquette, ILT practitioners provide the needed hula-hoop, straw or balls to parents.(61) An example of home programme activities is provided in Appendix J.

When comparing the ILT programme against a sensory integration treatment frame of reference, differences do arise. The sensory integration treatment frame of reference distinguishes between modulation and discrimination, whereas ILT views any of these difficulties as a weakness in a system and does not adapt the intervention according to a modulation or discrimination related concern.(8)(65) ILT does not cluster concern to identify for example bilateral integration and sequencing concerns or sensory modulation dysfunction. All difficulties observed are attributed to weaknesses in the underlying sensory systems such as a weak vestibular system. From an ILT perspective, treatment to address learning related concerns are directed at strengthening the identified areas of concern with daily sensory-based activities. From an occupational therapy perspective, treatment strategies can include addressing aspects of the person (e.g. body functions and or performance skills through for example the sensory integration treatment frame of reference), addressing environmental concerns (e.g. the context and environment as well as activity demands) or addressing the occupation of education to improve a child's performance in education. Thus, the educational concerns are addressed as part of a dynamic system.(4)(68) ILT does consider the individual as a system integrating with a larger system, but treatment is not directed at facilitating change in the larger systems. ILT therefore follows a therapist-directed approach to address the needs of the child, rather than focusing on the parents or a school.

2.4.4 The ILT process of programme implementation compared to Novak's recommended model

The ILT home programme development and implementation process partially follows the phases of the model recommended by Novak. The success of the ILT programme is dependent on a collaborative relationship between the parents and the therapist, as the parents' knowledge about their child and his/her behaviour is essential in identifying areas of concern during the assessment. This collaborative relationship represents Novak's first phase where a collaborative relationship is formed and roles are defined. Novak's second phase requires the identifying of mutually agreed upon goals and the development of goal attainment scales and finding opportunities in the family routine where the programme can be included. This is where the ILT process deviates from Novak's model. Within this phase the ILT practitioner develops and compiles a home programme and then only assists the parents in finding time in their routine, most suited to perform the recommended activities (as a guideline to ensure adherence). Within ILT mutually agreed upon goals are not set, nor does GAS occur. According to Novak's model, activities are now selected and implemented

via readable text, illustration and demonstration. At this stage in the ILT process, the programme is already developed and only programme implementation occurs. As also recommended by Novak, the ILT programme should be taught to the parent with their child present so the parent is educated on detecting physiological signs of stress. According to ILT, practice etiquette the needed equipment is provided. Within phase four, Novak recommends that support be implemented during the period where the home programme is followed. ILT follows this recommendation by providing an activity check approximately 10-14 days into the home programme. Parents are encouraged to continue to ask questions at any point during the home programme, however the ILT practitioner does not perform regular, therapist-directed follow-up. With the ILT programme being implemented together with occupational therapy, weekly follow-up on the programme and concerns could be addressed. From an ILT perspective, the completion of the ILT programme (phase 5 of Novak's model) is seen as the goal, and if the programme is completed the outcome has been met. Parents often now report on observations made on changed behaviours. However, a re-evaluation as recommended by Novak does not occur. In Novak's model a collaborative decision is made on the success of the programme, which is however similar to the ILT process where parents are asked to identify observed changes.(24)(30)(60)

2.4.5 Research on the use of the ILT programme

Research directly related to support for the ILT programme was first documented in 2003 in a case study of a gifted child's ability to overcome learning difficulties when following a neurodevelopmental approach.(28) S Kokot, the developer of the ILT programme, wrote the case study. Research on the ILT programme continued to refer to a neurodevelopmental approach when implementing the ILT approach. During 2005, a case study was written by Kokot, on the influence that a neurodevelopmental approach had on two gifted learners diagnosed with dyslexia and attention deficit hyperactivity disorder. The case study reported improvement in the behavioural irregularities and scholastic difficulties of both learners. (28) In 2006, Fredricks, Kokot and Krog published a pre-test, post-test between group comparison studies. The exploratory study was conducted on a sample of 53 Grade 1 children. Thirteen children were in the experimental group, 13 children in the control group, 14 children in the educational toy group and 13 in the free-play group. This study reports that children in the experimental group showed improvement where spatial factors were involved in learning and that these learners were reported to be more alert and quicker in their responses in the classroom after the exercise period. The researcher concluded that when movement targets those systems that are crucial to a child's ability to learn, certain learning

experiences of a Grade 1 learner would be enhanced. With this study, researcher bias has not been accommodated.(27)

The next study was only published in 2014, when research conducted by an ILT practitioner (v.d. Merwe Bothma et al. 2014) revealed that a statistical significant improvement was noted in development over a fourteen-week period with the implementation of the ILT developmental movement programme, using a standardised measure: The Griffiths Mental Development Scales. However, the researcher reports that due to the small sample size, the research results should be viewed with caution. The researcher further noted that the control group also demonstrated a statistically significant improvement in their total developmental age. The placebo intervention included colouring, storytelling, playing on a jungle gym, walking on a balance beam, throwing balls and building puzzles. The positive change that was observed in both groups was considered to contribute to the critique against movement programmes i.e. children who participate in movement programmes improve due to the placebo effect. During this study however, change in the experimental group was greater in comparison to the control group. It is however further noted that with an ILT practitioner performing research on ILT, biased observations may occur, even if not intentional especially as blind or double blind re-assessment did not occur.(26)

2.5 BRIEF SUMMARY OF THE KEY POINTS OF THE LITERATURE REVIEW IMPORTANT TO THE RESEARCH STUDY:

There is a lack in clear guidelines for how occupational therapists should implement home programmes and specifications or guidelines on the content of home programmes are limited. There is a possibility that an ILT sensory-based repetitive movement programme (implementable through willing parents/caregivers) may have benefits for children with sensory integration difficulties. The ILT programme partially matched Novak's recommended models of home programme implementation within occupational therapy. Therefore, the effects of an ILT home programme in combination with occupational therapy need further investigation.

CHAPTER 3

METHODOLOGY

In this chapter the current research study's design, measurement tools, data capturing and data analysis methods will be discussed. Many difficulties were encountered in the design and implementation of this study and these will be described in the methodology chapter and discussed again within the discussion chapter.

3.1 STUDY DESIGN:

This research project attempted to investigate the use of an ILT home programme together with occupational therapy in order to enhance therapy within the real world situation. When designing this study, two different types of research were considered, namely outcomes research, and experimental research. These two types of research will be discussed below in some detail and the reason for the choice of research design will be explained.(69)

The first type of research considered was outcomes research. The aim of outcomes research is to measure outcomes in the real world situation without controlling for all confounding variables or creating an artificially controlled environment in order to provide useful evidence for practitioners trying to make evidence-based practice decisions.(69)(70)(71) Outcomes research is usually conducted with already existing populations and makes use of observational study designs in order to answer real-world questions.(70) Causal relationships can be difficult to describe with certainty in outcomes research unless very large samples are used (e.g. databases that are analysed for outcomes using tens of thousands of participants).(71) An example of this type of research is comparative effectiveness research (CER) which compares existing protocols or existing groups without any direct intervention. As a result, outcomes research tends to have high external validity (high applicability with the real world environment), but not necessarily high internal validity (high control of confounding variables). Outcomes research can also assist in understanding what variables are important when attempting to understand a new intervention, when there is uncertainty regarding which variables to measure, when to measure these variables and how to measure them.(69)

Outcomes research was considered appropriate within this study, as ultimately the goal of this research was to contribute to the evidence used by practitioners to make decisions about the prescription of home programmes in the real world environment. The ILT home programme is also a new intervention and the variables that should be measured; how they should be measured, and when change can be expected was all unknown at the start of the project. Although the ILT home programme developers claim to influence educational outcomes, the activities and factors addressed in the ILT home programme are not directly related to educational tasks such as reading, writing or arithmetic. Rather the activities and factors addressed appear to focus more on sensory processing and motor skill. Therefore, some prediction about what variables to measure could be made, but exactly where change may happen and when it may happen were uncertain.

However, there were some serious limitations to using outcomes research at the outset of the research. As ILT is not yet a widely used form of home programme, there were not pre-existing populations where ILT home programmes had routinely been part of the therapy process, and therefore there were no previously existing groups with recorded outcomes to compare. Outcomes research also appears to deliver best results when conducted using larger samples or populations and this was not possible at the inception of this study. That being the case, a more prospective study design with a research specific protocol had to be considered.

The second type of research considered was experimental research, which attempts to determine, describe and understand the causal relationships between variables. Accordingly, the ultimate goal of experimental research is to be able to say with certainty that the change in one variable (i.e. the intervention) caused the change in another variable (i.e. the outcomes measured).(69)(70) To assign a causal relationship, experimental research attempts to control confounding variables and implement a highly controlled and standardized protocol. In its most recognized form, the randomized control trial (RCT), experimental research can have high internal validity (thus by controlling confounding variables and controlling the environment, true cause-effect relationships can be determined). However, because of the very controlled nature of this type of research, external validity and the generalization or applicability of findings in the real world may be questionable (when only a very specific sample is used in a RCT, the findings may only relate to others with those very specific characteristics).(69) In recent years, the pure RCT has been criticized for the difficulties in transferring findings to real practice as well as for the

cost involved and the long time it may take to enrol participants due to the very specific nature of the protocol.(72)(73)

Experimental research was considered appropriate for this study as a form of intervention (the ILT home programme) was being tested to investigate its usefulness together with occupational therapy to enhance therapy outcomes. This form of research would allow for the determination of causal relationships (does the intervention influence outcomes) and would allow for the prospective enrolment of participants with the specific intention of executing the research intervention (thus not dependent on routine procedures, but rather introducing a specific procedure). However, this type of research also has some disadvantages. In order to set up a specific research procedure, certain assumptions about what would be measured (in terms of variables) and when this would be measured had to be made (i.e. the exploration of variables and their measurement had to be curbed). The control of sample characteristics and the controlled implementation of the research protocol also had the potential of decreasing the applicability of findings within the real world practice environment.

In the end, an adapted form of randomised control trial using an alternate group intervention design with blind time-interval sampling and a minimally controlled sample was used. The intention was to allow for some of the real world application of outcomes research by having a more heterogeneous sample while still setting up a specific research intervention characteristic of RCTs and experimental research. This research design will be described in some detail below. It was approved as feasible by the methodology assessors' committee of the School of Therapeutic Sciences at the University of the Witwatersrand. As the project progressed, however, it became clear that the study design contained some flaws that were difficult to rectify once the project had started. One of the greatest obstacles was the difficulty of enrolling enough participants into the study to obtain enough data (a recognised problem with RCTs).(71-73) Secondly, the pre-test/post-test design of the alternate group intervention design did not allow enough exploration of the characteristics of the ILT home programme or of the variables involved. The chosen method will be further critiqued in the discussion chapter and some suggestions on how to improve the method will be made.

3.1.1 An alternate group intervention design, with blind time-interval sampling

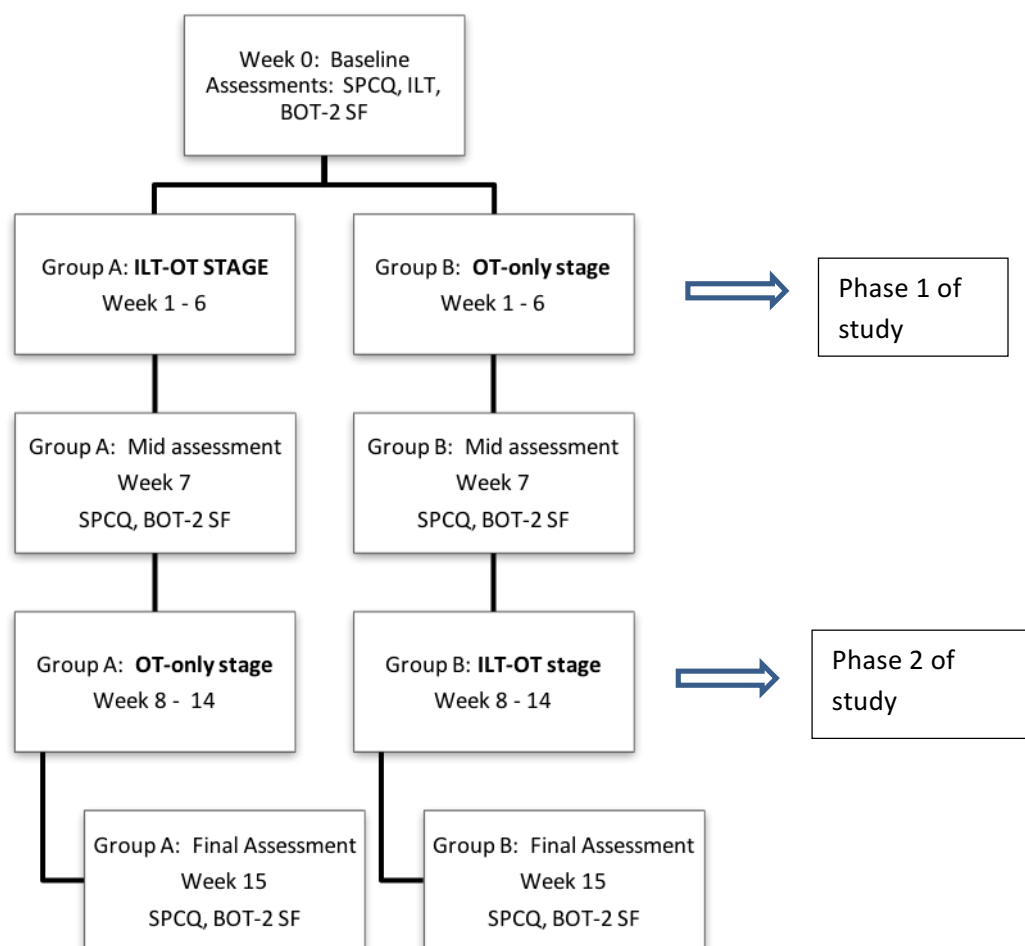
The **alternate group intervention design** is derived from an experimental design. With an experimental design, trends of change are measured under controlled circumstances, at specific points in time, to prove or to falsify an idea or concept. With a typical experimental design, two groups are created and only one group is exposed to the experimental intervention. The other group acts as the control. Change that occurred and the difference in the two groups are then contributed to the experimental intervention.(74) Within this research study, using an alternate group intervention design lead to both groups being alternatively exposed to the experimental intervention. This allowed a form of control i.e. each participant was his/her own control and the two groups acted as a control for each other. In addition, it accommodated a smaller sample group i.e. instead of having only five participants in each group, there were 10 participants in each group at different points in time. This design further allowed investigation of the possibility that change occurred due to normal development or occupational therapy intervention rather than the ILT home programme. Theoretically, with normal development a child will remain at a certain level of functioning compared to his/her peers over time. With intervention, the aim is to improve their performance when compared to peers. Should normal development occur only, the child will remain on the same level of functioning compared to peers across time.

Unbiased control over the measurement of change across time was established by **blind time-interval sample recording**. Research assistants blindly (unaware of the group the participant was in) performed reassessment at two points in time. The selected time intervals were guided by the ILT approach, where a home programme (intervention) lasted six weeks and reassessment was done upon completion of the programme, thus in week seven. Time sampling occurred during active participation in occupational therapy to exclude trends of change theoretically caused by normal development. Time sampling was used to observe possible trends of change during the time available to measure change.(74)

By using this study design: an alternate group intervention design with time-interval sample recording, a phenomenon of change (or no change) could be explained by collecting numerical data that was analysed by using mathematically based methods. For the study design to assist with researcher bias control, the research sample was randomly assigned

into two groups and each group alternatively received the ILT home programme. The study had two phases, in phase one Group A received occupational therapy and the ILT home programme while Group B received only occupational therapy. During phase two, the intervention strategy was switched. For ease of understanding, stages were attributed to each intervention strategy i.e. OT-only stage refers to the time when group participants received only occupational therapy and the ILT-OT stage refers to the time group participant received the ILT home programme together with occupational therapy intervention. In each phase, a group participate in either the ILT-OT stage or the OT-only stage.

Figure 3.1: An illustration of the alternate group study design with time-interval recording:



3.1.2 Population

The population consisted of all children newly referred to the researcher's occupational therapy practice between February 2014 and February 2015. Thus, the first participant could be included during February 2014 and the last participant during February 2015. Within this period, 15 children, between the ages of seven months and 18 years were new referrals and treated within the occupational therapy practice for developmental delay and/or school related difficulties.

3.1.3 Sample size

Total population sampling was used with consenting participants being enrolled into the study consecutively. Total population sampling means that all children referred to the occupational therapy practice during the data collection period, who meet the inclusion and exclusion criteria were included in the sample.

The inclusion and exclusion criteria are explained below:

Inclusion criteria:

- Referred for therapy with school related difficulties
- Aged 5 years 0 months – 10 years 11 months (If younger than 5 years, able to comfortably follow verbal instructions, according to the ILT recommendations, to ensure the child is able to follow the ILT home programme)
- Parents who are willing to perform a home programme
- English or Afrikaans as first language
- Parent consent to participation in the research study
- Child assent to participate in the research study
- Attending mainstream school
- Educational difficulties

Exclusion Criteria:

- Diagnosed pre-existing condition that affect neurological functioning for example Cerebral Palsy, Hydrocephaly, Traumatic Brain Injury, Autism Spectrum Disorder (made by a medical doctor)

The age of participants was set to accommodate the age parameters of the ILT programme (older than five years or able to follow a routine programme) and the age parameters of the standardised test that was used. Afrikaans and English speaking participants were selected to ensure that a difference in language proficiency between the child, parents and therapist did not influence the assessments results. The willingness to perform a home programme was an inclusion criterion to ensure that parents and/or caregivers were aware of the expectation to perform a home programme for six weeks. Parents were informed of the expectation of performing a home programme at least five days a week and were asked if they could commit to that for a period of 6 weeks. The exclusion of children with brain injuries (diagnosed by a medical doctor) was set as these children have a specific lesion causing their difficulties and respond to different types of treatment approaches than children who have school difficulties, but no obvious brain injury. Autism spectrum disorder was excluded as these children's development is expected to be at a different rate. Any diagnosed condition was recorded during the comprehensive pregnancy, birth and early developmental history that were taken on each child.

During the data collection phase of the study (February 2014 – February 2015) 15 children were newly referred to the research site. Of the total population of 15 children, three children did not meet the age criteria; one child performed only the ILT programme with no occupational therapy intervention by parental choice. One parent did not want to perform a home programme. Of the 10 remaining children, all parents and children consented to participate in the study. The sample consisted of 10 participants. This is a very small sample for an experimental study, but after a year of recruitment, it was decided to complete the study at this point. The small sample size meant that cause-effect relationships between variables could not be tested, but trends of change could be described and could be used to understand whether further studies of this nature should be planned and implemented. The sample (10 participants) was randomly divided into two groups (Group A and Group B). A random numbers table was generated at the beginning of data collection was used to assign children to Group A or B. Thus, the order in which children entered the research study, determined in which group they were placed, according to the next open slot on the random numbers table. Group a received occupational therapy and the ILT home programme for six weeks (ILT-OT stage), while Group B received occupational therapy only (OT-only stage). The first six weeks was considered phase one of the research study. After seven weeks, the two groups were swapped (see Figure 3.1. for a diagrammatic representation of the process). The next six week period was considered phase 2 of the research study. Five weeks into the home programme (phase 1) one participant from Group A was withdrawn

from the study. The participant was exposed to physical abuse i.e. bullying at school. The participant was removed from this school and enrolled in a new school that offered ILT as part of their daily teaching approach. Due to the participant being exposed to abuse (trauma – which has a known negative effect on development), and not being able to follow a six-week OT-only stage after the ILT-OT stage, the participant was withdrawn from the research sample. This left nine participants in the research sample.

3.2 RESEARCH PROCEDURE

For ease of reading and understanding the research, the process of the research project will be discussed prior to providing further information on measurement instruments used during the different phases.

The table lists the steps taken in preparation for the research procedure, the execution of the research as well as the steps taken to collect data. Refer to Figure 3.1 for a visual representation of the data collection procedure.

An example of a home programme is included in Appendix J with a description of three regularly prescribed activities.

3.2.1 Listed procedure

Table 3.1: Research procedure steps

PRIOR TO PROGRAMME IMPLEMENTATION / SAMPLING AND IDENTIFYING THE POPULATION	
Step 1	Obtained written permission from Doctor SJ Kokot to perform an investigative study where trends of change in motor skills and sensory changes in children receiving ILT intervention together with occupational therapy would be investigated (Appendix A).
Step 2	A research assistant (occupational therapist) was recruited to perform re-assessments at interval periods. A second research assistant (occupational therapist) was recruited for reassessment in 2015 as the first assistant relocated during November/December 2014. The high inter-rater reliability of the BOT-2 indicated that the change in the research assistant would not affect the assessment outcomes. The ILT evaluation was performed

	only once for each child and used to compile the ILT home programme at the beginning of the data collection period.
Step 3	Identified the sample from the population (Newly referred children within the occupational therapy practice between February 2014 and 15 February 2015, who met the inclusion and exclusion criteria, formed part of the sample) and approached the parents of children who met the inclusion and exclusion-criteria to participate in the study.
Step 4	A meeting with parents and children who indicated that they would participate was setup. The information package on the study (Appendix B) was provided. Informed consent (Appendix C) and assent (Appendix D) was obtained from the parent and child respectively.
Step 5	The child was randomly assigned into either Group A or Group B. A random numbers table was used to assign children to Group A or B. The order in which the children entered the research study determined in which group they were placed according to the next open slot on the random numbers table
Step 6	Each participant had a parent interview and each participant's parent completed the ILT –intake form (detailed information provided in section 3.3) (Appendix E). In addition, a comprehensive occupational therapy assessment was performed. Motor skills were assessed using the BOT-2 short form (detailed information provided in section 3.3). Activity participation was observed during different tasks such as gross motor play as well as age appropriate fine-motor tasks and completion of perceptual activities. Sensory processing was assessed using the Sensory Profile Caregiver Questionnaire (SPCQ) (detailed information provided in section 3.3). The ILT evaluation was performed (Appendix F). The BOT-2 Short form (Appendix G) and the SPCQ (Appendix H) served as the baseline measurements and re-assessment tools for the research study. The researcher completed baseline assessments. The BOT-2 assessment was performed first according to the guidelines and instructions in the BOT-2 manual, where after the ILT assessment was performed. This order of assessments was selected, as fluctuation in attention and concentration were less likely to affect the ILT assessment results in comparison to the BOT- 2. All parents received the baseline SPCQ electronically and returned the completed profile within 4 days after completion of the baseline assessment.
Step 7	Preparation for intervention: For each participant, evaluation results were used to plan occupational therapy intervention and to set occupational therapy aims and objectives.

	For participants in the ILT-OT stage: An individual home programme was developed based on the combination of dysfunctions identified during the ILT evaluation and information gained during the parent interview and information provided in the ILT intake form.(60) The ILT Neurodevelopmental Chart was used to identify clusters of areas of dysfunction. The Neurodevelopmental Chart can be viewed in Appendix I. An ILT home programme was compiled through careful selection from pre-developed sensory (movement) based activities. (Fifty activities were developed at the time of the research.) The pre-developed activities are pre-analysed to address; e.g., the vestibular system or the proprioceptive system. If the ILT evaluation indicated a cluster of difficulties in the vestibular system, activities that address this system are selected. ILT has a developmental hierarchy concerning which systems should be addressed first. Prior to addressing auditory processing for example, the vestibular system should be strengthened. A single programme consisted of a minimum of six and a maximum of nine activities. These activities were completed daily (at least five times a week) and were performed by the participant under the supervision of their parent or caregiver. Each home programme was developed individually based on the participant's identified areas of dysfunction. Thus, each programme could have a different combination of activities. However, the activities themselves were developed according to the prescribed sensory (movement) based activities in the ILT programme. An example of home programme activities can be found in Appendix J.(60) For the participants in the OT-only stage: Occupational therapy session were planned from a sensory integration frame of reference to be performed in a therapy environment that met the sensory integration fidelity measure.(Appendix K)
PROGRAMME IMPLEMENTATION: PHASE 1 Week one to week six	
Step 8	Group A (ABA) received regular weekly occupational therapy and followed the ILT home programme. The following steps were taken to implement to home programme (ILT-OT stage): i. The researcher compiled the ILT home programme based on the ILT

	assessment results. The family routine was considered prior to programme development and implementation. When regarding the family routine, the time of day that parents would be able to perform activities, where considered. I.e. two activities could be done during the morning, two in the afternoon and two before bedtime. Some families preferred completing all activities simultaneously e.g. prior to bedtime or directly after supper. When assisting parents in identifying suitable timeslots, information on the routines of individual family members where considered, for example if there are siblings, when can one-on-one time be selected for completion of the ILT home programme. A minimum of approximately six activities (instead of the allotted nine) can be implemented if the family cannot afford the time, with the option to request additional activities provided they can manage it in their daily routine. Guidance on which activities should be performed when, i.e. morning or evening, where provided for parents who preferred to split the programme to ensure that an excitatory activity was performed in the early morning or afternoon instead of before bedtime.(60) ii. During the parent/caregiver meeting, test results were explained together with the purpose of each activity to enhance programme adherence. Parent feedback was provided at home for children who received school-based therapy, and for one participant who received home based therapy. iii. The parent/caregiver and child were educated on how to perform each activity and parents received a home programme diary* (Appendix L) to improve adherence. iv. The following week occupational therapy intervention began. v. Weekly follow-up on programme participation and progress occurred via a conversation or e-mail. For one family an additional follow-up home visit was arranged to assess if the parents implemented the activity programme accurately. Group B (AAB) received only regular occupational therapy in this time (OT-only stage). Occupational therapy was planned and implemented from a sensory integration frame of reference in a therapy environment that met the sensory integration fidelity measure. (Appendix K).
--	---

Step 9	Re-assessment one (RE: 1) in week seven: The research assistant (another occupational therapist), accompanied by the researcher for introduction purposes, re-assessed all participants with the BOT-2 short form according to the BOT-2 short form guidelines. The research assistant (occupational therapist) was blinded to the group in which each child was. For school-based intervention, the SPCQ was sent electronically three to four days prior to the reassessment for parents to complete. If it was not returned by the reassessment day, a hardcopy was sent home on the day of the assessment, motivating parents either to submit electronically, or to complete a hardcopy and return it by the following week. Parents who attended practice-based intervention completed either an electronic form or hardcopy during the re-assessment procedure.
PROGRAMME IMPLEMENTATION: PHASE 2 Week eight to week fifteen	
Step 10	Group A (ABA) now received occupational therapy only (OT-only stage). Occupational therapy was planned and implemented from a sensory integration frame of reference within a therapy environment that met the sensory integration fidelity measure. The collection of the home programme diaries* upon completion of the ILT home programme became problematic as most parents reported that they did not complete the diary daily and stopped using it once they were familiar with the programme activities. Group B (AAB) now received regular occupational therapy (planned and implemented from a sensory integration frame of reference within an environment meeting the sensory integration fidelity measure) together with the ILT programme (ILT-OT stage). The same process was followed as with Group A.
Step 11	Week 16: Reassessment two (RE: 2) of all participants with the BOT2, and Sensory Profile.

** The home programme diary (a page, with dated blocks for each week) required of parent to write down the names of activities or done or difficulties encountered in the corresponding date block.*

The research study period of the three participants receiving school-based occupational therapy, stretched over the June/July school holiday. The decision was therefore made to

implement their phase 2 after the June/July school holiday, as no intervention would occur during that time. (Thus, theoretically, only normal development would occur which should not influence the outcomes of this study.)

3.3 MEASUREMENT INSTRUMENTS

3.3.1 Measurement Instruments used for the ILT-OT stage

3.3.1.1 Integrated Learning Therapy Parent Questionnaire and Interview (Appendix E)

All parents completed an initial intake form. This form is part of the prescribed ILT process that must be completed in order to proceed with an ILT home programme. The form reported on major areas of concern, history of previous therapy and scholastic history. Information on family structure, birth history, developmental history and early motor development was obtained through the form. As part of the initial intake form, information on speech and language development, a Candida albicans questionnaire, general health and nutritional habits questionnaire was completed. A section on previous and current sensory-motor issues was completed.(61) The completed questionnaire and additional concerns were discussed during the parent interview. The form and parent interview are part of the prescribed ILT intake process.

The purpose of this information is to determine the child's readiness to participate in the ILT home programme as well as to establish whether referral to other professional is needed in order to establish other causes for the reported educational difficulties (e.g. a speech therapist, dietician, paediatrician or neurologist)

All children in the population were assessed to be ready for an ILT programme. Information on the form, together with observations made during the ILT evaluation was used to determine areas of dysfunction for each participant.

3.3.1.2 ILT Evaluation (Appendix F)

A typical ILT evaluation relies on clinical observations taught to ILT practitioners during the ILT course work module and practical sessions. The ILT evaluation performed during the study, ILT included tests such as diodokokinesis, thumb-finger touching and nose-finger touching, that forms part of cerebral functioning testing, as well as reflex testing. It includes assessment of hand, foot, eye and ear dominance as well as balance testing and observations on writing and copy drawing. A child's ability to reproduce sound and rhythmic patterns as well as recall sounds and sentences are performed. The ILT evaluation procedure has not been normed, and reliability and validity have not been tested. However, the clinical observations included in the assessment are routinely used by a number of different professionals (neurologists, paediatricians, and occupational therapists) to identify possible problems in neurological and motor functioning. This collection of clinical observations in the ILT assessment procedure cannot measure change but can only be used to compile the ILT home programme (to decide which activities/tasks to include in the programme). During the ILT evaluation procedure, observations on irregularities made during the administration of the evaluation, together with irregularities detected from the intake form, were considered indicative of difficulties in the neurological systems supporting learning in participants. These systems include the tactile, gestational and olfactory systems, vestibular system, muscle tone, proprioception, visual and auditory system, differentiation, lateralisation and interhemispheric integration.(61)

The purpose of this evaluation is specifically to determine which activities from the ILT home programme activities bank to prescribe. This prescription is individual and relates to Novak's model where individual goal setting and individual programme development occurs.(24)

The ILT evaluation does not produce scores and is not designed to measure change. For this reason, two standardised assessments were added to the procedure in order to allow for reevaluation and the measurement of change. These standardised assessments formed part of the comprehensive occupational therapy evaluation.(61)

3.3.1.3 Home programme diary (Appendix L)

With the implementation of the ILT home programme, parents received a home programme diary. The diary consisted of six pages, each page representing a week that the programme was followed. On each page a table with seven columns (one column for one day of the week) was drawn. Each column had a designated area where activities done could be written

down, and additional comments or concerns could be written in. The aim was to improve adherence to the home programme and to collect information on the frequency per week that parents were able to complete the home programme in a real world scenario and the number of activities they perform on average per day, in a real world scenario.

3.3.2 Measurements and Procedures during the OT-only stage

A comprehensive occupational therapy assessment was performed to plan and prepare for occupational therapy intervention during the research procedure. Each participant's occupational performance was assessed. Client factors, performance skills, performance patterns, context, environment, and activity demands were assessed. Information on these aspects were obtained from the ILT intake form and parent interview, the BOT-2 short form, Sensory Profile, Clinical Observations and observation of each child during different types of activities were performed. For five participants an interview with the teacher and a school visit was performed, as this was indicated. For six participants a home visit was performed to investigate their sensory environment at home. Visual perception testing was performed with either the DTVP 2 or Beery VMI 6th edition. Test results and observations made during these assessments were used to establish where intervention is needed to improve educational performance.

Occupational therapy intervention occurred from a sensory integration frame of reference in a therapy environment that met the sensory integration fidelity measure.

3.4 MEASUREMENT INSTRUMENTS USED TO MEASURE THE OUTCOME OF THE ILT PROGRAMME

As the ILT evaluation procedure is not standardised, and criteria are that of either function or dysfunction based on quality of movement, norm referenced/ standardised assessment tests were used to measure the outcome of the ILT programme. During the ILT programme, re-assessments on the ILT form do not occur. Rather, parents monitor and report on changes in their child's behaviour, however it is not measured against age norms, but rather parental perception. As ILT is a movement based programme that allegedly address aspects of sensory integration and movement, standardised measurement instruments that measure

change in motor skills and change in sensory processing abilities were selected to measure change in these areas.

3.4.1 Bruininks-Oseretsky test of motor proficiency (BOT-2) short form (Appendix G)

The **BOT-2 short form** was used to assess motor skills. The BOT-2 short form comprises of 14-items from the BOT-2 complete form. The BOT-2 short form test assessed four domains: fine manual control, manual coordination, body coordination and strength, and agility for children aged four to 21 years. The BOT-2short form was developed as a screening tool to obtain a score on overall motor proficiency and as a research tool. The short form proved a single score on overall motor proficiency. The test came with a kit with standardised equipment and took approximately 15-20 minutes to complete. Each of the 14 task orientated test items consisted of an instruction (accompanied by teaching if necessary), a practice round and up to two trials. The opportunity for teaching and practice ensured that the instructions given were understood before the trials, to maintain accurate scoring of the participant's motor ability. Error due to inattention or poor ability to following instructions could be eliminated, thereby improving the opportunity to measure motor skills over time.(75)

The BOT-2 short form was developed from data gathered in standardisation of the BOT-2 (Normed with 1520 children, in 239 facilities, over 32 states in the United States and included a diverse population). The items used in the short-form were selected to represent the range of each BOT-2 Complete forms subtest's content, to span across the broadest possible range of motor proficiency and to provide sufficient reliable scores. The BOT-2reliability for internal consistency ranges between 0.70 to the mid-0.90. Test-retest reliability is established to be between 0.69 to the low 0.80 s for the subscale scores, and from the mid to upper 0.80 for the total motor composite and short form reliability. Inter-rater reliability shows reliability coefficients ranging from 0.92 to 0.99. The high inter-rater reliability was essential as research assistants administered both reassessments. The reassessment results were used to measure change over time.(76)(77)

The BOT-2 short form was considered an appropriate measurement tool, as there is some evidence that the test can be used to measure change accurately in motor skills in non-

American populations. In Australia, “30 Aboriginal children (18 males, 12 females: mean age 8.8 years) were assessed at eight remote Fitzroy Valley communities. During this assessment the inter-rater reliability for the BOT-2 short form score sheet outcomes ranged from 0.88 (95%CI, 0.77 – 0.94) to 0.92 (95%CI, 0.84 – 0.96) indicating excellent reliability. The test-retest reliability (median interval between tests being 45.5 days) for the BOT-2 short form score sheet outcomes ranged from 0.62 (95%CI, 0.34 – 0.80) to 0.73 (95%CI, 0.50 – 0.86) indicating fair to good reliability.”(78)(pg. 1) These scores supported the use of the BOT-2 short form as a measuring instrument across different cultural groups.(78)

3.4.2 Sensory Profile Caregiver Questionnaire (Appendix H)

The Sensory Profile Caregiver Questionnaire (SPCQ) is a behavioural questionnaire that gathers information regarding sensory integration abilities and the effect these abilities have on the daily functioning of children between the age of five and ten years. The sensory profile caregiver questionnaire measured each participants auditory processing, visual processing, vestibular processing, touch processing, multi-sensory processing, and oral sensory processing as part of sensory discrimination. As part of measuring sensory modulation the SPCQ measures sensory processing related to tone/endurance, modulation related to body position and movement, modulation of movement affecting activity level, modulation of sensory input affecting emotional responses and modulation of visual input affecting emotional responses and activity level. The raw score obtained in each section is interpreted as typical performance, probable difference or definite difference for a specific sensory integration area. The raw score for each questionnaire section is not valued, but rather the interpretation thereof as typical performance, definite difference or probable difference.(79)

Research has shown that the questionnaire can be used to detect disabilities such as Autism or Pervasive Developmental Disorder and Attention Deficit and Hyperactivity Disorder (ADHD), which affect learning.(80) The SPCQ identified differences in sensory processing abilities of children with Specific Learning Disorders (SLD), with and without ADHD when compared to children without disabilities.(81) Thus, the SPCQ is a valid means of screening for sensory integration abilities in children with learning problems. Furthermore, the SPCQ has moderate to high test-retest reliability, ranging between 0.67 and 0.93, for section scores over a period of seven and 14 days. These results suggest that the SPCQ has acceptable test–retest reliability and supports the use of section scores to analyse children’s sensory processing patterns.(82)

The SPCQ has also been used in a variety of cultural settings. It was found to have adequate psychometric properties to identify sensory processing dysfunction within an Indian population. It has also been used for studies related to ADHD and Sensory Processing disorders on a South-African population.(83)(84) The ability to use the Sensory Profile Caregiver Questionnaire across cultural borders and with different diagnostic conditions, as well as the test-retest reliability supported the use of the questionnaire during the research procedure.

3.5 DATA CAPTURING

Data for sensory integration abilities were captured using the SPCQ. The questionnaire, completed by parents, offered a rating scale (1 to 5) for sensory integration abilities. The SPCQ translated sensory integration abilities (sections on the questionnaire) to numerical values. These numerical section values (raw scores) on the SPCQ sections (A-K) were plotted on a scale to interpret sensory integration in a specific sensory area as typical performance; probable difference and definite difference (see Appendix M). Section scores obtained was captured on three different intervals: baseline assessment (B), reassessment one (RE:1) and reassessment two (RE:2).

The BOT-2 short form test was used to capture the performance of motor skills on the above-mentioned intervals. The BOT-2 (including the BOT-2 short form) is a norm-referenced test, indicating that it measures a child's performance against his/her age norm. The participant's total point score was recorded and converted to a standard score using the age and gender appropriate table in the BOT-2 Manual.

Initially it was thought that a home programme diary would aid in improving adherence to a home programme. Only a single home programme diary was returned after the research procedure; it did not serve as a tool to improve adherence to home programmes and data was not analysed further. With the poor return rate information on frequency of home programme performance in a real world scenario could not be establish, nor could information on the actual number of activities performed per day be captured.

3.6 DATA ANALYSIS

This section describes how the data gathered on the Sensory Profile Caregiver Questionnaire (SPCQ) and Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) were analysed by converting raw scores into standard scores or z-scores and placing each score in a ranked category.

The positive change (+), negative change (-) or no change (0) that occurred for each participant following the OT-Only stage, ILT-OT stage and for the duration of the study was tabled.

3.6.1 Bruininks-Oseretsky Test of Motor Proficiency Short Form (BOT-2) Analysis

The standard score of the BOT-2 short form, derived from the raw score, measured participants' motor skills at specific intervals i.e. baseline (B), reassessment one (RE:1) and reassessment two (RE:2). The standard score obtained at each interval was classified according to the BOT-2 standard deviation criteria based on a normal distribution. The BOT-2 short form was developed as a screening tool to obtain a score on overall motor proficiency. The short form provided a single score on overall motor proficiency, thus only an overall score on motor proficiency could be obtained per participant and change in items could not be analysed.

Table 3.2: BOT-2 standard score key

Standard score key
At or above the mean (50)
Below the mean of 50 (40-49)
One Standard deviation (10) below the mean (30-39)
Two Standard deviations below the mean (<30)

Standard scores at or above the mean of 50 were grouped together as the BOT-2 does not assess to maximum performance ability. Participants' performance was measured against the minimum criteria that should be met for each age group. Subtests, such as one-leg standing balance and ball dribbling were stopped if minimum criteria were met (according to

test instructions). Thus, for the purpose of the study, if a participant met the norm of 50, further improvement in gross-motor skills, although possible, was not measured and participants were not considered to have dysfunction. To observe change in participants' motor skills, an ordinal data range was used. The range indicated positive change, negative change or no change at the end of each assessment phase. Positive change (+) was indicated if a positive category change occurred (movement of a lower score towards a standard score of 50). Negative change (-) was indicated if a negative category change occurred (away from the mean of 50 to a lower score) and no change (0) was indicated if the participant remained in the same category. This approach was followed in order for the results to be analysed with the SPCQ, which has ordinal data.

At the start of each phase (OT-Only stage or ILT-OT stage), all standard scores below 50 were considered as an area of dysfunction for a particular participant. Thus, a score below 50 at the baseline assessment was considered as an area of dysfunction, as was a score below 50 at reassessment.

The change observed at the end of a phase was recorded on a grid. One grid per group was created and change from baseline (B) to Reassessment one (RE: 1) and from Reassessment one (RE: 1) to Reassessment two (RE: 2) recorded; as well as change from baseline to Reassessment two (RE: 2) (See Appendices N and O).

3.6.2 Sensory Profile Caregiver Questionnaire Analysis

Category scores (raw scores for section A-K) obtained on the SPCQ subsections were interpreted as Typical Performance (TP), Probable Difference (PD) or Definite Difference (DD) equivalent to standard deviations or z-scores on a normal distribution curve. Each subtest has a unique numerical score range that was used to classify the scores. The numerical raw score obtained is not valued, as it does not represent a numerical range with attributed meaning. Rather the interpretation indicates probable difference, typical performance and definite difference. Thus, the data analysis aimed to identify change between the areas of typical performance, definite difference and probable difference as this represents a change on the normal distribution curve. A change in a category was valued above the raw score obtained for a section, as only a category change was seen as a significant change.

Change in scores towards or away from the Typical Performance was recorded. If a child scored within the Typical Performance and remained within the Typical Performance range throughout the study period, no change occurred (0). Positive change (+) was indicated if a Definite Difference (DD) score changed to Probable Difference (PD) or Typical Performance (TP), or if a Probable Difference (PD) score changed to Typical Performance (TP). Negative change (-) was indicated if a Typical Performance (TP) score changed to Probable Difference (PD) or Definite Difference (DD), or when a Probable Difference (PD) score changed to Definite Difference (DD). Change between the baseline and first reassessment, baseline and the second reassessment and change between the first reassessment and the second reassessment was captured.

For the purpose of the study, data from the Sensory Processing (measuring sensory discrimination) (section A-F) and Sensory Modulation (section G-K) were analysed, as these areas were the focus points of treatment during both the ILT-OT stage and OT-only stage of the study. Section scores for A to K, obtained during baseline, reassessment one and reassessment two were plotted on the sensory profile interpretation grid (see Appendix N and O).

3.6.3 Determining change within groups over time

Each group was analysed individually. Within each group, variables were analysed across the group rather than averages from participants. Descriptive statistics (percentages) were used to analyse and present the data.

The following steps were taken to determine change in each group over time:

- a) At baseline, scores below 50 on the BOT-2 and Probable Difference and Definite Difference scores on the SPCQ were identified as areas of dysfunction. On the BOT-2 short form, the standard score was one category for each participant that was considered, thus the (n) value remains nine for the sample. The SPCQ's sections were considered separately, increasing the (n) value of the population. One child represented a possible 11 (n) values because the SPCQ results in scores for 11 different components.
- b) In each group, the number of scores for **all the areas of dysfunction** (that fell below 50 for the BOT-2 and outside of the typical range on the SPCQ), **were added together for the total number of areas which could be considered**

dysfunctional. Sections A-F provided information on sensory discrimination and sections G-K provided information on sensory modulation. Overall change refers to change in motor skills, sensory modulation and sensory discrimination. By distinguishing between sensory discrimination and sensory modulation on the SPCQ, scores on motor skill, sensory modulation and sensory discrimination were obtained. Positive change was possible with intervention in these areas, thus the total potential for change within either group was based on the number of dysfunctional areas within a given group.

- c) At reassessment one (RE: 1), the **number of areas that had positive change were counted and divided by the total number of areas that were dysfunctional** at baseline (B), in order to determine the **percentage of positive change** between Baseline (B) and reassessment one (RE: 1) for that group. (Overall change as well as change in individual areas motor skills, sensory discrimination and sensory modulation were calculated.) This process was repeated between reassessment one (RE: 1) and reassessment two (RE: 2) and between baseline (B) and reassessment two (RE: 2) and allowed for a representation of percentage of positive change over time.
- d) The same analysis process was carried out for no change and negative change. The two groups could then be **compared in terms of percentage positive change, percentage negative change and percentage no change**. Overall change (across all areas that were dysfunctional at baseline, including motor skills and sensory processing) was measured for **motor skills, sensory modulation and sensory discrimination** during for the two stages of OT-only and ILT-OT (baseline to reassessment one, reassessment one to reassessment two and baseline to reassessment two).
- e) Following the analysis, a numerical value and a percentage of change for a specific stage as well as a specific area was obtained; e.g., motor skills during a specific stage. These **percentages could now be compared** between groups. The study produced ordinal data and descriptive statistics were used to understand the trends of change

3.7 ETHICAL CONSIDERATIONS

Ethical clearance was obtained from the University of the Witwatersrand's Ethics Committee of Research on Human Subjects (see Appendix P). Parents were provided with detailed information (Appendix B) on the purpose and procedure of the study and written informed consent was obtained from all prospective participants' parents (Appendix C). Once consent from parents was obtained, the purpose of the study was explained to children in terminology they could understand and verbal and/or written assent was obtained from the participating children, depending on the age of the child (Appendix D).

All participants and their parents were informed that participation in the study was voluntary, and that they could withdraw from the study at any point without any negative consequences to their therapy programmes. Participants and their parents were also encouraged to ask questions or request more information throughout the research process. Information from the individual assessments was shared with participants and their parents to demonstrate their individual needs and progress and no extra fees were charged for the reassessments as these were purely for research purposes. To maintain confidentiality, participants were only identified by their research codes on any assessment documents and all identifying information was kept separately from the research results. In some cases, parents requested assessment results to be discussed with teachers, but this was only done with the expressed written permission of the parents.

CHAPTER 4

RESULTS

This chapter provides the **demographics and baseline measurement** of the sample. Each group's baseline scores are illustrated. Results of the study questions are presented.

4.1 DEMOGRAPHICS

This section provides the demographics of the sample and of each group. A table summary of each group's demographics and baseline assessment results are presented.

4.1.1 Demographics of the sample (n=9)

The median age of the sample population was 5 years and 6 months (IQR 5 years 2 months – 6 years 5 months). Three participants were girls and six were boys. All participants attended mainstream schools. One participant was a year behind his chronological age group in school grades. All other participants were in a grade corresponding to his/her age group. Eight participants were from high socio-economic families and one from a middle class socio-economic family.

4.1.2 Demographics of Group A (ABA) (n=4)

The median age of the group was 6 years 11 months with a range between 5 years 7 months and 8 years 10 months. Three group members were male and one group member was female. One group member was a year behind his chronological age group in school grades.

The baseline data for Group A will be represented in the next section.

4.1.2.1 Baseline Data for Group A (ABA)

The ILT assessment results for Group A are summarised in Table 4.1.

Table 4.1: ILT assessment results Group A (ABA)

X= area of dysfunction identified during the assessment procedure (Obtained from the parent questionnaire and ILT assessment.)

ILT Area of concern:	A1	A3	A4	A5
Reflex integration	X	X	X	X
Vestibular-cerebellar system	X	X	X	X
Proprioceptive system	X	X	X	X
Low muscle tone	X	-	-	-
Auditory system	-	X	X	X
Visual system	-	-	X	X
Tactile system	-	-	X	X

The ILT assessment provided information required for the development of the home programme for each individual child. A specific area can only be rated as functional or dysfunctional, thus this assessment cannot be used to measure change. Of the four children, two had dysfunction in four areas and two had dysfunction in six areas. All four children showed dysfunction in reflex integration, vestibular-cerebellar system, and the proprioceptive system, while only one child showed dysfunction in muscle tone. Three children had dysfunction in the auditory system and two had dysfunction in the tactile and visual system. Each child received a home programme of activities based on the areas of dysfunction.

Table 4.2 shows the areas of dysfunction for each participant in Group A for Sensory Integration at baseline (B). The sensory profile has to be interpreted to see patterns of dysfunction. These are represented in this table.

Table 4.2: Sensory Profile Caregiver Questionnaire Summary of Dysfunction for Group A

	Sensory Processing* Concerns	Sensory Modulation Concerns
A1	Vestibular processing* (DD) Multi-sensory processing* (PD)	-
A3	Auditory processing* (DD) Vestibular processing* (DD) Touch processing* (PD) Multi-sensory processing* (PD)	Sensory processing related to body position and movement (PD) Modulation of movement affecting activity level (PD) Modulation of sensory input affecting emotional responses (DD) Modulation of visual input affecting emotional responses and activity level (PD)
A4	Auditory processing* (PD) Vestibular processing* (PD) Multi-sensory processing* (DD)	Sensory processing related to tone/endurance (DD) Modulation of visual input affecting emotional responses and activity level (PD)
A5	Oral sensory processing* (DD)	Sensory processing to tone/endurance (DD) Modulation related to body position and movement (PD) Modulation of movement affecting activity level (PD) Modulation of visual input affecting emotional responses and activity level (PD)

PD= Probable difference

DD= Definite difference

*In the context of the study sensory processing difficulties on the SPCQ refers to sensory discrimination dysfunction in a particular system; e.g., auditory processing refers to auditory discrimination dysfunction. In the context of the study, sensory processing refers to both sensory discrimination and sensory modulation.

With baseline assessment, of the four children in Group A, three presented with sensory discrimination and sensory modulation dysfunction, while one presented with only sensory discrimination dysfunction. These areas of dysfunction were the areas identified for measuring change after the implementation of the ILT home programme.

Table 4.3 presents the baseline scores from the BOT-2 short form for Group A's members.

Table 4.3: BOT-2 results Group A (ABA):

Code	Standard Score	Standard Score Key
A1	21	At or above the mean (50)
A3	51	Below the mean of 50 (40-49)
A4	43	One Standard deviation (10) below the mean (30-39)
A5	43	Two Standard deviations below the mean (<30)

In this group, three of the four participants scored below the mean of 50, but only one displayed severe motor dysfunction (two standard deviations below the mean). One participant displayed normal motor functioning (a score of 50 or above).

4.1.3 Demographics of Group B (AAB) (n=5):

The median age of the group was 5 years 4 months with a range from 4 years 11 months to 5 years 6 months. Three group members were male and two were female. All members attended mainstream school to a grade corresponding to his/her age group. An Educational Psychologist assessment of the youngest member indicated him/her as gifted.

The baseline data for Group B will be represented in the next section.

4.1.3.1 Baseline data for Group B (AAB)

The ILT assessment results for Group B are presented in Table 4.4.

Table 4.4: ILT Assessment results for Group B

X= Area of dysfunction identified during the assessment procedure (Obtained from the parent questionnaire and ILT assessment.)

ILT areas of concern:	B1	B2	B3	B4	B5
Reflex integration	X	X	-	X	-
Vestibular-cerebellar system	X	X	X	X	X
Proprioceptive system	X	X	X	X	X
Low muscle tone	-	-	-	X	-
Auditory system	-	X	X	X	X
Visual system	-	-	-	X	X
Tactile system	X	-	-	X	X

The ILT assessment provided information required for the development of the home programme for each individual child. A child can only be rated as functional or dysfunctional, thus this assessment cannot be used to measure change. Of the five children, one had dysfunction in seven areas, two had dysfunction in four areas, one had dysfunction in five areas and one had dysfunction in three areas. All five children showed dysfunction in the vestibular-cerebellar system and the proprioceptive system. Three showed dysfunction in the tactile system, two showed dysfunction in the visual system, four showed dysfunction in the auditory system, one showed dysfunction in muscle tone and three showed dysfunction with reflex integration. Each child received a home programme of activities based on the areas of dysfunction.

Table 4.5 shows the areas of dysfunction for each participant in Group B for Sensory Integration at Baseline (B). The sensory profile has to be interpreted to see patterns of dysfunction. These are represented in this table.

Table 4.5: Sensory Profile Caregiver Questionnaire Summary of Dysfunction for Group B

	Sensory Processing*	Sensory Modulation
B1	Auditory processing* (DD) Visual processing* (PD) Touch processing* (PD) Multi-sensory processing* (DD) Oral sensory processing* (DD)	Sensory processing related to tone/endurance (DD) Modulation of movement affecting activity level (PD) Modulation of sensory input affecting emotional responses (DD)
B2	Auditory processing* (PD) Vestibular processing* (DD)	-
B3	Auditory processing* (PD) Vestibular processing* (DD)	Modulation of movement affecting activity level (DD) Modulation of sensory input affecting emotional responses (DD)
B4	Auditory Processing* (DD) Multisensory processing* (PD)	Modulation of sensory input affecting emotional responses (DD)
B5	Auditory processing* (PD) Vestibular processing* (PD) Touch processing* (PD) Multi-sensory processing* (DD) Oral sensory processing* (DD)	Modulation related to body position and movement (PD)

PD= Probable difference

DD= Definite difference

*In the context of the study sensory processing difficulties on the SPCQ refers to sensory discrimination dysfunction in a particular system e.g. auditory processing refers to auditory discrimination dysfunction. In the context of the study, sensory processing refers to both sensory discrimination and sensory modulation.

With baseline assessment (B), of the five children in Group B, all presented with sensory discrimination dysfunction. Four participants presented with sensory modulation dysfunction in conjunction with sensory discrimination dysfunction, while one presented with only

sensory discrimination dysfunction. These areas of dysfunction were the areas identified for measuring change after the implementation of the ILT home programme.

Table 4.6 presents the baseline scores from the BOT-2 short form for Group B's members.

Table 4.6: BOT-2 Results Group B (AAB)

Code	Standard Score	
B1	34	
B2	65	
B3	50	
B4	46	
B5	53	

Standard Score Key
At or above the mean (50)
Below the mean of 50 (40-49)
One Standard deviation (10) below the mean (30-39)
Two Standard deviations below the mean (<30)

In this group, three of the five participants had normal motor skills (at or above the mean of 50). Only one displayed slight motor dysfunction (one standard deviation below the mean). One participant displayed below average motor skills, but none of the participants showed severe motor dysfunction (two standard deviations below the mean of 50).

4.1.4 Comparison of baseline data

Due to the small sample size and the very small number of children in each group, it was not possible to compare baseline data statistically. Thus, the groups may display significantly different starting points. By using each child as their own control (i.e. looking at change in areas as compared to the child's own results), an attempt was made to control for this bias.

4.2 MEASURING CHANGE WITHIN AREAS OF DYSFUNCTION

Within this study, change in scores was measured and classified in three categories, namely positive change (+), negative change (-) and no change (0). The first attempt at identifying change within the raw scores of the SPCQ resulted in no identifiable pattern. It was further reasoned that a single point change, within the same category on the SPCQ, did not attribute to meaningful change. Only when there was a change between categories could

significance be attributed to the change. Trends of change between categories on the SPCQ was observed. It was a further possibility to follow the same observation on change with the BOT-2 according to the standard scores and standard score deviation.

Positive change was noted if a score moved from a lower ordinal category to a higher ordinal category, negative change was noted if a score moved from a higher ordinal category to a lower ordinal category. Moreover, no change was noted if the score remained in the same ordinal category (please refer to the data analysis section in Chapter 3 for further explanation). This information was presented on grids (see Appendices K and L) to assist in data analysis. All data analysis from this point on was done through calculating the number of areas of dysfunction in each group and not by dysfunction within each participant (number of areas rather than number of participants). Change was measured as a percentage (e.g. areas of dysfunction in which positive change was measured in relation to total number of areas of dysfunction).

4.3 DATA DERIVED FROM THE CHANGE GRIDS

To answer the research questions, results are presented according to the three research questions.

4.3.1 Question 1: Does the ILT home programme together with regular occupational therapy intervention enhance occupational therapy outcomes in sensory processing and motor skills?

To answer this question, positive change within *areas of dysfunction* was calculated during the ILT-OT stage and the OT only stage across the whole sample as well as in each group. Only the areas of dysfunction were analysed as these are the areas where positive change is expected during intervention and where it can be measured, (refer to section 3.6.3 Determining change within groups over time). Change during the ILT-OT stage of the groups was compared across the groups and between the groups in order to identify if the ILT programme enhanced occupational therapy outcomes.

Total Sample: Change in all areas of dysfunction (i.e. in total sample)

To compare the OT-only and ILT-only stage, the trends of change during each stage, was compared. Data obtained for both groups were combined.

Table 4.7 illustrates the percentage of change within each phase, for both groups.

Table 4.7: Combined percentage of change during each phase

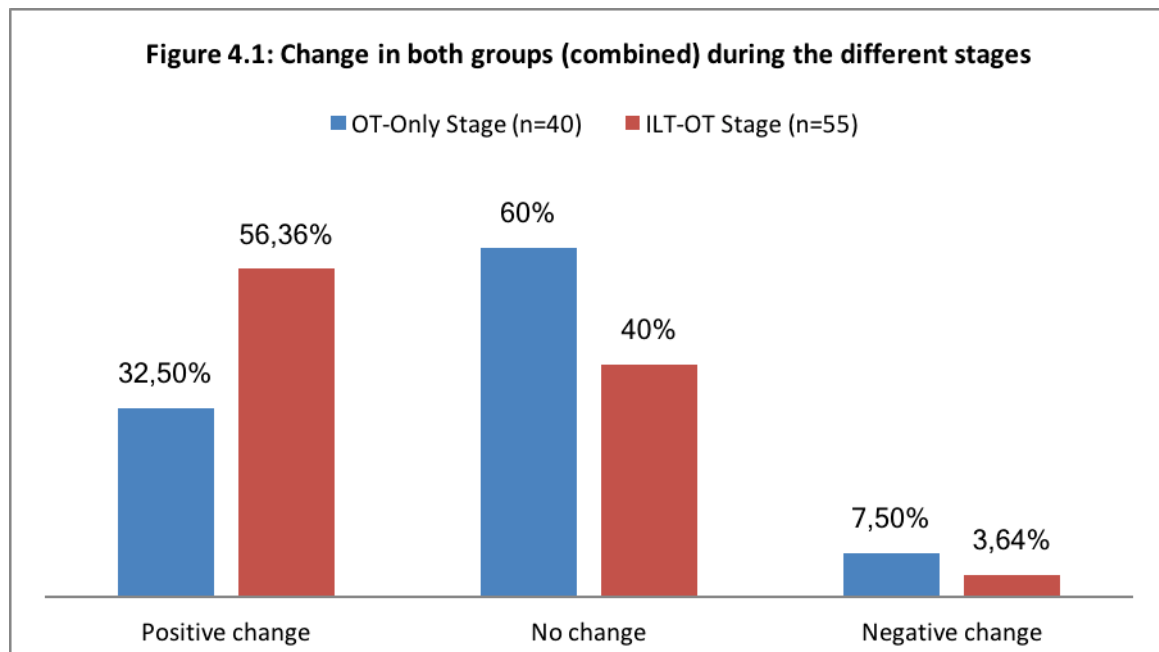
CHANGE IN BOTH GROUPS IN DIFFERENT PHASES	OT-Only Stage		ILT-OT Stage	
Areas of dysfunction (n)	40 (n)		55 (n)	
Positive change (+)	13	32.5%	31	56.36%
No change (0)	24	60%	22	40%
Negative change (-)	3	7.5%	2	3.64%

At the beginning of the OT-Only stage, the sample had 40 areas of dysfunction (n=40). During the OT-Only stage, there was a 32.5% positive change, a 60% negative change and a 7.5% negative change in areas of dysfunction. At the beginning of the ILT-OT stage the number of areas of dysfunction was 55 (n=55). During this stage, there was a 56.36% positive change, a 40% no change and a 3.64% negative change in areas of dysfunction. The ILT-OT stage demonstrated a higher percentage of positive change in areas of dysfunction.

The positive change in the ILT-OT stage and OT-Only stage was compared using a Chi Square analysis. There was a significant difference between these two stages (Chi-Square = 10.7, df = 1, p = 0.0011). Thus, the addition of the ILT home programme to regular occupational therapy following a sensory integration approach has the potential to enhance occupational therapy outcomes.

Figure 4.1 illustrates the trends of change of the sample during each stage.

Figure 4.1: Change in both groups (combined) during the different stages (OT-only and ILT-OT stage)



The combined result indicates that positive change within both groups, were higher during the OT-ILT stage.

The positive change was further analysed in the two groups to monitor change in each group.

4.3.1.1 Group A (ABA): Change in areas of dysfunction (Motor skills and Sensory Processing)

Group A demonstrated 56.5% positive change during the ILT-OT stage. The OT-only stage demonstrated a higher no change and negative change rate than the ILT-OT stage. Positive change was the highest during the ILT-OT stage. Table 4.8 illustrates the percentage of change that occurred in areas of dysfunction within Group A.

Table 4.8: Group A (ABA): Percentage of change in areas of dysfunction (motor skills and sensory processing) during each stage

GROUP A (ABA)	ILT-OT STAGE		OT- ONLY STAGE	
Areas of dysfunction (n)	23 (n)		15 (n)	
Positive change (+)	13	56.5%	4	26.7%
No change (0)	10	43.5%	9	60%
Negative change (-)	0	0	2	13.3%

At the beginning of the ILT-OT stage, Group A had 23 areas of dysfunction. During the ILT-OT stage, Group A demonstrated positive change in 56.5% of the sample (n=23) and there was no negative change during this period. At the beginning of the OT-only stage the number of areas of dysfunction was lower (n=15). During this stage, the no change was higher than the positive change and there was negative change in some of the sample. Group A demonstrated a 52.2 % positive change rate for the total duration of the study indicating that there was a trend towards positive change in areas identified as dysfunctional.

4.3.1.2 Group B (AAB): Change in areas of dysfunction (Motor skills and Sensory Processing)

Group B (AAB) demonstrated a 56.25% positive change in areas of dysfunction during the ILT-OT stage. Table 4.9 illustrates the percentage of change in areas of dysfunction for Group B.

Table 4.9: Group B (AAB): Percentage of change in areas of dysfunction (motor skills and sensory processing) during each stage

GROUP B (AAB)	OT-ONLY STAGE		ILT-OT STAGE	
Areas of dysfunction (n)	25 (n)		32 (n)	
Positive change (+)	9	36%	18	56.25%
No Change (0)	15	60%	12	37.5%
Negative Change (-)	1	4%	2	6.25%

At the beginning of the OT-only stage, Group B had 25 areas of dysfunction. These areas increased to 32, in spite of a 36% positive change in areas of dysfunction. The increase

indicates that typical areas underwent negative change during the OT-only stage. During the ILT-OT stage 56.25% positive change occurred.

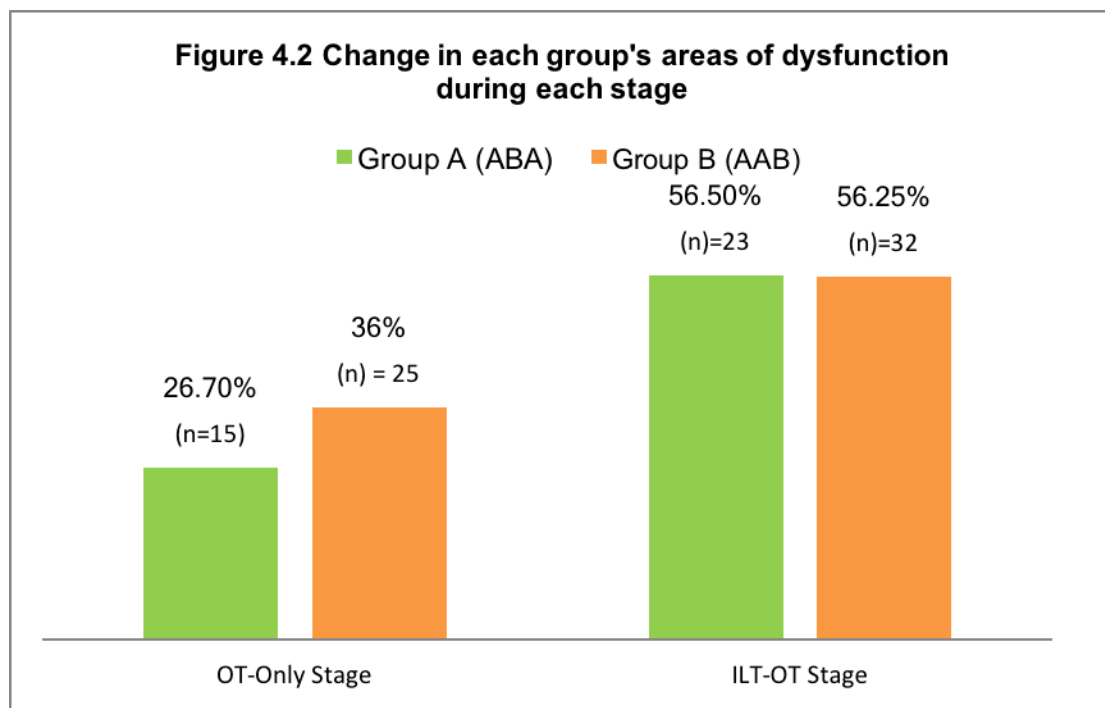
The phenomena of negative change will be elaborated on in Section 4.3.3, to illustrate the value of timing of home programme implementation.

4.3.1.3 Conclusion Question 1:

The positive change within areas of dysfunction in the sample was higher during the ILT-OT stage when compared to the OT-only stage. Each groups, demonstrated a higher percentage of change during the ILT-OT stage in areas of dysfunction.

The results indicated that positive change during the ILT-OT stage did occur. Consequently, the ILT programme, together with occupational therapy, enhanced the occupational therapy outcomes for improving sensory processing skills and motor skills of children. Figure 4.2 illustrates the positive change in areas of dysfunction for each group during each stage.

Figure 4.2: Change in each groups areas of dysfunction during each stage (Motor skills and sensory processing skills)



4.3.2 Question 2: If there is change, where does this change predominantly occur (i.e. in which skills)?

To answer this question, an analysis of each aspect i.e. motor skill, sensory discrimination and sensory modulation was performed for each group.

4.3.2.1 Motor skills: Change in areas of dysfunction (Group A and Group B)

The OT-only stage of Group A had a 66.6% positive change on motor skills (equal to the ILT-OT stage) (n=3). The OT-only stage of Group B had a 100% positive influence on motor skills (n=2), compared to the ILT-OT stage of Group B which had a 100% negative change (n=1).

Only one group demonstrated positive change in motor skills during the ILT-OT stage, while the other group demonstrated negative change. However, the motor skills assessments indicated that this sample did not have significant motor skill dysfunction, which decreased the number of areas of dysfunction included in the analysis. These results are viewed with caution, as the sample and total areas of dysfunction, (n) value, are small and prevent making any conclusions. As the BOT-2 short form was used, subsections in the test could not be analysed (as with the SPCQ to increase the n value) for a more detailed investigation and only a single total score and thus a single standard score was obtained for each participant. This is a limitation of the study. Table 4.10 and Table 4.11 illustrate the change that occurred in the motor skills (areas of dysfunction) of both groups.

Table 4.10 Group A: Motor skills change in areas of dysfunction during each stage

GROUP A (ABA)	ILT-OT STAGE		OT-ONLY STAGE	
Motor skills areas of dysfunction (n)	3 (n)		3 (n)	
Positive change (+)	2	66.67%	2	66.67%
No Change (0)	1	33.33%	1	33.37%
Negative change (-)	0	0	0	0

Table 4.11 Group B: Motor skills change in areas of dysfunction during each stage

GROUP B (AAB)	OT-ONLY STAGE		ILT-OT STAGE	
Motor Skills areas of dysfunction (n)	2 (n)		1 (n)	
Positive change (+)	2	100%	0	0
No Change (0)	0	0	0	0
Negative Change (-)	0	0	1	100%

4.3.2.2 Sensory discrimination Measured on the SPCQ section A-F. (Auditory-, Visual-, Vestibular-, Touch-, Multisensory- and Oral Sensory Processing.)

4.3.2.2 (a) Sensory discrimination change within Group A (ABA)

During the ILT-OT stage, Group A demonstrated 60% positive change in sensory discrimination areas of dysfunction. During the OT-Only stage, there was no change in 83.3% of the areas and no further positive change. Table 4.12 illustrates the percentage of change within Sensory Discrimination for Group A.

Table 4.12: Group A (ABA): Change in sensory discrimination areas of dysfunction

GROUP A (ABA)	ILT-OT STAGE		OT-ONLY STAGE	
Sensory Discrimination areas of dysfunction (n)	10 (n)		6 (n)	
Positive change (+)	6	60%	0	0
No Change (0)	4	40%	5	83.33%
Negative change (-)	0	0	1	16.67%

At the beginning of the ILT-OT stage, Group A had 10 areas of sensory discrimination dysfunction. These areas demonstrated a 60% positive change and reduced to 6 areas of dysfunction at the start of the OT-only stage. The OT-only stage demonstrated no further positive change, but rather a 16.67% negative change.

4.3.2.2 (b) Sensory discrimination change in Group B (AAB):

Within areas of dysfunction in sensory discrimination, the OT-only stage yielded a 25% positive change rate, which continued to improve to 58.82% positive change during the ILT-OT stage. During the initial OT-only stage, a 6.25% negative change rate occurred in anticipated areas. No negative change was observed during the ILT-OT stage. Table 4.13 illustrates the percentage of change in sensory discrimination for areas of dysfunction

Table 4.13: Group B (AAB): Change in sensory discrimination areas of dysfunction:

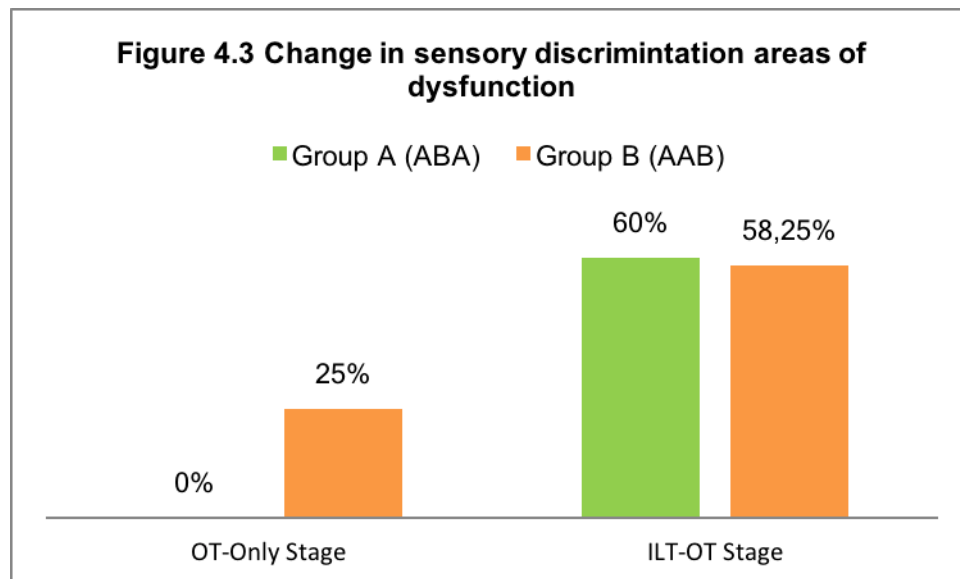
GROUP B (AAB)	OT-ONLY STAGE		ILT-OT STAGE	
Sensory Discrimination areas of dysfunction (n)	16 (n)		17 (n)	
Positive change (+)	4	25%	10	58.82%
No Change (0)	11	68.75%	7	41.18%
Negative Change (-)	1	6.25%	0	0

At the beginning of the OT-only stage, there were 16 areas of sensory discrimination dysfunction in Group B. The OT-only stage showed 25% positive change in areas of dysfunction, but there was also an increase in the number of areas of dysfunction to 17 at the end of the OT-only stage. The increase indicates that typical areas of sensory discrimination became areas of dysfunction during the OT-only stage. The ILT-OT stage showed a 58.82% positive change for sensory discrimination.

4.3.2.2 (c) Between group sensory discrimination change:

Positive change in sensory discrimination dysfunction during the ILT-OT stage for both groups was similar, i.e. 60% positive change for Group A and 58% positive change for Group B. Positive change was higher during the ILT-OT stage for both groups than the no change and negative change percentage. Figure 4.3 illustrates the difference in change for sensory discrimination dysfunction in each group during each stage.

Figure 4.3: Sensory Discrimination: Change in areas of dysfunction for both groups during each stage



4.3.2.2 (d) Conclusion regarding change in sensory discrimination:

Considering the high percentage of change within sensory discrimination for both groups during the ILT-OT stage, the ILT programme together with occupational therapy was considered to contribute to positive change in sensory discrimination.

4.3.2.3 Sensory modulation measured on the SPCQ section G-K. (Modulation of sensory processing related to tone/endurance, Modulation related to body position and movement, Modulation of movement affecting activity level, Modulation of sensory input affecting emotional responses, Modulation of visual input affecting emotional responses and activity level.)

4.3.2.3 (a) Sensory modulation change in Group A (ABA)

Group A's sensory modulation areas of dysfunction demonstrated a higher percentage of positive change during the ILT-OT stage (50%) in comparison to the OT-only stage (33.33%). Table 4.14 illustrates the change in sensory modulation areas of dysfunction during the course of the study.

Table 4.14: Group A (ABA): Change in sensory modulation areas of dysfunction:

GROUP A (ABA)	ILT-OT STAGE		OT-ONLY STAGE	
Sensory Modulation areas of dysfunction (n)	10 (n)		6 (n)	
Positive change (+)	5	50%	2	33.33%
No Change (0)	5	50%	3	50%
Negative change (-)	0	0	1	16.67%

At the beginning of the ILT-OT stage, Group A had 10 areas of sensory modulation dysfunction, which improved to six areas of sensory modulation dysfunction at the beginning of the OT-only stage. The ILT-OT stage showed improvement in 50% of the areas of dysfunction. The OT-only stage showed positive change in 33% of areas of dysfunction and negative change in 16.67%.

4.3.2.3 (b) Sensory modulation change within Group B (AAB):

Group B's sensory modulation areas of dysfunction showed a 57.14% positive change during the ILT-OT stage compared to a 42.86% positive change during the OT-only stage. Table 4.15 illustrates the change in sensory modulation areas of dysfunction during the course of the study.

Table 4.15: Group B (AAB): Change in sensory modulation areas of dysfunction

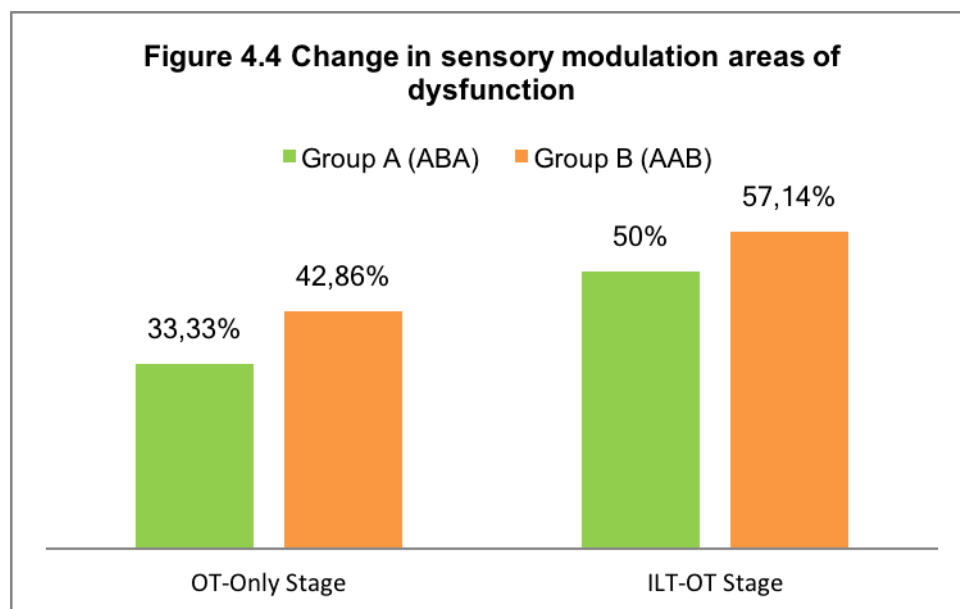
GROUP B (AAB)	OT- ONLY STAGE		ILT-OT STAGE	
Sensory modulation areas of dysfunction (n)	7 (n)		14 (n)	
Positive change (+)	3	42.86%	8	57.14%
No Change (0)	4	57.14%	5	35.71%
Negative Change (-)	0	0	1	7.14%

At the beginning of the OT-only stage, Group B had seven areas of sensory modulation dysfunction. This number doubled to 14 areas at the start of the intervention programme, which indicated that in spite of the 42.86% positive change in areas of dysfunction, typical areas demonstrated negative change during the OT-only stage. The ILT-OT stage had 57.14% positive change. The negative change will be elaborated on in Chapter 5.

4.3.2.3 (c) Between group changes in sensory modulation areas of dysfunction.

During the ILT-OT stage Group A demonstrated 50% positive change for sensory modulation while Group B demonstrated 57.14% positive change. During the OT-only stage, both groups demonstrated a lower percentage of positive change for sensory modulation. Figure 4.4 illustrates the change in sensory modulation areas of dysfunction for each group during the OT-Only stage and ILT-OT stage.

Figure 4.4: Sensory Modulation: Change in areas of dysfunction for both groups during each stage



4.3.2.3 (d) Conclusion on sensory modulation change within each group:

From these results, areas of sensory modulation dysfunction were positively affected when ILT was presented together with occupational therapy although the difference between intervention and the OT-only stage was not as great as in sensory discrimination.

4.3.2.4 Conclusion on Question 2:

A greater percentage of positive change was detected in sensory discrimination and sensory modulation when ILT was presented together with occupational therapy. The biggest difference between the OT-only stage and ILT-OT stage was found in sensory discrimination areas. The results on motor skill development were inconclusive.

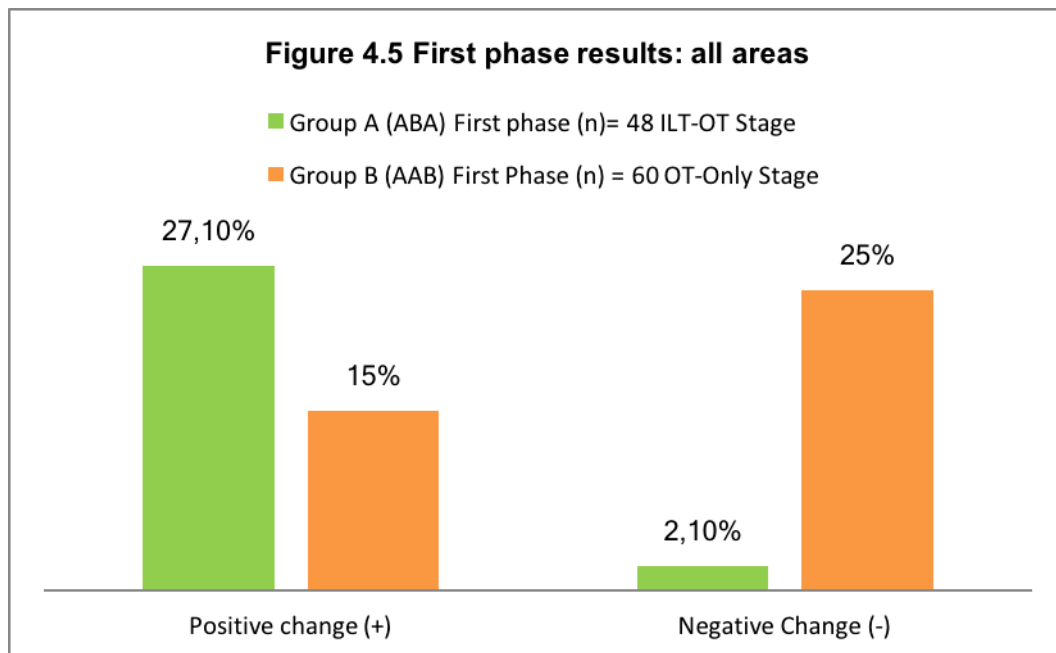
4.3.3 Question 3: When is the appropriate time to prescribe an ILT programme (i.e. at what point in therapy should the home programme be prescribed)?

To answer this question, the effect of a delay in programme implementation was investigated. Results pertaining to **areas of dysfunction and total number of areas (on the BOT-2 short form and SPCQ) at the end of the first phase** were compared to analyse the effect of a delay in programme implementation further. Results of the second phase were not included, as this includes results after withdrawal of a home programme. Trends of change after withdrawal are beneficial to make recommendations with regard to length of time for a home programme rather than timing of programme implementation.

4.3.3.1 Change at the end of the first phase (after the first six weeks) for both groups:

The results of the first phase in all areas, illustrated a higher positive change percentage of Group A (ABA) than for Group B (AAB). Of note, for Group B the negative rate of change is higher than the positive rate of change following the first phase. These results suggested that children would benefit from earlier programme implementation, to enhance the positive effect of occupational therapy. Figure 4.5 and Figure 4.6 illustrates positive and negative change in each group at the end of the first phase. Results of all areas (assessed as functional and dysfunctional at Baseline) are represented, as well as only areas of dysfunction at Baseline.

Figure 4.5: First phase (after the first six weeks) results for both groups: All areas (motors skills, sensory modulation and sensory discrimination.)



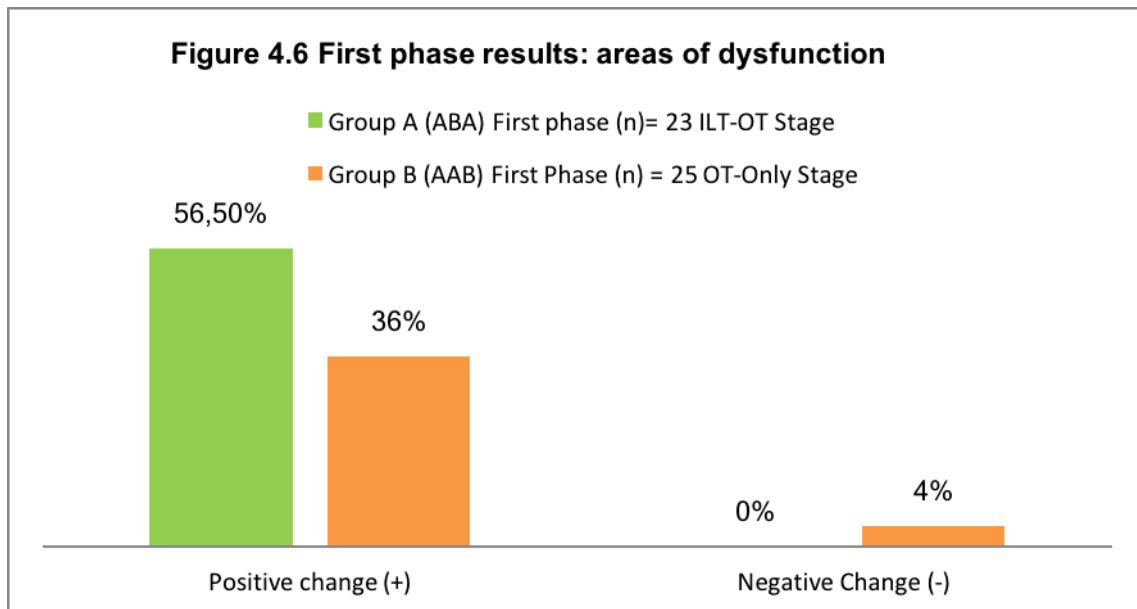
(Information calculated from raw data grids, at the end of the first phase of the study Appendix N and O) The SPCQ and the BOT-2 short form provided 12 areas per child that could be influence during treatment. With four members in Group A, the group had 48 areas to be monitored (n=48). With five members in Group B, there was 60 areas to be monitored (n=60). In all areas, Group A, who received the ILT-OT stage first demonstrated a higher percentage of positive change.

Group B who received the OT-only stage first demonstrated a 25% negative change, meaning 15 of 60 areas demonstrated negative change. Within Group B, 34 of the possible 60 areas demonstrated no change (56%) and 9 of the possible 60 areas demonstrated positive change (15%).

Group A who received the ILT-OT stage first demonstrated a 2.1% negative change, meaning 1 of the possible 48 areas demonstrated negative change. Within Group A, 34 of the possible 48 areas demonstrated no change (56.67%) and 13 of the 48 areas demonstrated positive change (27.1%).

Figure 4.6 illustrates change at the end of phase when within areas of dysfunction.

Figure 4.6: First phase (after the first six weeks) results for both groups: Areas of dysfunction



(Information calculated from raw data grids, at the end of the first phase of the study Appendix N and O) At the start of the first phase, Group A had 23 areas of dysfunction (n=23) and Group B had 25 areas of dysfunction (n=25). During that phase, Group A (ABA) demonstrated positive change in 56.5% of these areas, thus 13 of the 23 areas demonstrated positive change. During the first phase of Group A, no area of dysfunction demonstrated negative change and 10 of the 23 areas demonstrated no change (43.5%). During the same phase, Group B demonstrated 36% positive change in areas of dysfunction, thus 9 of the 25 areas demonstrated positive change. A single area of the 25 areas of dysfunction demonstrated negative change (4%) and 15 of the 25 areas demonstrated no change (60%).

4.3.3.2: Conclusion of Question 3:

The results suggest that earlier programme implementation could be recommended to enhance occupational therapy outcomes early on in therapy.

4.4 RESULTS CONCLUSION

This research project had three main research questions that are answered as follows:

4.4.1 Does the ILT home programme together with regular occupational therapy intervention contribute to positive change in the developmental skills of children (i.e. is there change)?

The current research results indicated that positive change during the ILT-OT stage did occur. The ILT programme together with occupational therapy supported the outcomes of occupational therapy to improve sensory processing and motor skills of children in the sample of the study.

4.4.2 If there is change, where does this change predominantly occur (i.e. in which skills)?

A greater percentage of positive change was detected in sensory discrimination and sensory modulation when ILT was presented together with occupational therapy. The results on motor skill development are inconclusive.

4.4.3 When is the appropriate time to prescribe an ILT programme (i.e. at what point in therapy should the home programme be prescribed)?

The current study suggests that early programme implementation may be more beneficial, to prevent negative change.

CHAPTER 5

DISCUSSION

The final section will review the research design and method. It will then discuss how the available research results contribute to answering the research aim and objectives. It addresses the question of whether or not ILT can be used as a home programme together with occupational therapy. It identifies the limitations of the study.

5.1 Introduction:

This research study set out to explore whether or not an ILT home programme implemented together with occupational therapy can enhance occupational therapy outcomes in motor skills and sensory processing skills. The timing of the implementation of a sensory home programme was investigated with the onset of therapy or later during the therapy process. An adapted form of randomised control trial using an alternate group intervention design with blind time-interval sampling and a minimally controlled sample was used. The intention was to allow for some of the real world application of outcomes research by having a more heterogeneous sample while still setting up a specific research intervention characteristic of RCTs and experimental research. As the project progressed, however, it became clear that the study design contained some flaws that were difficult to rectify once the project had started. One of the greatest obstacles was the difficulty of enrolling enough participants into the study to obtain enough data (a recognized problem with RCTs).(71-73) Secondly, the pre-test/post-test design of the alternate group intervention design did not allow enough exploration of the characteristics of the ILT home programme, or of the variables involved. There was not enough information previously published on what variables to measure nor how to measure them. This significantly influences the interpretation of the results. A discussion around the problems encountered in the study design will be discussed first before the trends detected in the study as the problems in study design influence the interpretation of results.

5.2 CRITIQUE OF THE STUDY

5.2.1 Problems with sample size:

During the execution of the research project, it became clear that recruiting a big enough sample for the alternate group design was going to be difficult. The original power calculation indicated that a minimum of 30 children were necessary for statistical calculation on the BOT-2 short form, yet only ten children could be recruited into the original sample and only nine children participated in the entire study. The need to have a large sample during the RCT and the difficulty in obtaining a large sample during RCT is a familiar critique against RCT.(71-73)

In other research projects centred on home programmes (not limited to occupational therapy) wherein the samples were large; 84 children (with Autism and unknown age)(20), 70 children (with diagnosed developmental delay and aged 6-48 months)(23) and 114 children (with diagnosed developmental delay and aged 6 years to 12 years)(51), recruitment was done at hospitals and rehabilitation centres. In one instance, there was a combination of 6 rehabilitation departments and 17 primary schools. The research recruitment period varied between two to three years.(20)(23)(51) The demand on the human resources needed to conduct a RCT with a large sample as well as the period needed to conduct a RCT with a large sample contributes to the difficulty in performing a RCT. The studies performed on the single sensory stimuli intervention strategies, (weighted vest, stability ball, auditory stimulation introduced in chapter one of the report) all had a sample size too small to generalise the results to the sample population.(19)(20)(22) The studies mentioned do not comment on difficulty in reaching sample, and only state that the results cannot be cross validated or generalised. From the studies looked at, there is a combination of studies with large and small sample sizes available, with no clear reason for the smaller sample in some studies.

The decision was made to stop recruitment after a year and to complete the project on the remaining nine participants. Since the ILT home programme is a new programme, it is considered sufficient to explore the use of the programme with therapy. However, during data analysis it became clear that the study design and chosen measuring tools did not allow for enough exploration of the different characteristics of the ILT programme. The small

sample size and heterogeneous nature of the sample participants, remain a limitation of this study.

5.2.2 Problems measuring change:

Initially, for the study to be an adapted RCT, predictions on where change would occur were made i.e. motor proficiency and sensory processing, based on what the programme claimed to treat. From the prediction of where change would occur, standardised measuring tools that would measure these changes in a research setting were identified, namely the BOT-2 short form, and the SPCQ.

(a) Measuring change in motor and sensory integration skills

Investigating change in motor proficiency using the BOT-2 short form during an adapted RCT, would have sufficed, as this would have measured overall motor skill. When exploring trends of change in motor proficiency, however, it would have been better to use the full BOT-2 assessment as this would have given scores for different components of motor skill (e.g. manual coordination, body coordination, etc.).⁽⁷⁵⁾ Unfortunately, the individual item scores on the BOT-2 short form are not aged normed individually; and thus could not be investigated, as this was not for what the research tool was designed. Furthermore, the BOT-2 did not measure an improvement in quality of movement: For example, the amount of body movements during the one-leg standing balance subtest is not considered, as it only measures the time stood on one leg. A child can show improvement by standing on one leg with a well-controlled posture instead of excessive body movements, but then be able to hold it for a shorter duration. Quality in posture during drawing and cutting is not measured nor the quality of the hand function skills displayed during these tasks.

Thus, the BOT 2 short form did not allow exploration on where change in motor proficiency occurred, how much change in certain areas of motor proficiency occurred or what contributed to that change. In retrospect, the Movement Assessment Battery for Children – 2 (Movement ABC-2) would have been more effective in exploring change in motor skills as the scoring sheet offers check boxes for observations on movements as well as a standardised score for subtests.⁽⁶²⁾⁽⁸⁵⁾ This test can be administered on children aged 3-16

years. It assesses manual dexterity, aiming, catching, and balance.(85) This would have offered a measurable objective manner to investigate change in motor skill development.

The measurement of sensory integration skills also posed some difficulties. The SPCQ is frequently used within South African occupational therapy practice to screen for sensory processing and modulation problems. However, the use of the tool to measure change in sensory integration abilities is not documented. The difficulty in detecting change in sensory processing with this tool might be because it was not designed for this purpose; it was not designed to detect small change in sensory processing that will indicate improvement over a short time.(80-84)

The SPCQ is dependent on the honest and reflective answers of parental observation on child behaviour and does not measure, for instance, touch processing objectively, but rather relies on subjective observations of parents and child behaviour. It provides cut scores and categories, but not aged-normed scores. The change measured is the change in perceptions of the parent when evaluating the child's behaviour. This could be problematic as parents came from different educational backgrounds and likely had different perceptions of what their children should be doing, according to the age and in which developmental level they were.

In addition, the small sample size as well as the heterogeneous nature of this small sample makes it difficult to generalise results obtained on the SPCQ to a larger population. As the SPCQ is not norm referenced, it does not account for the difference in sensory processing skills of children at different ages, nor does it account for the difference in rate of change that can be expected from children at different ages.

From these difficulties encountered with measuring change in occupational therapy outcomes with the SPCQ and the BOT-2 short form, it became clear that these tools do not measure the actual outcome of occupational therapy.(75)(79) As occupational therapists we are not only concerned with motor skills and sensory processing (aspects of performance skills), but rather a broader possibility of aspects that influences occupation performance. These aspects can range from client factors (e.g. self-esteem), performance skills (e.g. emotional regulation, cognitive skills, communication and social skills), performance patterns (e.g. habits, routines and roles), context and environment (e.g. temporal, virtual, cultural,

etc.) as well as activity demands (e.g. sequencing and timing, social demands).(4) Occupational therapy intervention will be directed to improve areas of dysfunction within any of these domains that are problematic. The measurement of change in only these aspects, could then ultimately lead to not all outcomes of occupation therapy being measured.

Using Goal Attainment Scaling (GAS) could have assisted in measuring change within the identified areas of concern for each child during each phase of this study. Originally, GAS was developed for use on an adult population within the mental health system. GAS was utilised to engage them in the goal-setting process. The client forms part of the process of identifying a goal and measures the outcome of goal attainment after a pre-determined time, on a five-point scale. The scale ranges from -2 to +2. A score of -2 indicates that much less of the expected outcomes was reached (performance that is likely to occur approximately 7% of the time and includes regression and only minor changes). A score of -1 indicates that the desired performance is reached 21% of the time, but is less than the ideal for the treatment period that has passed. A score of 0 indicates that the goal was met in a satisfactory manner, and occurs about 43% of the time. A score of +1 indicates progress, to some extent, was made in reaching the expected outcome. A score of +2 indicates that much more of the expected outcome is met. GAS has been used as a process of goal setting with a paediatric population as part of the client centred approach and is considered an effective measure of occupational therapy outcomes due to the individual nature.(34)

However, the use of GAS relies on a well-trained clinician and can become time consuming when goals are set and measured. With the variation in GAS that can occur, it becomes difficult to generalise research results.(1)(34) If an argument is made that GAS should have been used, a counter argument of equality in difficulty in goals that should be met between individuals can be counter argued and difficulty in replicating the current research study arises. It is also difficult to use GAS if there is uncertainty about where a specific programme will bring about change as the goal would have to be set in relation to pre-identified areas of change.

An assessment tool that was considered lacking in the current research study was a measurement instrument that measured age appropriate participation in the occupation of education. Especially as standardised assessment results did not consistently portray reported areas of concern. However, such a measuring tool does not currently exist within the paediatric scope of practice. This research study highlights the need (and importance)

for an assessment tool that measures both strengths and weaknesses of children on a continuum scale, as well as the need of an outcomes measure within occupational therapy.

Furthermore, both parents and participants could have been discouraged to perform the same assessment measures consecutively over a short period of time, which will affect the test-retest reliability. To obtain an accurate concept of motor skill performance on the BOT-2, a child would be expected to perform the task at his/her best effort. However, if a task is mastered by a child, he/she could be discouraged to do it again or if a child knows he/she will fail at the task, he/she might be discouraged to attempt the task. The parents completing the sensory profile might be discouraged as it is quite lengthy and requires honest reflection on their child's behaviour.

The results of this research should be considered with these limitations in mind.

(b) Measuring the characteristics of home programmes

From the literature review of this research(6)(23)(25)(55)(56), the researcher was left with the following criticisms and limitations surrounding the implementation of home programmes:

- Clarity on the duration a programme must be implemented to make measurable gains was vague and varied between eight and twenty weeks in these studies.
- Information on the length of time that should be spent per day in participating in the home programmes was not provided consistently. One study recommended 16.5 minute per day, 17 days per month over two months and another recommended 15 minutes per day over 20 weeks.
- The content of the home programmes was not described in these studies, which made it difficult to evaluate the type of activities prescribed.

It was considered that a home programme diary, completed by parents could attribute to shedding light on some of these aspects e.g. the amount of activities done per day and how many days a week it was performed. However, the home programme diaries were not returned and this information could not be derived. This may have been due to a poor design of the home programme diary. A checklist could have been more suitable as it would have improved the ease of use.

(c) Conclusion:

The original study design and chosen measurement tools based on predicted areas of change did not allow for more exploration of the use of the ILT home programme with occupational therapy. It did not explore all aspects that could influence occupational therapy outcomes and was ultimately limited to monitoring trends of change in sensory processing of children participating in the ILT home programme while receiving occupational therapy.

Thus, the research study was not exploring the characteristics of the ILT home programme or the patterns of change in motor proficiency. It would be useful to attempt outcomes research in the future using a variety of measurements in order to explore what type of children are best suited for the ILT home programme, what variables need to be measured and how easy/difficult/useful the programme is for parents to complete.

5.3 SAMPLE DEMOGRAPHICS:

5.3.1 Difficulty in meeting the Sample

After a year after of data collection, the research project had only 10 participants. During the research period that had passed, the researcher could not expand her practice by more than 10 participants, due to study obligations and full time work. In the year period that had passed, an attempt was made to reach the required sample by approaching two occupational therapy practices within schools, but these efforts were met with resistance which was why the population remained limited to the researcher's practice.

5.3.2 Discussion of sample demographics

The median age of the two groups differed by more than a year with a smaller age range and younger members in Group B. All participants attended mainstream schools, with only one participant in Group A, who was a year behind his chronological age group in grade.

Both Groups were considered to be in Erikson's psychosocial developmental stage of industry vs. inferiority (5 years to adolescence). This stage is considered the optimal period for individuals to acquire and refine new skills such as motor skills and sensory processing skills.(86) At the baseline assessment, a difference in skill acquisition between the two groups was observed.

a) Motor skills at Baseline:

When assessed on the standardised assessment, not all children included in this research study had limitations with motor skills. In three cases, this was contrary to the parent and teacher report on the particular child's motor abilities in for example a playground or music room session. The reason for difficulty with motor skills in these children were related to the use of motor skills in a specific environment i.e. in rhythm with music and manoeuvring over large playground equipment, thus not with a specific motor skill ability but with the application thereof. These scenarios emphasise the role that occupational therapists play when assessing beyond performance skills, to identify the reasons for concern in a child's performance.

From those participants who demonstrated motor skill dysfunction, Group A had a single participant who was two standard deviations below the mean of 50. Group B did not have such a participant, which illustrates the difference between the groups with regard to motor skill at Baseline. Group B had three members with no motor skill dysfunction, one member who was one standard deviation below the mean of 50 and one participant who was below the mean of 50, but not a full standard deviation below. Group A had only one member who met the mean of 50. The two remaining members in Group A were below the mean of 50, but not a standard deviation below. (Refer to Table 4.3 and Table 4.6 for a visual guide on how the two groups differed in their motor skills abilities at Baseline.) From the Baseline comparison, Group B's members had better developed motor skills at Baseline than Group A and there was a difference in acquired motor skills between the two groups. The encountering of the ceiling effect of the BOT-2 and the lack of reflecting quality of movement that depicts refinement of skill development was an area of concern during this research study. It may thus be possible that the BOT-2 does not truly represent the motor skill abilities of the participants during this study. (Refer to section 5.1 limitations of this research study.)

b) Sensory integration skills at Baseline:

All participants demonstrated sensory integration dysfunctions, but the rate of children with sensory discrimination and sensory modulation varied slightly between the two groups. In Group A, the rate for sensory discrimination dysfunction was 2.5 areas of sensory discrimination dysfunction per child. In Group B, this rate was 3.2 areas of sensory discrimination dysfunction per child. The high rate of sensory discrimination dysfunction in Group B, highlights the possibility that motor skill abilities as assessed on the BOT-2 short form, does not accurately reflect the motor skill abilities of the participants, as poor sensory

discrimination is often associated with poor motor skills⁽¹⁵⁾⁽⁴⁴⁾. It is contradictory that the group with the higher rate for sensory discrimination dysfunction was measured to have better developed motor skills. Group A, the rate for sensory modulation dysfunction was 2.5 areas of sensory modulation dysfunction per child. In Group B, this rate was 1.4 areas of sensory modulation dysfunction per child. (Refer to Table 4.2 and Table 4.5 for a visual guide on the sensory integration difference between Group A and Group B).

With limitations in measuring motor skills and the variability that occurred between the areas of dysfunction between the groups (i.e. Group A more areas of dysfunction in motor skills, Group A higher rate for dysfunction with sensory modulation, Group B a higher rate for dysfunction in sensory discrimination) it remains difficult to compare the two groups to each other. However, all participants were referred to occupational therapy for valid concerns related to scholastic performance (inclusion criteria), which is essential in the occupational area of education.⁽⁴⁾ It may have been presumptuous to implement a sensory based –home programme without setting sensory processing difficulties as inclusion criteria of the study. However, occupational therapy intervention was indicated for each child based on the comprehensive evaluation performed for each child and the ILT evaluation indicated a need for the ILT programme for each child. Furthermore, the standardised test used does not represent all areas assessed during the comprehensive occupational therapy assessment and a limitation of the study is that it does not depict the full assessment and intervention of each child. Parental / caregiver concern and/or teacher concern validated the reason for referral. Within an occupational therapy practice, there is no control over the level of skill development of a child; meaning that a child does not have to have poor standardised tests scores to be eligible for intervention, as standardized assessments do not measure all occupational therapy domains. All children, regardless of their skill development level as assessed by a standardised test, is eligible for intervention if a concern related to their abilities to participate in an area of occupation exists.⁽⁴⁾⁽¹³⁾ If a child has poor performance in education (area of occupation); occupational therapists will intervene even if standardised test scores reflect age appropriate abilities. The aim of intervention may then include finding the cause for poor school performance and referring to the relevant expert or addressing aspects such as socialisation at school and adjusting to the school routine, which also forms part of the occupation of education. Both groups represented children, with scholastic concerns from families requesting additional assistance. Furthermore, each participant in both groups, received a personalised home programme and individual occupational therapy intervention, designed to meet the needs of the child's difficulties and designed to meet the needs and abilities of the families. Each child acted as his or her own control; i.e., did he/she demonstrate improvement in individual areas of dysfunction. However, because of the

differences between the demographics for the two groups, only trends of change could be reported.

c) Limitation of the sample

Due to the small sample size ($n=9$), the results cannot be used to draw a firm conclusion regarding specific approaches i.e. the impact of an ILT home programme on child development, but rather represents these two groups' responses to the implementation of the ILT home programme and the research programme. Unfortunately, statistics of sensory integration and motor skill abilities (as assessed on standardised tests) of children seen in occupational therapy for scholastic / learning difficulties within South Africa were unobtainable from the Occupational Therapy Association of South Africa (OTASA), the World Federation of Occupational Therapy (WFOT) as well as from the World Health organisation (WHO) websites. In that light, it remains unknown if these results can be compared to a larger population of children who receive occupational therapy intervention. Research studies providing information on practice demographics could not be found. Through an informal census (telephone calls to ten occupational therapists working within paediatrics in the Gauteng region), paediatric practices in Gauteng receive between 10-15 new children per therapist per annum into their practice.

5.4 RESEARCH QUESTIONS DISCUSSED

5.4.1 Question 1: Does the ILT home programme together with regular occupational therapy intervention enhance occupational therapy outcomes in sensory processing and motor skills?

The research results indicated that the ILT home programme does enhance the outcomes of occupational therapy to enhance sensory processing and motor skills.

The positive change in the ILT-OT stage and OT-Only stage was compared using a Chi Square analysis. There was a significant difference between these two stages (Chi-Square = 10.7, $df = 1$, $p = 0.0011$). The addition of the ILT home programme to regular occupational therapy following a sensory integration approach has the potential to enhance occupational therapy outcomes.

The positive results obtained were attributed to three possible factors that will be discussed hereafter. Of importance is that it should be remembered that areas of change were

predicted and a standardised assessment tool that was selected to measure a specific area (i.e. motor skills and sensory processing), based on the areas that the ILT programme claim to address through treatment.

With the prediction made, not all areas of actual change were measured. Due to poor control over all external factors, all possible reasons for change are discussed, as poor control over external factors limits the degree to which change can be attributed to the ILT programme.

- a) The value of a home programme used together with occupational therapy
- b) The impact family involvement has on child development
- c) The process of home programme implementation (as compared to Novak's model) that was followed during the current study

a) The value of a home programme used together with occupational therapy

The results of this research study agree with others that the use of a home programme enhances occupational therapy outcomes.

Within occupational therapy, therapists often prescribe home programmes to develop or stimulate certain skills within a child or to enhance participation in specified areas of daily living that needs to be incorporated into a family routine.(53) The value of the use of home programmes within occupational therapy is evident in studies with children diagnosed with intellectual disabilities where a 20-week programme contributed to improved fine-motor activities (writing, drawing and object manipulation).(51) When an eight-week home programme was used with a population of children with Cerebral Palsy, gains were made in occupational performance as identified through GAS.(25) Positive results for development of cognition ($p=0.015$), language ($p=0.010$), motor ($p=0.0$) and social functioning ($p=0.038$) in children (aged 6 months – 4 years) occurred when a structured home programme was implemented together with occupational therapy for a period of twelve weeks.(23) This study showed similar patterns to the literature and indicated that the implementation of the ILT home programme together with occupational therapy may enhance occupational therapy outcomes. This study contributes to the literature by showing evidence for home programmes benefiting different populations from those already studied, namely a population of children attending mainstream schooling with educational difficulties as opposed to intellectual difficulties or physical difficulties. This study focused on the measurement of skills rather than occupational performance and the results indicated that adding a sensory-based home programme could positively affect the development of sensory integration skills. It can be speculated that the increase in exposure to sensory

enhanced activities (through the ILT sensory based home programme) within the home environment, outside of hands-on-therapy, contributed to positive change in sensory integration skills of children as this contributes to a higher dosage of intervention.(12)

By definition, “Sensory based activities occur in the child’s natural environment and consist of applying adult-directed sensory modalities to the child with the aim of producing short-term effect on self-regulation, attention or behavioural organisation.” (1) (pg. 2) Despite the critique against the use of sensory based activities, such as: auditory stimulation(19), therapy ball chairs (20), deep pressure, weighted vests (21) and stability balls(22) this study provided support for the use of a sensory based home programme (as a whole) in conjunction with occupational therapy. The strategies investigated in the supporting literature contributed to a positive effect in aspects that contribute to improved school performance. In this study, the use of the ILT home programme followed the positive trend of change documented in these studies for aspects (skills) that, according to sensory integration theory, support improved educational performance. This research study did not measure an aspect of education performance, which may have contributed a valued view on the influence of the programme. Nor did this research study include a diagnostically defined population, which may provide support for generalising the belief that enhanced sensory stimulation improves skill development in children.

Whenever change is measured in research, some thought must be given to the placebo effect. The placebo effect refers to treatment that is offered, that brings about change, purely due to the belief that it will and not due to the therapeutic nature of the treatment. This means that the extra attention and focus on certain activities has the potential to enhance performance automatically due to factors outside of the therapeutic nature of the activities.

During v.d. Merwe Bothma’s study, the effect of the ILT movement sequence had on the development of a South African population of hearing-impaired children (aged 4-8 years) was investigated and measured with the Griffiths Scale of Mental Development. Results from v.d. Merwe Bothma’s study indicated improvement in locomotor functioning, performance-related abilities, and practical reasoning skills in the sample population. Van der Merwe Bothma however indicated that low levels of improvement and similarities of improvement was found between the intervention and control group (who participated in games including building puzzles, throwing balls, storytelling etc.), implying that a significant difference in change between the intervention group and control group’s trends of change did not occur.

Thus, in this study, the ILT programme was no more effective than regular activity participation and thus the increase in skills could not be attributed directly to the ILT programme. This finding adds argument to critique against movement programmes, where the placebo effect is considered as reason for change in children participating in movement programmes(26).

Hence, the question arises: were the differences observed in this study due to the nature of the ILT home programme itself, or would any activities have been just as good, as demonstrated in the v.d. Merwe Bothma study? This question is difficult to answer as this study had limited control over external factors that could attribute to the changes observed. Information about how and when the ILT home programme was implemented was not collected and there was no control group that did non-prescribed activities with the family that could investigate the influence of family involvement on occupational therapy outcomes, since a child's motivation to develop arises from his/her family.(52) This will be discussed in more detail in the following section.

b) The impact family involvement has on child development

The collaborative relationship between the therapist and parent, where the therapist relies on the parent/caregivers knowledge of their child's behaviour, stems from a family-centred approach. From this approach, the family is considered to have a key role in the intervention process, as they know the child best. During the current research study, the parent/caregiver knowledge on behaviour was essential to identify areas of dysfunction from which an individualised home programme was developed. Furthermore, the family and early caregiving can be considered key in motivating the process of development as it is believed that a sense of attachment is needed from where a child develops the need to explore an environment, which enhances his/her development. Therefore, it is hypothesised that the motivation to develop occurs within the context of supportive and consistent caregiving interaction.(52)(54)

During this research study, it was expected from parents/caregivers to perform a home programme with the child during a one-on-one session. Thus, both the parent/caregiver and the child were involved in a task unique to their relationship. This task was not part of the daily routine; it was added to daily routine, which could contribute to a child's sense of

importance in his/her caregiver's life. It is thus hypothesised that the one-on-one time that was spent on a unique activity contributed to developing a sense of attachment between the child and the parents/caregivers, from where the child experienced a motivation to develop. From this hypothesis the newly found motivation to develop, which possibly contributed to the positive changes seen in sensory integration abilities, can be due to an increase in family involvement brought on by the home programme prescribed.(47)(76)

This hypothesis is supported by other research studies that are of opinion that parental involvement in treatment (rehabilitation) is the reason for goal achievement as opposed to the home programme itself.(87-89) The observed improvement in sensory processing skills can be purely due to a child's motivation to develop (related to family involvement) and not just the ILT activities. To distinguish between the two, it would have been beneficial to also assess an aspect of development, not addressed directly by the home programme, but that remained an area of concern for an individual child, for example communication skills. By measuring an area not addressed by the programme, it would be possible to compare the change that occurred in the two areas. It would be expected that parental involvement would affect both areas, whereas the sensory-based home programme would only address aspects of sensory processing. As the study did not offer a control for the affect family involvement could have had, it cannot be excluded from the possible reasons for change. Thus, the change observed can be either due to the ILT home programme or due to the increased family involvement. The change that could occur due to increased family involvement is seen as the possible placebo effect.

c) The process of home programme implementation followed during the study

The positive change that occurred could also be due to the process of home programme implementation that was followed. This process was similar to Novak's model (described in section 2.4.4) and could provide support for the use of Novak's model.(24)(30)(60)

During the current research, the support phase (phase four) differed from the recommended ILT programme. From an ILT approach, therapists do not direct interaction but rather encourage parents to initiate contact after the activity check, should questions arise. During the current research, weekly face-to-face feedback occurred as the children received weekly occupational therapy. For those in the school-based intervention programme, feedback occurred at least once every second week via a text message or email. It supports Novak's emphasis on support that needs to be provided during the implementation phase. Furthermore, in contrast to the ILT process outside of the research study, the ILT

programme as applied during the current study did provide a reassessment on standardised measures at the end of the programme. The reassessment results provided parents with feedback on the progress of their efforts. The value of the reassessment results illustrated the value of Novak's recommendation that goals on desired outcomes must be set prior to programme implementation, during phase two, which may also have a positive effect on adherence to home programmes.

An area of difference between Novak's recommendations and the ILT programme implementation was that a firmly established collaborative relationship did not exist prior to programme implementation, but rather developed as part of the programme implementation. Novak's recommendation on the establishment of a collaborative relationship prior to programme implementation is similar to the Alert programme and Sensory Diet where a collaborative relationship needs to be established to ensure successful programme development and implementation.(17)(18)(24) The results of the current research do however suggest that perhaps a collaborative relationship is not an essential part, if the programme characteristics support successful implementation and may in fact contribute to the development of a collaborative relationship.

5.4.2 Question 2: If so, where does this predominantly occur (i.e. in which skills)?

Assuming that it was not only family involvement (the placebo effect) that attributed to change, but likely that combination of the parental involvement and the ILT home programme (sensory based home programme), the next section will elaborate on where the change occurred and why it is thought that change occurred in these areas.

Positive change (enhanced occupational therapy outcomes) occurred in sensory discrimination skills (Group A: 60%, Group B: 58.25 %) and sensory modulation skills (Group A: 50%, Group B 57.14%) of both groups. The results regarding the effect the ILT home programme had on motor skill development was inconclusive due to the small sample size. It will not be discussed in detail.

The change that was observed in these areas are attributed to the types of activities in the ILT home programme.

The ILT activities, in contrast to the Sensory Diet (18) and Alert programme (17) that ideally stretches across a full day, are designed to be short: six to nine activities are carefully selected from the activity manual to last only 15-20 minutes per day. Parents and children can choose if all activities should be done in a single time slot, or during the course of a day, to remain flexible to a family's lifestyle. If a stress response occurs during the activity, it is stopped. This is opposed to the Alert programme where a parent needs to select an appropriate activity to reduce observed physiological stress observed during the day. As a result, if during ILT, an activity is not experienced as playful and children are stressed by the presentation thereof, it will be stopped. The ILT programme did not rely on parents to have an understanding of their child's sensory thresholds that needed monitoring and regulation during the day as with the Alert programme. Parents did not have a need to self-select an activity best suited to regulate arousal level (from pre-identified activity options). Nor did the ILT programme place a burden on parents to ensure their child received enhanced exposure to sensation during the course of a day as with the Sensory Diet. In contrast to these demands on parents, the ILT programme is structured by the therapist, who taught the parents to perform the programme, presented a typed text as reference and who provides the parents with the needed equipment to ensure swift programme implementation. It can be seen as a programme focused less on addressing sensory modulation concerns and focused more on improving sensory discrimination.(17)(18)(60)

The results obtained during the current research, indicate the possibility that perhaps it is also beneficial to construct activities that do not place as much responsibility on parents with regard to selecting the appropriate activity at a specific point in time. The results further indicate the possibility that a home programme does not have to merge into an already structured daily routine. It creates the possibility of developing short (15-20 minute) home programmes that can be done as a unit at one point during the day or in small fragments during the day, but not as part of a daily routine. A home programme then becomes an extra activity, in its own right, but requires less 'throughout the day planning' to implement the programme. The possibility of utilising a home programme as an independent activity and not combined with routine activities, should not be misunderstood with programme rigidity, as a family can still decide when during their day the activities can be performed. The parents can decide on the length of time they have to spend on the activities, and the programme can be adjusted to suit the time and routine needs of the family. This flexibility is likely to provide parents with a sense of control over and involvement in the programme instead of feeling overwhelmed by the responsibility of performing the home programme.

The positive view of the programme will again aid in improving adherence to the programme, especially if the parents were not involved in creating the programme. (60)

The current research study originally aimed at including home programme diaries, to assist with adherence but these were either not completed or never returned. This was possibly due to the expectation that activity names be written out instead of checked off. From the current research study, face-to-face time, email or text messaging proved effective to assist with programme adherence. However, comment on actual home programme adherence and how this affected the results as well as further comment on the amount of times a programme should be performed per week to contribute to the observed positive changes, cannot be made. Thus, the current research study failed to elaborate on programme characteristics in this area.

5.4.2 Question 3: When is the appropriate time to prescribe an ILT programme (i.e. at what point in therapy should the home programme be prescribed)?

With the detected positive change that occurred during the ILT-OT stage, it has to be noted that there was a difference in the trends of change between the groups. Both groups demonstrated negative change during the OT-only stage. This was an unexpected result and speculations as to why the negative change was seen will be discussed below.

a) Negative change in Group B with the onset of therapy, during the OT-only stage:

Group B, who received the OT-only stage first, demonstrated a 25% negative change (across all areas, including typical areas) while only 15% positive change was measured during the first phase. In comparison, Group A demonstrated only 2.1% negative change in all areas (including typical areas) during the first phase (1 of 48 area), when the ILT programme was implemented during the first phase. (Refer to Figure 4.5 and Figure 4.6 for a visual illustration of the negative changes.) This was an unexpected result as the prediction was that both groups would show improvement (as both groups had a form of intervention), but that Group A may show more improvement than Group B in the first phase of the study as they would have the added intervention of the ILT home programme. It was certainly not expected that one group would show more dysfunction at the end of the first phase than at baseline and this caused some alarm. It is possible that the negative change was amplified

by the small sample size as well as the heterogeneous nature of the sample and may not be as noticeable within a larger sample. However, some explanation of this result is necessary with suggestions for future investigation of this phenomenon.

The first possible reason for this negative change relates to the way the SPCQ measures sensory processing and modulation. The questionnaire infers dysfunction in different sensory areas based on reported behaviours. Behaviour in itself is a complex concept and is influenced by a number of different factors. Particularly in children, where the ability to verbalise feelings is immature, behaviour can indicate changes in levels of comfort.(45) At the onset of therapy, it is possible that an increase in discomfort was experienced by some of the children as areas showing dysfunction were challenged. Children experienced a change in their weekly routine, and adapting to a therapy environment, which placed demands on areas of dysfunction. These changes, within a population with vulnerable sensory integration abilities, could place a higher demand on their adaptive behaviours(2) and result in deteriorating behaviour due to a feeling of discomfort. They may demonstrate behaviours that are more undesirable or acting out, which affects performance on the SPCQ as the SPCQ relies on observations on behaviour.(45)(46) It is also possible that particularly older children will become more aware of their difficulties when they enter therapy and may experience discomfort in the initial stages of building a therapeutic, collaborative relationship with the therapist. This deterioration of behaviour might be picked up by the SPCQ (as the parents are reporting on behaviour in this questionnaire) and might possibly incorrectly be interpreted as a decrease in sensory integration abilities. This phenomenon of decline in behaviour before improvement has been reported in psychology in relation to behaviour modification programmes, but no evidence for changes in skills and behaviour following the implementation of an occupational therapy intervention could be found.(45)(46) This could be because of the shortened period for formal reassessment (6 weeks) of behaviours.

The children in Group A also had to adapt to a change in their weekly routine and the therapy environment, which placed new demands on areas of dysfunction. However, with the implementation of a home programme, additional exposure to sensory-based activities were provided, assisting with achievement of adaptive behaviours within a shorter time. Thus, the discomfort felt by this group may have been less. Furthermore, the added home programme encouraged family involvement and support which may decrease a child's experience of discomfort.(45)(46) As the child may feel a renewed sense of parental support. There is also the possibility that parents may experience positive feelings when implementing an easy home programme and may therefore be more inclined to evaluate

subsequent behaviours more positively than those who do not have this experience. As the SPCQ depends on parental perceptions of their child's behaviour,(79) this could also influence the patterns of change noticed in phase 1 of the study.

An additional explanation for the unexpected desirable pattern of change could be the Hawthorne effect. The Hawthorne effect occurs when there is change in people's behaviour, due to the interest taken in them. Thus, when parents knew the home programme period is coming, it is possible that they did not want to indicate positive change prior to participation in the programme, as they only anticipated change at a later stage. Thus, the negative change could have occurred as they waited for the ILT home programme and positive change could have been noted as they anticipated it to occur.(74)

b) The negative change observed in Group A, after the withdrawal of the ILT programme, during their OT-only stage:

The observation made on the different trends of change within the two groups i.e. group A demonstrated negative change after withdrawal of the ILT home programme, may suggest that a follow-up ILT home programme may be needed or a follow-up programme with a Sensory Diet or the Alert programme.(17)(18) The deterioration could suggest that skills were not adequately established. Alternatively, it supports Watling et al.'s (2015) view that sensory-based activities result in short lived improvement of self-regulation, attention or behavioural organisation. However, it is part of the ILT approach to present a more difficult home programme after six weeks to continue improvement in the areas of dysfunction. ILT currently recommends that home programmes can last between six and twelve months. The length of time recommended by the ILT programme thus supports the notion of a dosage of intervention that is necessary to create lasting sensory integration changes.(12)(30)

c) Conclusion on timing

The current research study results suggest that earlier implementation may be more beneficial than a delay in programme implementation. Novak suggests that prior to implementing a home programme a collaborative relationship should be established, but perhaps the collaborative relationship can develop with the programme implementation and not be a pre-requisite(24), especially when that home programme (such as the ILT home

programme) does not require in-depth knowledge of sensory integration abilities and threshold for response. The current research study results also suggest that to maintain gains, home programmes must be continued throughout the therapy period. It would be interesting to investigate the use of an in-depth Sensory Diet or the Alert programme, as a follow up to the ILT home programme.(17)(18)

Further research on the phenomenon of negative behavioural change at the onset of occupational therapy as reported in this study is needed in order to determine whether this is a real phenomenon (as seen in psychology) or an artefact of the small, heterogeneous sample of this study.

5.5 DISCUSSION CONCLUSION

The aim of this study was to describe the change that may occur in the developmental skills (sensory processing and motor skills) of children, aged five to eleven years, when they participate in an ILT home programme together with weekly occupational therapy and to investigate issues such as timing of intervention.

The current research study results suggest that ILT presented together with occupational therapy bring about positive change in sensory integration. Results pertaining to motor skills are inconclusive. The positive change is attributed to an increase in sensory stimulation during the day, family participation that support child development, the process that was followed to implement the programme as well as the characteristics of the ILT home programme.

From the current research study, children benefitted most if the home programme was implemented with the onset of therapy. However, the duration of the programme should be longer than six weeks.

CHAPTER 6

CONCLUSION

Within this chapter, the study conclusion is reviewed. Limitations of the study are discussed. Recommendations for the use of home programme within a therapeutic environment are discussed and recommendations for future research are made.

6.1 CONCLUSION

This research study investigated the possibility of using ILT programme (sensory-based activities) as a home programme to enhance occupational therapy outcomes. ILT is a sensory based home programme developed by a South African (Dr S Kokot) for children with special learning and behavioural needs. Sensory based activities include adult directed activities, performed in the natural environment of the child with the aim of producing a short-term effect on self-regulation, attention, or behavioural organisation.(1)

An adapted, alternate RCT, with blind time-interval recording was used to describe the effects ILT together with occupational therapy has on the sensory processing and motor skills of children aged 5 years to 11 years. A sample of nine children was used in this pilot study. Each child participated in the ILT-OT stage and acted as his/her own control. The study produced ordinal data and descriptive statistics were used to understand the trends of change. The results suggested that ILT presented together with occupational therapy showed a higher percentage of positive change in areas of dysfunction in comparison to OT-only. Change occurred predominantly in the sensory discrimination and sensory modulation abilities of the children. The results on the influence the ILT home programme together with occupational therapy had on motor skill development were inconclusive, due to the small sample size and lack of test sensitivity. The current research study indicated that earlier implementation of a home programme may be more beneficial than a delay in programme implementation.

6.2 RECOMMENDATIONS FOR THERAPY

From the current research results, occupational therapists are encouraged to implement home programmes to increase time spent participating in sensory-based activities. Home programmes can be implemented sooner to contribute to a more favourable pattern of change in sensory processing areas of dysfunction.

6.3 RECOMMENDATIONS FOR FUTURE RESEARCH

The implementation of this research study resulted in the need to explore new interventions extensively before attempting the design of highly controlled RCTs. The difficulty in measuring change objectively during this research study emphasises the need to define the variables that could indicate positive outcomes within paediatric occupational therapy. Measurement tools that are sensitive to change and measure the right kind of change are needed in order to further research within paediatric occupational therapy. Only once variables have been defined and sensitive enough measurement tools have been developed, can the efficacy of a new intervention be determined.

The characteristics of home programmes that are preferred by families should be investigated. Characteristics such as ease of performance, preference for activities, amount of activities and the realistic amount of days per week a programme can run, should be investigated. It should be explored whether families prefer activities that form part of the daily routine or activities that are done as an additional activity. To further research on home programmes used in occupational therapy, Novak's model can be applied on different diagnostic populations using different types of home programmes to identify if the suggested model can be generalised as a guiding model for home programme implementation within occupational therapy.(24)(25)(58) Research on the effect of the Sensory Diet(18) and the Alert programme(17), presented as a whole (and not just single activities), are needed to support the use thereof in practice. Future research on types of home programme diaries or electronic devices or electronic applications to improve adherence to home programmes will be beneficial.

Reference List

1. Watling R, Hauer S. Effectiveness of Ayres Sensory Integration® and sensory based intervention for people with Autism Spectrum Disorder: Systematic Review. *The American Journal of Occupational Therapy*, 2015; 69(5): 2 - 12.
2. Bundy AC, Murray EA. Sensory integration: A. Jean Ayres' theory revised. Lane SJ, Murray EA, Bundy AC. (Eds) In: *Sensory integration theory and practice*. 2nd edition. Philadelphia, PA: F.A Davis Company; 2002, p. 3 - 33.
3. Parham LD, Mailloux Z. Sensory integration. J. Case-Smith (Eds.) In: *Occupational therapy for children*. 4th edition. St. Louis, Missouri: Mosby; 2001, p. 329 - 380.
4. American Occupational Therapy Association. Occupational therapy practice framework: Domain and process. 2nd edition. *The American Journal of Occupational Therapy*, 2008; (62)6: 625 - 682.
5. The HANDLE institute. *Our mission and philosophy*. [Online] Available from: <http://thehandleinstitute.wildapricot.org/mission-and-philosophy>. [Accessed: 25 October 2015.]
6. Segal R, Beyer C. Integration and application of a home treatment program: A study of parents and occupational therapists. *The American Journal of Occupational Therapy*, 2006; (60)5: 500 - 510.
7. Stephens LC, Tauber SK. Early intervention. J. Case-Smith. (Eds) In: *Occupational therapy for children*. 4th edition. Missouri: Mosby; 2001, p. 708 - 729.
8. Lane SJ. Structure and functions of the sensory systems. Lane SJ, Murray EA, Bundy AC (Eds). In: *Sensory integration theory and practice*. 2nd edition. Philadelphia, PA: F.A. Davis Company; 2002, p. 35 - 70.
9. Sensory Processing Disorder. [Online] Available from: <http://spdfoundation.net/index.php/about-sensory-processing-disorder/> [Accessed: 29 January 2016.]
10. Case-Smith J, Rogers J, Johnson JH. School based occupational therapy. J. Case-Smith (Eds). In: *Occupational therapy for children*. 4th edition. St. Louis, Missouri: Mosby; 2001, p. 757 - 779.
11. Lane SJ, Schaaf RC. Examining the neuroscience evidence for sensory-driven neuroplasticity: implications for sensory-based occupational therapy for children and adolescents. *The American Journal of Occupational Therapy*, 2010; 64(3): 375 - 390.
12. Schaaf RC, Burke JP, Cohn E, May-Benson TA, Schoen SA, Roley SS, et al. State of measurement in occupational therapy using sensory integration. *The American Journal of Occupational Therapy*, 2014; 68(5): e419 - e153.
13. American Occupational Therapy Association. Providing occupational therapy using sensory integration theory and approach methods in school-based practice. *American Journal of Occupational Therapy*, 2009; 63(4): 823-842.

14. Schaaf RC, Nightlinger KM. Occupational therapy using a sensory integrative approach: A case study of effectiveness. *American Journal of Occupational Therapy*, 2007; 61(2): 239-246.
15. Schaaf RC, Schoen SA, Smith-Role S, Lane SJ, Koomar J, May-Benson TA, Hinojosa P, Kramer J (Eds). In: *Frames of reference for pediatric occupational therapy*. Baltimore, Maryland: Wolters Kluwer; 2010, p.99-186.
16. American Psychiatric Association. *Diagnostic and Statistical manual of mental disorders: DSM-5*. Washington, D.C. : American Psychiatric Association, 2013.
17. Shellenberger S, Williams, MS. "How does your engine run?": The Alert Program for Self-regulation. Lane AC, Murray SJ, Bundy EA (Eds). In: *Sensory Integration Theory and Practice 2nd edition*. Philadelphia, PA : FA Davis Company, 2002. p.342-345.
18. Wilbarger J, Wilbarger P. Clinical application of the Sensory Diet. Bundy AC, Lane SJ, Murray EA. (Eds.) In: *Sensory integration theory and practice*. 2nd edition. Philadelphia, PA: FA Davis Company; 2002. p.339-341.
19. Ablcuff H, Courtney ME. The effects of auditory stimulation on the arithmetic performance of children with ADHD and nondisabled children. *Journal of Learning Disabilities*, 1996; 29(3): 238 - 250.
20. Bagatel N, Mirigliani G, Patterson C, Reyes Y, Test L. Effectiveness of therapy ball chairs on classroom participation in children with autism spectrum disorders. *American Journal of Occupational Therapy*, 2010; 64(6): 895 - 903.
21. Fertel-Daly D, Bedell G, Hinojsa J. Effects of a weighted vest on attention to task and self-stimulatory behaviours in preschoolers with pervasive developmental disorders. *American Journal of Occupational Therapy*, 2001; 55(6): 629 - 640.
22. Fedewa A, Erwin H. Stability balls and students with attention and hyperactivity concerns: Implications for on-task and in-seat behaviour. *American Journal of Occupational Therapy*, 2011; 65(4): 393 - 399.
23. Tang MH, Lin CK, Lin WH, Chen CH, Tsai SW, Chang YY. The effect of adding a home program to weekly institutional-based therapy for children with undefined developmental delay: A pilot randomised clinical trial. *Journal of the Chinese Medical Association*, 2011; 74: 259-266.
24. Novak I, Cusick A. Home programmes in paediatric occupational therapy for children with cerebral palsy: Where to start? *Australian Occupational Therapy Journal*, 2006; 53: 251 - 264.
25. Novak I, Cusick A, Lannin, N. Occupational therapy home programs for Cerebral Palsy: Double-blind, randomised, controlled Trial. *Pediatrics*, 2009; 124(4): e606 - e614.
26. v.d. Merwe Bothma J, Dunn M, Kokot S. The impact of a developmental movement programme on the performance of rural hearing-impaired children on the Griffiths Scales of Mental Development. *South African Journal of Psychology*, 2014; (44) 1: 36 - 47.

27. Fredericks CR, Kokot SJ, Krog S. Using a developmental movement programme to enhance academic skills in grade 1 learners. *South African Journal for Research in Sport, Physical Education and Recreation*, 2006; 28(1): 29 - 42.
28. Kokot SJ. A neurodevelopmental approach for helping gifted children with diagnosed dyslexia and attention deficit/hyperactivity disorder (AD/HD). *Africa Education Review*, 2005; 2(1): 130 - 146
29. Van der Westhuizen B. *An eco-systemic approach to addressing attentional difficulties and heightened motor activity*. Pretoria: University of South-Africa (Thesis – D.Ed); 2007.
30. Kokot SJ. *Integrated Learning Therapy*. [Online] Available from: <http://www.ilt.co.za>. [Accessed: 16 May 2015.]
31. Wang TN, Hinojosa J, Kramer P. Applying the evidence-based practice approach. Hinojosa P, Kramer J (Eds). In: *Frames of reference for pediatric occupational therapy*. Baltimore, Maryland: Wolters Kluwer; 2010, p. 582 - 590.
32. Miller LJ, Coll JR, Schoen, SA. A randomised controlled pilot study on the effectiveness of occupational therapy for children with sensory modulation disorder. *American Journal of Occupational Therapy*, 2007; 61(2): 228 - 238.
33. Bennett S, Bennett JW. The process of clinical-based practice in occupational therapy: informing clinical decision making. *Australian Occupational Therapy Journal*, 2000; 47: 171 - 180.
34. Mailloux Z, May-Benson TA, Summers CA, Miller LJ, Nrett-Green B, Burke JP et al. Goal attainment scaling as a measure of meaningful outcomes for children with sensory integration disorder. *American Journal of Occupational Therapy*, 2007; 61(2): 254-259
35. Christiansen C, Baum MC, Bass-Haugen J. *Occupational therapy: Performance, participation, and well-being*. Thorofare, NJ: Slack; 2005.
36. Dunbar SB. Theory, Frame of reference, and Model: a differentiation for practice considerations. SB Dunbar (Ed). In: *Occupational Therapy Models for Intervention with children and families*. Thorofare, N : Slack Incorporated; 2007. p. 1-9.
37. Allart Wilcock, A. Doing, being and becoming. *Canadian Journal of Occupational Therapy*, 1998; 65: 248 - 257.
38. Reilly M. Occupational therapy can be one of the great ideas of 20th century medicine. *American Journal of Occupational Therapy*, 1962; 23(4): 299 - 307.
39. Anderson J, Schoelkopf JS. Home-based intervention. J Case-Smith (Ed). In: *Occupational Therapy for children*. 4th ed. Missouri: Mosby; 2001. p. 823- 831.
40. Kramer P, Hinojosa J. Developmental Perspective: Fundamentals of Developmental Theory. Kramer P, Hinojosa J (Eds). In: *Frames of reference for pediatric occupational therapy*. 3rd edition. Baltimore: Wolters Kluwer; 2010, p. 23 - 30.
41. Law M, Missiuna C, Pollock N, Stewart D. Foundations for Occupational Therapy Practice with Children. J. Case-Smith (Eds). In: *Occupational Therapy for children*. Missouri : Mosby, 2001, p. 39-69.

42. May-Bensen TA, Koomar JA. Systematic review of the research evidence examining the effectiveness of interventions using a sensory integration approach for children. *American Journal of Occupational Therapy*, 2010; 64(3): 403 - 414.
43. Health Professions Council of South Africa. Guidelines for good practice in health care professions. General ethical guidelines for the health care profession. *HPCSA*. [Online] Available from: http://www.hpcsa.co.za/Uploads/editor/UserFiles/downloads/conduct_ethics/rules/generic_ethical_rules/booklet_1_guidelines_good_prac.pdf. [Accessed 6 May 2016]
44. Stock C, Kranowitz MA. *The out-of-sync child*. New York : Perigee, 2005
45. Watling R. Intervention and Strategies for challenging behaviours. Clifford O'Brien J (Eds.) Case-Smith J. *In: Occupational therapy for children 6th edition*. Maryland Heights, Missouri : Mosby Elsevier, 2010; 434-445.
46. Blundell P. Learning in Psychology. Gould R, E, Furnham E, Corner A. Chichester (Eds): John Wiley & Sons Ltd., 2013; 237-271.
47. Davidson, DA. Psychosocial issues affecting social participation. Clifford O'Brien J (Eds.) Case-Smith J. *In: Occupational therapy for children 6th edition*. Maryland Heights, Missouri : Mosby Elsevier, 2010; p.404-433.
48. Sadstrom H, Huerta S. *The Negative Effects of Instability on Child Development: A research synthesis*. The Urban Institute, September 2013.
49. Tetreault S, Parrot A, Trahan J. Home activity programs in families with children presenting with global developmental delays; evaluation and parental perceptions. *International journal of rehabilitation research*, 2003; 26(3): 165 - 173.
50. Ratzon NZ, Zabaneh-Tanns K, Ben-Hamo L, Bart O. Efficiency of the home parental programme in visual-motor home activity among first-grade children. *Child: care, health and development*, 2009; 36(2): 249 - 254.
51. Wuang Y, Ho G, Su C. Occupational therapy home program for children with intellectual disabilities: A randomised, controlled trial. *Research in Developmental Disabilities*, 2013; 34: 528 - 537.
52. Emde RN, Robinson J. Guiding principles for theory of early intervention: A developmental-psychoanalytic perspective. Meisels SJ, Shonkoff JP (Eds.) *In: Handbook of early childhood intervention*. New York: Cambridge; 2000, p. 160 - 178.
53. Segal R, Hinojosa J. The activity setting of homework: An analysis of three cases and implications for occupational therapy. *The American Journal of Occupational Therapy*, 2006; 60(1): 50 - 59.
54. Fingerhut PE, Piro J, Sutton A, Campbell R, Lewis C, Lawji D, Martinez N. Family-centred principles implemented in home-based, clinic-based and school-based pediatric settings. *The American Journal of Occupational Therapy*, 2013; 67(2): 228 - 235.

55. Rickards AL, Walstab JE, Wright-Rossi RA, Simpson J, Reddiough DS. One-year follow-up of the outcome of a randomized controlled trial of a home-based intervention programme for children with autism and developmental delay and their families. *Child: Care, health and development*, 2009; 35(5): 593 – 602.
56. Lorimer Moseley G. Do training diaries affect and reflect adherence to home programs? *Arthritis & Rheumatism*, 2006; 55(4): 662 - 664.
57. Robert J, Williams K, Carter M, Evans D, Parmenter T, Silove N, et al. A randomised controlled trial of two early intervention programs for young children with autism: centre-based with parent program and home-based. *Research in Autism Spectrum Disorders*, 2011; 5: 1553 - 1566.
58. Novak I, Cusick A, Lowe, K. A pilot study on the impact of occupational therapy home programming for young children with cerebral palsy. *Australian Journal of Occupational Therapy*, 2007; 61(4): 463 – 468.
59. Van Meerbek AV, Talero-Gutierrez CT, Gonzales-Reyes R. Prevalence of Delayed Neurodevelopment in Children from Bogota, Colombia, South America. *Neuroepidemiology*, 2007; 29: 74 - 77.
60. Kokot S, van der Westhuizen B. *ILT 2 - Distance Component Module 1: Movement and Learning*. [Module]Centre for integrated learning therapy. Wellington; 2011.
61. Integrated Learning Therapy. *An Ecosystemic Approach to learning and behavioural challenges*. Wellington, CTN : Unpublished, 2011.
62. Sugden AD, Henderson SH. *Ecological intervention for children with movement difficulties*. London: Pearson, 2007.
63. Kaplan, M. A frame of reference for motor skill acquisition. [book auth.] Kramer P, Hinojosa J. *Frames of reference for pediatric occupational therapy*. Baltimore: Wolters Kluwer; 2010, p. 390 - 424.
64. Doyle Morrison C, Metzger P. Play. J Case-Smith (Eds). In: *Occupational Therapy for Children*. 4th edition. Missouri: Mosby; 2001, p. 528 - 544.
65. Lane SJ. Sensory Modulation. Bundy AC, Lane S.J, Murray EA (Eds). In: *Sensory integration theory and practice*. 2nd edition. Philadelphia: F.A. Davis Company; 2002, p. 101 - 122.
66. Kleim JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *Journal of Speech, Language, and Hearing Research*, 2008; 51: S225 - S239.
67. Kokot S, Kokot M. *Introduction to an eco-systemic, neurodevelopmental approach for recognising and supporting learners with learning and behavioural difficulties*. [Lecture]Centre for integrated learning therapy. Wellington; 13 - 14 February 2011.

68. Luebben AJ, Hinojosa J, Kramer P. Domain of concern of occupational therapy: relevance to practice. Kramer P, Hinojosa J (Eds). In: *Frames of Reference for Pediatric Occupational Therapy*. 3rd edition. Baltimore, Maryland: Wolter Kluwer Health; 2010. p.31-49.
69. Tomlin G, Bernard S. Research Pyramid: A new evidence-based practice model for occupational therapy. *The American Journal of Occupational Therapy*, 2011; 65(2):189-196.
70. Kielhofner G. The Nature and Scope on Inquiry in Practice Profession. Keilhofner, G (Eds) In: *Research in Occupational Therapy: Methods of Inquiry for Enhancing Practice*. Philadelphia, USA: F.A. Davis Company; 2006. p.1-45.
71. Hickham D, Totten A, Berg A, Rader K, Goodman S, Newhouse, R. The PCORI Methodology Report, November 2013. [Online] Available from: <http://www.pcori.org/assets/2013/11/PCORI-Methodology-report.pdf>. [Accessed: 9 May 2016]
72. Lohr KN. Emerging methods in comparative effectiveness and safety: Symposium overview and summary. *Medical Care*, 2007; 45: s5-s8.
73. Gabriel SH, Normand SLT. Getting the Methods Right- The foundation of patient-centred outcomes research. *The New England Journal of Medicine*, 2012; 365(9):789-790.
74. Thomas G. Methodology Part 2: the design frame. *How to do your research project*. Thousand Oaks: SAGE; 2013. p. 132-188.
75. Bruininks RH, Bruininks B.D. *Bruininks-Oseretsky Test of Motor Proficiency*. 2nd edition. [Manual]. Minneapolis: Pearson; 2005.
76. Spironello C, Hay J, Missiuna C, Faught BE, Caimay J. Concurrent and construct validation of the short form of the Bruininks-Oseretsky Test of Motor Proficiency and the Movement-ABC when administered under field conditions: implications for screening. *Child: Care, health and development*, 2010; 36(1): 499 - 507.
77. Washington State Office of Superintendent of Public Instruction. Washington state, A guide to assessment in early childhood development, infancy to age eight. [Online] Available from: http://www.k12.wa.us/EarlyLearning/pubdocs/assessment_print.pdf. [Accessed: 2015 January 2016.]
78. Lucas BR, Latimer J, Doney R, Ferreira ML, Adams R, Hawks R, et al. The Bruininks-Oseretsky Test of Motor Proficiency- short form is reliable in children living in remote Australian Aboriginal communities. *BMC Paediatrics*, 2013; 13: 135.
79. Dunn W. *Sensory Profile Supplement User's Manual*. San Antonio, TX : Harcourt Assessment, 2006.
80. Ermer J, Dunn W. The sensory profile: A discriminant analysis of children with and without disabilities. *American Journal of Occupational Therapy*, 1998; 52(4): 283 - 290.

81. Dove S, Dunn W. Sensory processing in students with specific learning difficulties: Findings and implications for assessment and intervention planning. *Journal of occupational therapy, schools and early intervention*, 2008; 1(2): 116 - 127.
82. Ohl A, Butler C, Carney C, Jarmel E, Palmieri M, Potttheiser D, Smith T. Retest reliability of the Sensory Profile Caregiver Questionnaire. *American Journal of Occupational Therapy*, 2012; (66)4: 483 - 487.
83. Benjamin TE, Crasta JE, Suresh APC, Alwinesh MJT, Kanniappan G, Padankatti SM, et al. Sensory Profile Questionnaire: A measure for sensory impairment among children with developmental disabilities in India. *Indian Journal of Pediatrics*, 2014; 81(2) S183 - S186.
84. Cook, RA. Sensory processing of learners in the Western Cape diagnosed with attention-deficit/hyperactivity disorder. Cape Town: University of Stellenbosch; December 2011.
85. Henderson SE, Sudgen DA, Barnett AL. Movement Assessment Battery for Children -2. Examiner's Manual. London: Pearson Education, 2007.
86. Barnstorf MJ. The dying child. Case-Smith J.(Eds). *In: Occupational Therapy for children 4th edition*. St Louise, Missouri : Mosby, 2001. p. 833-842.
87. Brinker RP, Seifer R, Sameroff AJ. Relations among maternal stress cognitive development and early intervention in the middle and low SWS infants with developmental disabilities. *American Association of Mental Retardation*, 1994;98:463 - 430.
88. Law M, King G. Parent compliance with therapeutic interventions for children with cerebral palsy. *Developmental Medicine and Child Neurology*, 1993; 35:983-990.
89. Schreiber JM, Effgen SK, Palisano RJ. Effectiveness of parental collaboration on compliance with a home program. *Pediatric Physical Therapy*, 1995; 7: 59-64.
90. Pharham LD, Roley SS, May-Benson TA, Koomar J, Brett-Green B, Burke JP, et al. Development of a fidelity measure for research on the effectiveness of Ayres Sensory Integration Intervention. *American journal of Occupational Therapy*, 2011;64:133-142.

APPENDIX

APPENDIX A: Permission to conduct study



Funda Fun c.c. t/a
CENTRE FOR INTEGRATED LEARNING THERAPY
for Neurodevelopmental and Psychological Health
Pr No. 8623910

34 The Village
Diemersfontein Estate
Piet Retief Street (R301)
Wellington
7655

e-mail: ilt@icon.co.za & info@ilt.co.za

P O Box 251
Wellington
7654

Tel: 082 414 4814
082 559 9966
Fax: 086 619 0051

www.ilt.co.za

Informed consent form:

I, Prof. Shirley Joan Kokot hereby acknowledge that I have read the information sheet on the study. I understand the title of the study, the purpose of the study, possible risks and benefits involved in the researcher study being performed. I am fully aware of the process involved and what is expected of me, as participant in this study.

I have had the opportunity to ask questions and understand that I am always entitled to ask more questions and guidance from the researcher during the time period of the study.

I give my permission that results may be published.

No costs are charged against me, for my involvement in this research study. Nor am I providing funding in aid of the study.

I hereby give my permission for this study to be performed on the Integrated Learning Therapy material.

The following has been agreed upon:

- a) A trained ILT practitioner will perform all ILT evaluations
- b) The full ILT parent questionnaire will not be published. (pg. 1-2 only)
- c) The full ILT evaluation form will not be published. (pg 1 only)
- d) A full ILT programme will not be publish (3 example activities only)

Signed by:

Prof. Shirley Joan Kokot

On this date: 25 February 2016

Witness

M L Kokot

On this date: 25 February 2016

Funda Fun C.C. t/a Integrated Learning Therapy

Chief Practitioner: Prof Shirley J Kokot BA(Hons) BEd (SG) MEd (Counselling) D Ed STD Educational Psychologist
Michael L Kokot M.Sc. M.B.L.

APPENDIX B: Information package and procedures

Study Information Letter

Dear Parent(s)

I, Elecia van Zyl (occupational therapist and integrated learning therapist), am doing research to identify what changes occur in child development when an Integrated Learning Therapy Program is followed in conjunction with occupational therapy.

You are kindly invited to participate in the study.

a) Who can participate?

Any child referred to occupational therapy with school related difficulties. The child must be attending weekly occupational therapy for the duration of the study. The child cannot be diagnosed with cerebral palsy. The child and parents must be willing to follow a home programme.

b) What can you expect?

- The study runs over a 16-week period, while your child is attending occupational therapy intervention. Your child must attend occupational therapy for the duration of the study.
- During six of those weeks, you will be provided with a six week Integrated Learning Therapy (ILT) home programme. The home programme will be implemented either during the first six weeks during the last six weeks. The home programme will be developed according to your child's development needs. The home programme is developed to take a maximum of 20 minutes per day and to fit in with your family routine. Your child will be randomly assigned to the group where the programme is implemented in the first six weeks or during the last six weeks.
- The process starts with an initial assessment performed by me and questionnaires completed by the parents.
- A home programme is developed. You will be trained to perform the programme within the first week following the assessment. Ten to fourteen days into your home programme, I will follow-up to establish if there are any difficulties with the programme. I will check if the activities are done correctly. You will be required to follow the programme for six weeks.

- In week seven, following a six-week period of receiving occupational therapy with or without the ITL programme implemented, a reassessment on all participants is performed. Another occupational therapist will perform this assessment, to limit bias. At this time, you will complete one questionnaire. If you have been receiving ILT with occupational therapy in the first six weeks, you will now continue to receive only occupational therapy for the six weeks to come. If you are in the group where ILT occurs during the last phase, your ILT programme will be implemented now. All participants will be asked to keep a daily diary of the ILT activities you did. Following the last 6 weeks, a last reassessment will be performed. The reassessment will be performed by a research assistant.
- A diagrammatic illustration of the process to come:



Your child will receive ILT in either phase, depending on the group he or she is randomly allocated to.

- No ILT related costs will be incurred during this process.
- The study relies on assessment results for the Sensory Profile Caregiver Questionnaire and the BOT-2 short form. Some of these initial assessments may form part of the initial assessments of your treating occupational therapist performs and I will obtain these results from them. The initial integrated learning therapy assessment will be performed by Elecia van Zyl (Occupational therapist and ILT practitioner). If additional initial assessments are required, to adhere to the study requirements, Elecia van Zyl will be performing them.
- The evaluation sessions for the development of the integrated learning therapy home programme and reassessment periods will not interfere with your scheduled therapy time.
- The total time required for each evaluation session is 60 minutes, but will be performed in your home environment or at a location of convenience.
- Following the completion, the research period, your child will continue with occupational therapy at our discretion. Should you wish to follow a second ILT programme it will be provided.
- Your participation is voluntary and you will remain free to withdraw from the study at any time during the study.

- For more information on integrated learning therapy you can visit their website: www.ilt.co.za
- Benefits of participating in this research is that the ILT programme may enhance your child's occupational therapy as the programme has proved effectiveness but uncertainty remains as to what is improved. This study hopes to explore this.

Your participation will be appreciated!

Please complete the section below and give the return slip to you treating occupational therapist or contact me at 083 291 5860

Should there be any ethical queries about the research please feel free to contact the Human Research Ethics Committee (HREC) Chairman Prof P Cleaton-Jones at 011 7171234 or anisa.keshav@wits.ac.za for reporting of complaints / problems

Warm regards,

Elecia van Zyl

APPENDIX C

Informed consent form: Parent Participation

I _____ hereby acknowledge that I have read the information sheet on the study. I understand the title of the study, the purpose of the study, possible risks and benefits involved in my participation of the study. I am fully aware of the process involved and what is expected of me, as participant in this study.

I have had the opportunity to ask questions and understand that I am always entitled to ask more questions and guidance from the researcher during the period of the study.

No costs are charged against me, as participant, or my medical aid, for my involvement in this research study. I acknowledge that I remain free to withdraw from the study and all that the withdrawal procedure involves.

Signed by: _____

On this date: _____

Place: _____

APPENDIX D

Assent for child participation

I _____ want to participate in this project. I know why the study is being done. The information letter was explained to me. I know what I will have to do. I asked question if I wanted to, and got answers I understood. I know that I may stop participating if I wanted to.

My name: _____

Date: _____

Parent/Caregiver name and surname: _____

Parent/Caregiver Signature: _____

Date: _____

Therapist name and surname: _____

Date: _____

APPENDIX E: ILT Parent Questionnaire form – pg 1-2 of 12 as an example. ©

-1-



INTEGRATED LEARNING THERAPY

Greetings

Please take your time and complete the following document as comprehensively as possible. We do understand that this may take up a lot of your time, but all the information is crucial for our understanding of the client. It will be a great help in guiding us to know how best to help.

Child/client's name:

Age: (Year:months).....Grade at school:

Date of appointment: Name of person completing form.....

Relationship to child/client
.....

INITIAL INTAKE FORM FOR EVALUATION
(to be completed in full by client / parent / primary caregiver)

Major areas of concern.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Summary of prior assessments relevant to this evaluation:

.....

.....

.....

.....

.....

Intake landscape

FAMILY STRUCTURE

- Family structure (Please indicate)

Intact	Single parent	Divorced	Remarried	Other
--------	---------------	----------	-----------	-------

- Is the child an adopted child? _____ If YES, at what age did the child join the family?
- Is the child a foster child? _____ If YES, at what age did the child join the family?
- Number of children in family _____

Name	Gender	Age	Grade	Progress at school

- Hereditary illness in the family:

BIRTH HISTORY

- Where were parents working before conception?
- Was either parent in contact with heavy metals or chemicals before conception, during pregnancy or in the child's early childhood?
- State any problems during pregnancy (e.g. serious illness, emotional tension, imminent abortion):
- Was it a planned pregnancy? (Y/N).....
- Did the mother experience any viral infection (e.g. influenza, measles) during the second trimester (3-6 months) of pregnancy?.....
- Name any difficulties with previous pregnancies.....
- Did you lay new carpets in your house while you were pregnant?.....
- Did you paint any part of your house or office while you were pregnant?.....
- Was the mother bedridden for any period during the pregnancy?..... When?..... How long?..... Why?.....
- Did the mother smoke or consume any alcohol during pregnancy? (Y/N)
- Was the mother subjected to 'passive smoke' during the pregnancy? (Y/N)
- Did the mother use any recreational drugs during the pregnancy? (Y/N)..... Specify.....
- Age of mother at birth.....
- Was the baby premature? (Y/N)..... How much?.....
- Birth weight of baby.....
- Birth process (please indicate with a cross)

Normal	Caesarean Section
Without drugs	Elective
With drugs	Emergency
Epidural	Epidural
Forceps	Full anaesthesia
Suction	
Short delivery	
Long delivery	

- Was labour induced or spontaneous?.....
- Was it a breech or headfirst birth?.....

Intake landscape

APPENDIX F: Example of ILT evaluation form:

ILT EVALUATION SCALE– Recording Sheet ©

Name _____ Date _____

1) Coordination and Balance

a) Windmill (eyes open, then close).....

b) Tandem walk (eyes open, focus point)

Forwards.....

Backwards.....

c) Fog walk -forwardsBackwards.....

d) Cross pointing walk.....

e) Hopping -5 times on one leg and 5 times on the
other.....

f) One leg standing (on preferred foot then the other)

Preferred foot (L/R): eyes open secs eyes closed secs

Other foot: eyes open secs eyes closed secs

g) Nose – finger pointing (straight arm)(r)(l).....

(cross arm/nose)

2) Paper folding (fine motor, handedness, kinesthesia)

Paper folding

Hand dominance

Name, number, circle

Copy drawing

Kinesthesia

APPENDIX G: Buininks-Oseretsky test of moto proficiency short form



Bruininks-Oseretsky Test of Motor Proficiency, Second Edition

Robert H. Bruininks, PhD, & Brett D. Bruininks

	Year	Month	Day
Test Date			
Birth Date			
Chronological Age			

Preferred Drawing Hand	Right	Left
Preferred Throwing Hand/Arm	Right	Left
Preferred Foot/Leg	Right	Left

Norms Used: ☐ Female ☐ Male ☐ Combined

Participant Code _____ Sex _____ Grade _____

Examiner Name _____ School/Clinic _____

	Total Point Score	Scale Score Mean = 15, SD = 5 (Tables B.1–B.3)	Standard Score Mean = 50, SD = 10 (Tables B.4–B.7)	Confidence Interval: 90% or 95% (Tables C.1–C.4)		%ile Rank (Tables B.4–B.7)	Age Equiv. (Tables B.14–B.16)	Descriptive Category (Table C.13)
				Band	Interval			
1 Fine Motor Precision								
2 Fine Motor Integration								
Fine Manual Control	Sum							
3 Manual Dexterity								
7 Upper-Limb Coordination								
Manual Coordination	Sum							
4 Bilateral Coordination								
5 Balance								
Body Coordination	Sum							
6 Running Speed and Agility								
8 Strength Push-up: Knee Full								
Strength and Agility	Sum							
Total Motor Composite	Sum							

	Total Point Score	Standard Score (Tables B.8–B.13)	Confidence Interval: 90% or 95% (Tables C.3, C.4)		%ile Rank (Tables B.8–B.13)	Descriptive Category (Table C.13)
			Band	Interval		
SHORT Form	Push-up: Knee Full					

DIRECTIONS

Complete Form

During the testing session, record the examinee's performance on each item. After the testing session, convert each item raw score to a point score using the conversion table provided. For items needing two trials, convert the better of the two raw scores. Then, record the point score in the appropriate oval in the Point Score column.

For each subtest, add the item point scores, and record the total in the oval labeled Total Point Score and on the appropriate line on the cover page.

Short Form

During the testing session, record the examinee's performance on each Short Form item, listed on page 8.

After the testing session, convert each item raw score to a point score using the conversion table provided. For items needing two trials, convert the better of the two raw scores. Then, record the point score in the appropriate oval in the Point Score column.

Finally, add the item point scores for all 14 Short Form items, and record the total in the oval labeled Total Point Score and on the appropriate line on the cover page.

PEARSON

Copyright © 2005 NCS Pearson, Inc. All rights reserved.

WARNING: No part of this publication may be copied, reproduced, modified, or transmitted by any means, electronic or mechanical, without written permission from NCS Pearson, Inc., PO Box 1416, Minneapolis, MN 55440. 800-627-7271 PearsonAssessments.com.

A 0 9 8 7 6 5 4 3

Product Number 58002

SHORTForm

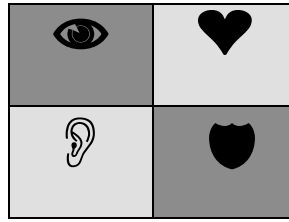
Subtest 1: Fine Motor Precision		Raw Score										Point Score								
3	Drawing Lines through Paths—Crooked	errors	Raw	≥21	15–20	10–14	6–9	4–5	2–3	1	0									
			Point	0	1	2	3	4	5	6	7									
6	Folding Paper	points	Raw	0	1–2	3–4	5–6	7–8	9–10	11	12									
			Point	0	1	2	3	4	5	6	7									
Subtest 2: Fine Motor Integration		Basic Shape	Closure	Edges	Orientation	Overlap	Overall Size	Raw Score*	Point Score											
2	Copying a Square	0 1	0 1	0 1	0 1		0 1													
7	Copying a Star	0 1	0 1	0 1	0 1		0 1													
Subtest 3: Manual Dexterity		Raw Score																		Point Score
2	Transferring Pennies	Trial 1	Trial 2	Raw	0–2	3–4	5–6	7–8	9–10	11–12	13–14	15–16	17–18	19–20						
		pennies	pennies	Point	0	1	2	3	4	5	6	7	8	9						
Subtest 4: Bilateral Coordination		Raw Score								Point Score										
3	Jumping in Place—Same Sides Synchronized	Trial 1	Trial 2	Raw	0	1	2–4	5												
		jumps	jumps	Point	0	1	2	3												
6	Tapping Feet and Fingers—Same Sides Synchronized	Trial 1	Trial 2	Raw	0	1	2–4	5–9	10											
		taps	taps	Point	0	1	2	3	4											
Subtest 5: Balance		Raw Score								Point Score										
2	Walking Forward on a Line	Trial 1	Trial 2	Raw	0	1–2	3–4	5	6											
		steps	steps	Point	0	1	2	3	4											
7	Standing on One Leg on a Balance Beam—Eyes Open	Trial 1	Trial 2	Raw	0.0–0.9	1.0–2.9	3.0–5.9	6.0–9.9	10											
		seconds	seconds	Point	0	1	2	3	4											
Subtest 6: Running Speed and Agility		Raw Score																		Point Score
3	One-Legged Stationary Hop	Trial 1	Trial 2	Raw	0	1–2	3–5	6–9	10–14	15–19	20–24	25–29	30–39	40–49	≥50					
		hops	hops	Point	0	1	2	3	4	5	6	7	8	9	10					
Subtest 7: Upper-Limb Coordination		Raw Score										Point Score								
1	Dropping and Catching a Ball—Both Hands	Trial 1	Trial 2	Raw	0	1	2	3	4	5										
		catches	catches	Point	0	1	2	3	4	5										
6	Dribbling a Ball—Alternating Hands	Trial 1	Trial 2	Raw	0	1	2	3	4–5	6–7	8–9	10								
		dribbles	dribbles	Point	0	1	2	3	4	5	6	7								
Subtest 8: Strength		Raw Score																		Point Score
2a	Knee Push-ups	Trial 1	Trial 2	Raw	0	1–2	3–5	6–10	11–15	16–20	21–25	26–30	31–35	≥36						
2b	OR (circle one) Full Push-ups	push-ups	push-ups	Point	0	1	2	3	4	5	6	7	8	9						
3	Sit-ups	Trial 1	Trial 2	Raw	0	1–2	3–5	6–10	11–15	16–20	21–25	26–30	31–35	≥36						
		sit-ups	sit-ups	Point	0	1	2	3	4	5	6	7	8	9						

Notes & Observations

Total Point Score
Short Form
(max = 88)

* For Subtest 2: Fine Motor Integration, add the facet scores, record the sum in the Raw Score column, and transfer the raw score for each item directly to the corresponding oval in the Point Score column.

APPENDIX H: Sensory Profile Caregiver Questionnaire



SENSORY PROFILE

Winnie Dunn, PhD. OTR, FAOTA

CAREGIVER QUESTIONNAIRE

Participant Code _____

Birth Date: _____

Date: _____

Completed by: _____

Relationship to Child: _____

Service Provider's Name: _____

INSTRUCTIONS

Please check the box that best describes the frequency with which your child does the following behaviours. Please answer all of the statements. If you are unable to comment because you have not observed the behaviour or believe that it does not apply to your child, please draw an X through the number for that item. Write any comments at the end of each section. Please do not write in the Section Raw Score Total row.

Use the following key to mark your responses:

Always	When presented with the opportunity, your child always responds in this manner, 100% of the time.
Frequently	When presented with the opportunity, your child frequently responds in this manner, about 75% of the time.
Occasionally	When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time.
Seldom	When presented with the opportunity, your child seldom responds in this manner, about 25% of the time.
Never	When presented with the opportunity, your child never responds in this manner, 0% of the time.

SENSORY PROCESSING								
ITEM			A. AUDITORY PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	1	Responds negatively to unexpected or loud noises (for example, cries or hides at noise from vacuum cleaner, dog barking, hair dryer)					
	L	2	Holds hands over ears to protect ears from sound					
	L	3	Has trouble completing tasks when the radio is on					
	L	4	Is distracted or has trouble functioning if there is a lot of noise around					
	L	5	Can't work with background noise (for example, fan, refrigerator)					
	H	6	Appears to not hear what you say (for example, does not "tune-in" to what you say, appears to ignore you)					
	H	7	Doesn't respond when name is called but you know the child's hearing is OK					
	H	8	Enjoys strange noises/seek to make noise for noise's sake					
Section Raw Score Total								

Comments:

ITEM			B. VISUAL PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	9	Prefers to be in the dark					
	L	10	Expresses discomfort with or avoids bright lights (for example, hides from sunlight through window in car)					
	L	11	Happy to be in the dark					
	L	12	Becomes frustrated when trying to find objects in competing backgrounds (for example, a cluttered drawer)					
	L	13	Has difficulty putting puzzles together (as compared to same age children)					
	L	14	Is bothered by bright lights after others have adapted to the light					
	L	15	Covers eyes or squints to protect eyes from light					
	H	16	Looks carefully or intensely at objects/people (for example, stares)					
	H	17	Has a hard time finding objects in competing backgrounds (for example, shoes in a messy room, favourite toy in the "junk drawer")					
Section Raw Score Total								

Comments:

ITEM			C. VESTIBULAR PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
→	L	18	Becomes anxious or distressed when feet leave the ground					
→	L	19	Dislikes activities where head is upside down (for example, somersaults, roughhousing)					
→	L	20	Avoids playground equipment or moving toys (for example, swing set, merry-go-round)					
→	L	21	Dislikes riding in a car					
→	L	22	Holds head upright, even when bending over or leaning (for example, maintains a rigid position/posture during activity)					
→	L	23	Becomes disoriented after bending over sink or table (for example, falls or gets dizzy)					
→	H	24	Seeks all kinds of movement and this interferes with daily routines (for example, can't sit still, fidgets)					
→	H	25	Seeks out all kinds of movement activities (for example, being whirled by adult, merry-go-rounds, playground equipment, moving toys)					
→	H	26	Twirls/spins self frequently throughout the day (for example, likes dizzy feeling)					
→	H	27	Rocks unconsciously (for example, while watching TV)					
→	H	28	Rocks in desk/chair/on floor					
Section Raw Score Total								

Comments:

ITEM			D. TOUCH PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	29	Avoids getting "messy" (for example, in paste, sand, finger paint, glue, tape)					
	L	30	Expresses distress during grooming (for example, fights or cries during haircutting, face washing, fingernail cutting)					
	L	31	Prefers long-sleeved clothing when it is warm or short sleeves when it is cold					
	L	32	Expresses discomfort at dental work or tooth brushing (for example, cries or fights)					
	L	33	Is sensitive to certain fabrics (for example, is particular about certain clothes or bed sheets)					
	L	34	Becomes irritated by shoes or socks					
	L	35	Avoids going barefoot, especially in sand or grass					
	L	36	Reacts emotionally or aggressively to touch					
	L	37	Withdraws from splashing water					
	L	38	Has difficulty standing in line or close to other people					
	L	39	Rubs or scratches out a spot that has been touched					
	H	40	Touches people and objects to the point of irritating others					
	H	41	Displays unusual need for touching certain toys, surfaces, or textures (for example, constantly touching objects)					
	H	42	Decreased awareness of pain and temperature					
	H	43	Doesn't seem to notice when someone touches arm or back (for example, unaware)					
	H	44	Avoids wearing shoes; love to be barefoot					
	H	45	Touches people and objects					
	H	46	Doesn't seem to notice when face or hands are messy					
Section Raw Score Total								

Comments:

ITEM			E. MULTI-SENSORY PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		47	Gets lost easily (even in familiar places)					
		48	Has difficulty paying attention					
	L	49	Looks away from tasks to notice all actions in the room					
	H	50	Seems oblivious within an active environment (for example, unaware of activity)					
	H	51	Hangs on people, furniture, or objects even in familiar situations					
	H	52	Walks on toes					
	H	53	Leaves clothing twisted on body					
Section Raw Score Total								

Comments:

ITEM			F. ORAL SENSORY PROCESSING	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	54	Gags easily with food textures or food utensils in mouth					
	L	55	Avoids certain tastes or food smells that are typically part of children's diets					
	L	56	Will only eat certain tastes (list: _____)					
	L	57	Limits self to particular food textures/temperatures (list: _____)					
	L	58	Picky eater, especially regarding food textures					
	H	59	Routinely smells non-food objects					
	H	60	Shows strong preference for certain smells (list: _____)					
	H	61	Shows strong preference for certain tastes (list: _____)					
	H	62	Craves certain foods (list: _____)					
	H	63	Seeks out certain tastes or smells (list: _____)					
	H	64	Chews or licks on non-food objects					
	H	65	Mouths objects (for example, pencil, hands)					
Section Raw Score Total								

Comments:

MODULATION								
ITEM			G. SENSORY PROCESSING RELATED TO TONE/ ENDURANCE	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		66	Moves stiffly					
	H	67	Tires easily, especially when standing or holding particular body position					
	H	68	Locks joints (for example, elbows, knees) for stability					
	H	69	Seems to have weak muscles					
	H	70	Has a weak grasp					
	H	71	Can't lift heavy objects (for example, weak in comparison to same age children)					
	H	72	Props to support self (even during activity)					
➔	H	73	Poor endurance/tires easily					
➔	H	74	Appears lethargic (for example, has no energy, is sluggish)					
Section Raw Score Total								

Comments:

ITEM			H. MODULATION RELATED TO BODY POSITION AND MOVEMENT	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		75	Seems accident-prone					
		76	Hesitates going up or down curbs or steps (for example, is cautious, stops before moving)					
➔	L	77	Fears falling or heights					
➔	L	78	Avoids climbing/jumping or avoids bumpy/uneven ground					
➔	L	79	Holds onto walls or banisters (for example, clings)					
➔	H	80	Takes excessive risks during play (for example, climbs high into a tree, jumps off tall furniture)					
➔	H	81	Takes movement or climbing risks during play that compromise					

			personal safety					
→	H	82	Turns whole body to look at you					
👤	H	83	Seeks opportunities to fall without regard to personal safety					
👤	H	84	Appears to enjoy falling					
Section Raw Score Total								

Comments:

ITEM			I. MODULATION OF MOVEMENT AFFECTING ACTIVITY LEVEL	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
🏰	L	85	Spends most of the day in sedentary play (for example, does quiet things)					
🏰	L	86	Prefers quiet, sedentary play (for example, watching TV, books, computers)					
→	L	87	Seeks sedentary play options					
→	L	88	Prefers sedentary activities					
→	H	89	Becomes overly excitable during movement activity					
🏰	H	90	"On the go"					
🏰	H	91	Avoids quiet play activities					
Section Raw Score Total								
ITEM			J. MODULATION OF SENSORY INPUT AFFECTING EMOSIONAL RESPONSES	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
❤️		92	Needs more protection from life than other children (for example, defenceless physically or emotionally)					
👤	L	93	Rigid rituals in personal hygiene					
❤️	H	94	Is overly affectionate with others					
❤️	H	95	Doesn't perceive body language or facial expressions (for example, unable to interpret)					
Section Raw Score Total								

Comments:

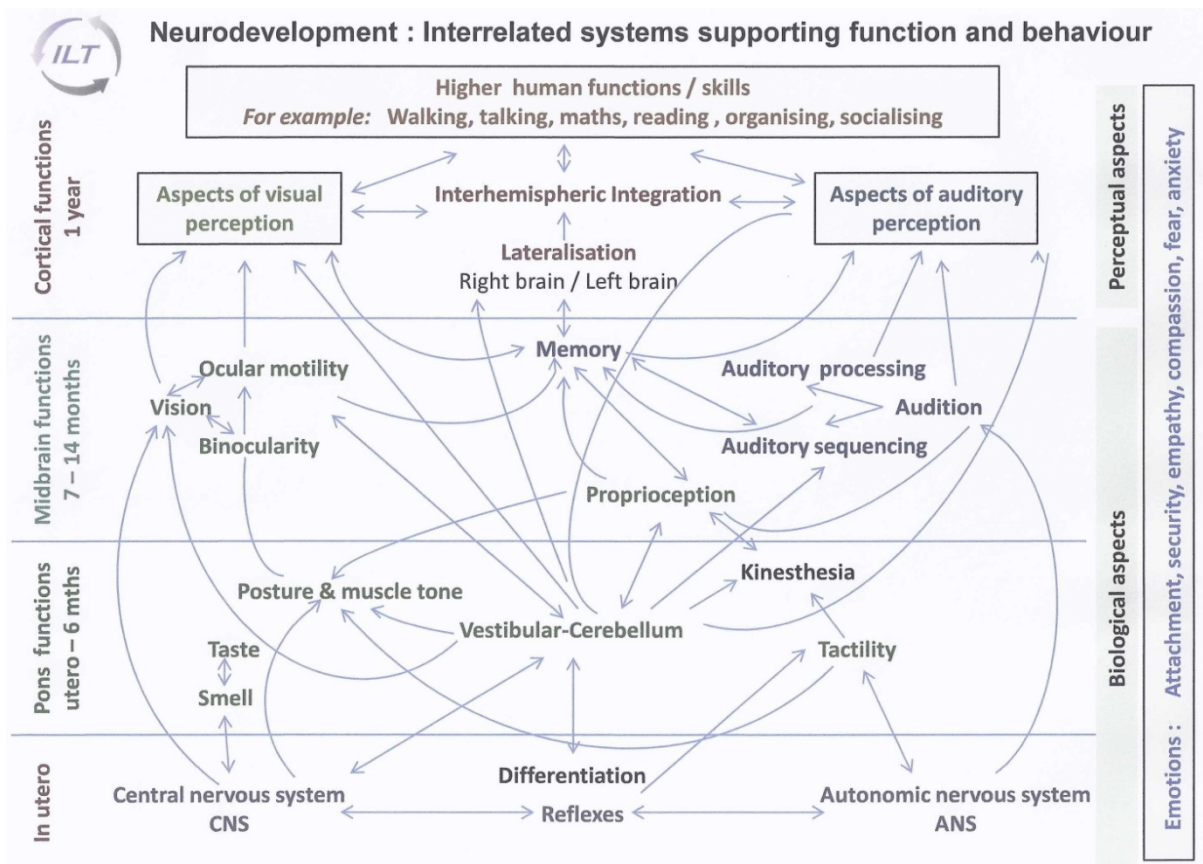
ITEM			K. MODULATION OF VISUAL INPUT AFFECTING EMOTIONAL RESPONSES AND ACTIVITY LEVEL	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	96	Avoids eye contact					
	H	97	Stares intensively at objects or people					
	H	98	Watches everyone when they move around the room					
	H	99	Doesn't notice when people come into the room					
Section Raw Score Total								

ICON KEY	
	Auditory
	Visual
	Activity Level
	Taste/Smell
	Body Position
	Movement
	Touch

THRESHOLD KEY	
	Neither low nor high
L	Low
H	High

SCORE KEY	
1	Always
2	Frequently
3	Occasionally
4	Seldom
5	Never

APPENDIX I: Neurodevelopmental Chart ©. Used with permission from Dr SJ Koko.



APPENDIX J: Example of Integrated Learning Therapy home programme activities

Examples of activities include¹

- Citrus Circles
- Loopy Straw
- Pancake
- Side tips

Example of how it was presented to parents:

¹Please note that these activities are copy right protected and may only be prescribed by a trained and qualified ILT practitioner. These activities are only described for the purpose of the research report.

CITRUS CIRCLES ©

(Adapted from activities of The HANDLE® Institute)

PURPOSE: To enhance tactility, muscle tone and proprioception. May help integrate the Spinal Galant reflex.

AGE: From 5 years and up

HOW OFTEN: Daily

MATERIALS: If possible, use a special ball provided by your practitioner. Otherwise, a small, round orange is a good substitute. If the person is insensitive to tactile stimulation, a 'knobbly' ball might be appreciated.

METHOD:

The person lies on stomach, with arms bent and hands at head level, palms flat on the surface of the floor or bed. The head can be turned to the side for comfort.

Place the ball on the nape of the neck and begin turning it in small circles in clockwise direction. Maintain the clockwise turn throughout this exercise, even though the direction of the moving ball might change. Keep a constant pressure on the ball and try not to touch the person with anything else but the ball throughout.

From the nape of the neck, roll the ball down the dominant arm. From the wrist, progress down the thumb. Return to the wrist and then progress down each finger in turn, starting with the index finger. Return to the wrist in-between. Make sure that the very top of each finger receives stimulation by rolling the ball almost off the finger and onto the floor/bed. If any tickle is felt, stop the ball and apply gentle pressure until the person instructs you to continue.

Return to the nape of the neck and repeat the above on the non-dominant arm.

From the nape of the neck, proceed down the spine and the leg on the dominant side. From the heel, roll the ball three times down the foot – once on the inside, then the middle of the foot and finally the outside of the foot. Return to the base of the spine and repeat down the leg and foot of the non-dominant side.

Return all the way up the spine to the nape of the neck.

LOOPY STRAW ©

PURPOSE: The action of sucking through a straw has many benefits.

We use the straw primarily to encourage binocularity, but also to enhance interhemispheric integration, stimulate the trigeminal nerve branches around the mouth and into the tongue for better articulation and improved facial muscle tone. It may also help with light and sound sensitivity.

AGE: As soon as a child can suck hard through a straw.

HOW OFTEN: Daily

MATERIALS: The straws are currently not available in South Africa. ILT imports them from overseas. You are welcome to contact the ILT office to order straws through us.

METHOD: Place either end of the straw in the middle of the mouth and insert the other end into a glass of water. You should not allow the child to drink anything else through the straw. In the first place, it is impossible to clean the straw of sticky or sugary substances. In the second, we need to encourage children as much as possible to drink plenty of water.

As they drink, they should close their eyes – unless they have a history of or tendency towards one or two eyes that turn in. If this is the case, they should focus on something in the distance when they are drinking. Try to encourage a rhythmic suck, swallow and breathe pattern. If wished, the child can open eyes between sucks. Rinse the straw in water with a little Milton added to it. Do not put the straw into dishwashing machines!

The child should drink one or two small glasses of water each day through the straw. The amount depends on the age of the child.

PANCAKE ©

PURPOSE: Enhancing vestibular functioning by stimulating one of the semicircular canals in the inner ear; improving proprioception and tactility.

AGE: Any age.

HOW OFTEN: Daily

MATERIALS: A blanket, preferably manufactured from natural fibre such as cotton.

METHOD:

- Children like to play Pancake with this activity, which is what we call it. We ask them what they would like to have on their pancake and pretend to add this before we begin to roll them up. Be prepared for some strange combinations!
- The child lies on the blanket so that the body will be completely covered. Most children prefer to have their heads exposed, but if they want it covered as well, this is permissible.
- Roll the child very slowly in the blanket. You will have to monitor how many rolls the child can manage by watching carefully for signs of stress shown on the face or expressed by the child. If no stress signs are seen or mentioned, it is usually enough to roll until there is no more blanket (usually three full rolls).
- Once the child is fully rolled into the blanket, give some compression to the joints of the body. Do this by holding the joints on either side of the body with your hands and press inwards on both sides simultaneously. Begin by cupping the shoulders and pressing several times. Move down to the elbow region, then the wrists, hips, knees and ankles.
- Some children prefer a more vigorous movement. Pat their joints with some energy so that their body bounces from side to side. Sometimes it is a good idea to ask them whether they prefer the compression (squeezing) or rebounding (vigorous patting).
- If a child is tactile sensitive, it may help to touch him firmly on various parts of his body as you roll him up.
- Children who are hypersensitive to touch may not like the feel of the blanket. Fold the blanket to make a narrower strip, or even use some other length of material that touches the body only on less sensitive areas or on only a small portion of the body.

SIDE TIPS ©

(Adapted from activities of The HANDLE® Institute)

PURPOSE: To enhance vestibular functioning primarily the semi-circular canal on the roll axis. It may encourage head-righting reflexes as well as helping the integration of the ATNR. Muscle tone may be enhanced and the cross-legged position with hands facing each other enhances interhemispheric integration.

AGE: A four-year old may need help, but it can be done at any age.

HOW OFTEN: Daily

MATERIALS: None

METHOD:

Sit in a cross-legged position with hands on upper thighs, fingers and thumbs of each hand pointing towards each other. This results in the arms bending at the elbow and protruding out on either side of the body.

Keep a visual focus at eye height and maintain that focus throughout the roll.

Tip very slowly to one side, allowing the head to drop very slowly with the body.

The elbow on that side of the body will ultimately support the body and allow the head to be dropped so that the ear is close to the shoulder.

Count to three while in this position, and then slowly return to upright. After a short pause, tip over to the other side.

Vestibular activities need careful monitoring for stress signs. The practitioner will help to determine how many rolls are possible and how the amount of rolls may be increased over time.

Notes regarding amount of rolls / help needed / best time of day to do this, etc.

APPENDIX K: Sensory Integration Fidelity Measure (90)

Physical environment that meets the Sensory integration fidelity Measure demands:

1. Adequate space for flow of vigorous physical activity
2. Flexible arrangement of equipment and material for rapid change of the intervention environment.
3. No less than 3 hooks for hanging suspended equipment, minimal distance between hooks 2.5 to 3 ft
4. One or more rotational devices attached to ceiling support to allow a full rotation
5. Quiet space
6. One or more sets of bungee cords for suspended equipment
7. Mats, cushions, pillows
8. Equipment adjustable to child's size
9. Therapist monitors accessible equipment is safe for use
10. Documentation of routine monitoring of equipment for safety
11. Variety of equipment available

Examples of equipment used during the therapy process:

ITEM	USES
Platform swing	Improve postural control and equilibrium reactions. Used in projection action sequence games. Assists in integrating the vestibular and proprioceptive system.
Flexion-swing	Improves trunk extension. Used in projection action sequence games. Assists in integrating the vestibular and proprioceptive system.
Different Hammocks	Assists in improving the vestibular, proprioceptive and tactile system.
75cm ball	Working over the ball in supine:
Scooter boards	Provides vestibular and proprioceptive input as the child pushes or pulls himself/herself on the scooter board. Can assist with motor planning as the child navigates two scooter boards through obstacle courses.
Blow pens	Provides proprioceptive input.

APPENDIX L: HOME PROGRAMME DIARY

ILT TRAINING DIARY

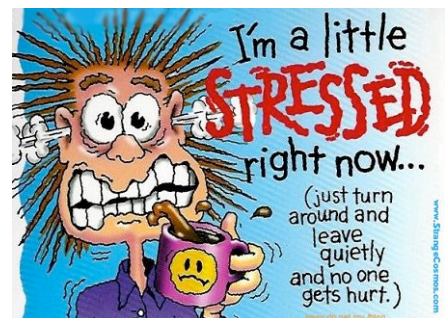
Example Week 1:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Activities done						
Comments/ Concerns / Progress made						

Remember: Gentle enhancement

Stop at these signs of stress:

Flushed cheeks, Dizziness, Loss of visual focus, Red ears, Nausea



APPENDIX M: Sensory profile interpretation grid:

	Ranges of Scores		
	68% of Population	More Than Others	
	Typical Performance (TP)	Probable Difference (PD)	Definite Difference (DD)
SENSORY PROCESSING			
A) Auditory Processing	40 – 30	29 – 26	25 – 8
B) Visual Processing	40-32	31 – 27	26 – 9
C) Vestibular Processing	55 – 48	47 – 45	44 – 11
D) Touch Processing	90 – 73	72 – 65	64 – 18
E) Multisensory Processing	35 – 27	26-24	23-7
F) Oral Sensory Processing	60 – 46	45 – 40	39 – 12
SENSORY MODULATION			
G) Sensory Processing Related to Endurance/ Tone	45-39	38-36	35-9
H) Modulation Related to Body Position and Movement	50 – 41	40 – 36	35 – 10
I) Modulation of Movement Affecting Activity Level	35 – 23	22 – 19	18 – 7
J) Modulation of Sensory Input Affecting Emotional Responses	20-16	15 – 14	13-4
K) Modulation of Visual Input Affecting Emotional Responses and Activity Level	20-15	14-12	11 – 4

Appendix N: Group A (ABA) Change Grid: ILT-OT stage and OT-only stage:

In this table, areas of dysfunction (as indicated by the sensory profile and the BOT-2 scores) at the start point of a specific time period are indicated by shading that area on the grid grey. For example, for the period baseline to reassessment one, the start point is the baseline assessment and all **areas of dysfunction (where improvement is expected)** as indicated by the sensory profile sections and the BOT-2 are **shaded grey** on the grid. The +, - or 0, indicates the change that actually occurred during that time period.

	Motor development	BOT	Sensory Processing	Auditory Processing	Visual processing	Vestibular processing	Touch processing	Multisensory processing	Oral Sensory Processing	Sensory modulation	Sensory processing related to tone/endurance	Modulation related to body position and movement	Modulation of movement affecting activity level	Of sensory input affecting emotional responses	Of visual input affecting emotional responses and activity level
GROUP A (ABA – ILT-OT stage) : BASELINE TO RE 1															
A1		+		0	0	+	0	+	0		0	0	0	0	0
A3		-		+	0	0	+	+	0		0	0	0	+	+
A4		+		0	0	0	0	+	0		0	0	0	0	0
A5		0		0	0	0	0	0	0		0	+	+	0	+
GROUP A (ABA – OT-Only stage) : RE 1 to RE 2															
A1		0		0	0	-	0	-	0		0	0	0	0	0
A3		+		0	0	0	0	0	0		0	-	+	0	0
A4		-		0	0	0	0	-	0		0	-	0	-	0
A5		+		0	0	0	0	0	0		+	0	0	0	0

Appendix O: Group B (AAB) Change grid: ILT-OT stage and OT-only stage

In this table, areas of dysfunction (as indicated by the sensory profile and the BOT-2 scores) at the start point of a specific time period are indicated by shading that area on the grid grey. For example, for the period baseline to reassessment one, the start point is the baseline assessment and all **areas of dysfunction (where improvement is expected)** as indicated by the sensory profile sections and the BOT-2 are **shaded grey** on the grid. The +, - or 0, indicates the change that actually occurred during that time period.

	Motor development														
	BOT														
	Sensory Processing														
	Auditory Processing														
	Visual processing														
	Vestibular processing														
	Touch processing														
	Multisensory processing														
	Oral Sensory Processing														
	Sensory modulation														
	Sensory processing related to tone/endurance														
	Modulation related to body position and movement														
	Modulation of movement affecting activity level														
	Of sensory input affecting emotional responses														
	Of visual input affecting emotional responses and activity level														
GROUP B (AAB – OT only stage) : BASELINE to RE 1															
B1		+		0	0	-	0	0	0		0	-	+	0	-
B2		0		-	-	0	0	0	0		-	-	0	-	0
B3		0		0	0	0	0	0	-		-	-	+	0	-
B4		+		+	0	-	0	+	0		0	0	-	+	0
B5		0		0	0	0	+	0	+		0	0	0	-	0
GROUP B (AAB – ILT-OT stage): RE 1 to RE 2															
B1		-		0	0	+	0	0	0		0	+	-	0	+
B2		0		+	+	0	0	0	0		-	0	0	+	0
B3		0		0	0	+	0	0	+		+	0	-	+	+
B4		0		-	0	+	0	0	0		0	0	0	-	0
B5		0		+	0	+	0	+	+		0	+	0	+	0

APPENDIX P: Ethical Clearance Certificate



R14/49 Ms Elecia Nora van Zyl

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130930

NAME:
(Principal Investigator)

Ms Elecia Nora van Zyl

DEPARTMENT:

Occupational Therapy
Life Eugene Marais Hospital

PROJECT TITLE:

A Pilot Study to Determine the Effectiveness of
an Integrated Learning Therapy Home Program
Together with Occupational Therapy

DATE CONSIDERED:

27/09/2013

DECISION:

Approved unconditionally

CONDITIONS:

SUPERVISOR:

Mrs Lyndsay Koch

APPROVED BY:


Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL:

13/11/2013

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 Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. I agree to submit a yearly progress report.


Principal Investigator Signature

Date

13/11/2013

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES