Determining the Feasibility and Acceptability of the Moves4LilMinds Programme in the New Zealand Context: A Randomised Pilot Study

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A research component submitted to

Auckland University of Technology

in fulfilment of the requirements of the degree of

Master of Philosophy

2024

National Institute for Stroke and Applied Neurosciences, School of Clinical Sciences,
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Abstract

Background. Primitive reflexes are automatic stereotyped movements, present in the first year of life which assist with birthing and development of motor, sensory and visual systems. Primitive reflexes are superseded by fully developed postural reflexes by 4-years-old. The prolonged presence of primitive reflexes indicates an increased risk of neuromotor immaturity, developmental delay and neuro-behavioural disorders in children. Neuromotor interventions can reduce the presence of primitive reflexes and lead to improvements in motor development, and pro-social behaviour, along with reading, spelling, and writing in school-aged children (Goddard Blythe, 2005; Goddard Blythe, 2023; Konicarova et al., 2013; Marlee, 2008). However, few studies have measured neuromotor interventions in younger children and to the best of our knowledge, there have been no prior studies of this kind in four-year-olds in New Zealand. Accordingly, this thesis aimed to examine aspects of feasibility and acceptability of a neuromotor programme, 'Moves4LilMinds' (M4LM), in children aged 4-years-old.

Methods. Using a single-centre, two-arm, single-blinded, pilot randomised controlled trial (RCT) design, 11 children (mean age = 4.2 years) were randomised to the intervention or a general exercise control group. Feasibility of conducting a full-scale trial of the intervention was quantitatively assessed by examining rate of recruitment, acceptance and effectiveness of randomisation, and participant burden. Feasibility of the intervention was quantitatively assessed by programme adherence and safety. Acceptability was qualitatively assessed by semi-structured interviews with parents and teachers.

Results. Findings supported feasibility of participant recruitment (81%), effectiveness of balanced randomisation (Māori/non-Māori, age, sex), acceptance of randomisation (100%), safe delivery (100%) and consistent improvements in teacher intervention adherence across two assessment timepoints. Parent and teacher feedback on intervention acceptability revealed three themes: benefits; challenges; and the importance of teacher initiative when delivering the intervention. Teachers found the intervention acceptable to use in the early childhood centre, with reported improvements in teacher-child relationships, concentration, attention, self-regulation, body/mind connections, and child leadership. Both parents and teachers reported benefits for children's confidence, focus, behaviour and coordination. Teacher-reported barriers to intervention delivery including remembering the exercises, initial discomfort modelling exercises and staffing challenges. Teacher initiatives to support delivery included reminder sheets, shared leadership and flexibility.

Conclusions. Study findings suggest that a future full-scale trial is likely to be feasible, with changes to the study design to increase participant completion of assessments and intervention delivery. Future studies can draw on the strengths and recommendations of the current study, allowing greater time for intervention delivery and larger sample sizes to enhance design. Future research can harness the opportunity to determine the efficacy of neuromotor intervention programmes for reducing the presence of primitive reflexes in four-year-olds as an intervention pre-primary school. This offers the potential to enhance children's learning, behaviour and physical development in New Zealand and beyond.

Key words: primitive reflexes; postural reflexes; Moves4LilMinds; early childhood; learning; behaviour; coordination; feasibility; acceptability.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed:

Dated: 30 January 2024

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List of Abbreviations

ATNR	Asymmetrical Tonic Neck Reflex, elicited by movement of the head left to right (Berk, 2009; Goddard, 2005). Turning the head to one side will result in straightening of the arm and leg on the side the head is turned to, and flexion of the limbs on the opposite side. Usually inhibited around 4 months of age. Tested using Ayres 1 (Goddard Blythe, 2012a).
BL	Baseline
CG	Control Group
CONSORT	Consolidated Standards of Reporting Trials
CNS	Central Nervous System
ECC	Early Childhood Centre
ECE	Early Childhood Education
IG	Intervention Group
INPP	Institute of Neuro Physiological Psychology
M4LM	Moves4LilMinds Movement programme
NM	Neuromotor
RCT	Randomised Control Trial
SDQ	Strengths and Difficulties Questionnaire
TLR	Tonic Labyrinthine Reflex, elicited by movement of the head both in flexion and extension with inhibition occurring around 2 months of age (Berk, 2009; Goddard, 2005). Tested using Erect Test for TLR (Goddard Blythe, 2012a).

Acknowledgements

Thank you to Southern Health and Disability Ethics Committee for the ethical approval of this research study on the 30 March 2022, reference number 2022 FULL 11628 (Appendix A).

I would like to thank the participating early childhood centre manager and teachers, your desire to always go above and beyond for the children in your care has not gone unnoticed. I thank the parents/whānau and children for your willingness to be involved in this research, and your thoughts and your opinions, without you this research could not have happened.

I would like to acknowledge and thank my supervisors Associate Professor Kelly Jones and Dr. Charmaine Bright for your continued encouragement, support, and willingness to share your knowledge and experiences with me. Your presence in this journey has enhanced my research and enriched my life.

I also acknowledge and thank the contribution of my husband Joseph, who encouraged, supported and reminded me of why I undertook this. Your help allowed me to spend the time needed to make this dream a reality. I thank my children also, who by their very presence, inspire me to be my best self. I am forever grateful to you all.

Prologue

This study aimed to explore if a movement intervention programme, aimed at supporting children's neuromotor development, was feasible for delivery to young children and acceptable to parents and teachers in an early childhood centre in New Zealand. Additionally, the study aimed to examine the feasibility of potentially running a larger study in the future. To provide some context to this research, the introductory section of this thesis is organised into the following three chapters:

Chapter 1 provides an overview of primitive reflexes, including its definition, assessment, and prevalence. Outcomes associated with the prolonged presence of primitive reflexes and neuromotor interventions to reduce the presence of primitive reflexes are also discussed.

Chapter 2 reviews literature examining the feasibility and acceptability of movement intervention programmes in young children (aged 4-7 years). Study findings are compared and contrasted, along with discussion of the strengths and limitations of studies to date. Further rationale for the current study is outlined based on literature review findings. The aims of this research are fully discussed.

Chapter 3 outlines the methodological frameworks, theoretical orientation, and epistemology underpinning this research. Justifications for the chosen modes of data collection and measurement tools are also presented in line with the theoretical orientation of the research.

Chapter 1

Primitive Reflexes

This chapter gives an overview of how physical movement develops brain capacity, the definition of primitive reflexes, the problems associated with prolonged primitive reflexes, the prevalence of prolonged primitive reflexes, and the research on movement interventions designed to support children's neuromotor development. This is followed by an overview of gaps in the literature, and an introduction to the aims of the current research project.

1.1 Background

Child development studies have been ongoing since Darwin in 1877 (Keenan et al., 2016) with the intent to support children's developmental and academic growth. More recently, links have been established between children's physical and cognitive development (Bjorklund, 1998). For example, Butcher et al. (2009) examined the quality of early spontaneous movement among infants aged 11–16 weeks and found direct associations with children's intelligence at 7-11 years of age. In fact, established evidence confirms widespread benefits of physical movement in children, including enhanced motor development, mental health, cardiovascular activity, well-being, cognition and executive function skills, such as planning, organising, working memory and problem solving skills (Alesi et al., 2016; Donnelly & Lambourne, 2011; Esteban-Cornejo et al., 2014; Gordon et al., 2013; Haapala, 2013; Hillman et al., 2008; McMorris et al., 2009; Singh et al., 2012; Stevens & Culpan, 2021; Van der Niet et al., 2016). Such benefits may be due, at least in part, to the role physical movement plays in facilitating the development of neural connections (Melillo et al., 2022). Both motor and cognitive functions are regulated by the frontal lobes, cerebellum, and basal ganglia which synergistically influence executive function and movement demonstrating the complex connections between physical movement and brain activity (Leisman et al., 2016). Furthermore, brain growth occurs through movement and interactions with the environment allowing neurons to increase in size and connectivity which activates more advanced areas of the brainstem and neocortex (Melillo et al., 2022). The repetition of motor movements in the first year of life leads to synaptic reorganisation in motor areas of the brain (Infante-Cãnetea et al., 2023). Therefore, optimal neural development requires physical activity (Tomporowski et al., 2011).

One of the ways the brain grows neurons and connections is through the sensorimotor system (Infante-Cãnetea et al., 2023). Primitive reflexes are the first phase of the

sensorimotor stage of development (Santrock, 2014) and are the medium through which infants experience and integrate movement (Bilbilaj et al., 2017). Additionally, the vestibular system is pivotal in the sensorimotor system, and needs to be working efficiently otherwise children may experience difficulties maintaining their physical balance and managing motor control (Goddard Blythe, 2023). Therefore, when supports are given to the full development of sensorimotor, vestibular and motor systems the brain is enhanced to maturely carry out other cognitive tasks (Infante-Cãnetea et al., 2023). However, because of the complex interactions of neurological systems, a delay in any of these systems can impact numerous areas of child development and brain processing such as vision, speech, attention and more (Bilbilaj et al., 2017; Goddard Blythe, 2023; Pecuch et al., 2020). Further research has found that retained primitive reflexes are linked to adverse sensory processing abilities, sensory motor skills, inattention, and social skills (Goddard Blythe, 2003; Pecuch et al., 2020). These aspects play a significant role in shaping a child's fundamental academic skills, which are essential prerequisites for learning and achieving in education (Ivanović et al., 2019).

The embodied learning theory, that movement establishes mental processes, is well regarded in modern schools (Tomporowski et al., 2011). In fact, physical movement as the foundation for all learning is an acknowledged educational practice (Connell & McCarthy, 2014; Dennison, 2006; Goddard Blythe, 2008; Jensen, 2005). Hence, the *New Zealand School Curriculum* mandates the use of physical education programmes in state and state integrated schools (Ministry of Education, 2007; New Zealand Government, 2023; Te Kete Ipurangi (TKI), 2014). Similarly, the New Zealand Early Childhood Education (ECE) curriculum *Te Whāriki* instructs all ECE providers to offer young children physical challenges so that they may learn how to be confident in, and in control of their physical bodies (Ministry of Education, 2017). Culpan (2017), who was involved in the development of the New Zealand Physical Education Curriculum, considers movement as the primary driver not only for the development of physical abilities but also for fostering children's social and emotional and learning. Additionally, other researchers have assessed brain activity in physically active children and found a connection between movement and cognition (Hannaford, 2005). Likewise, physical movement has been found to enhance children's cognitive and emotional development (Infante-Cãnetea et al., 2023; Tomporowski et al., 2011). Taken together, evidence suggests that physical activity can enhance children's learning, and highlights the importance of affording motor development the same priority as academic abilities while considering the impact of prolonged primitive reflexes in children's development.

1.2 Overview of Primitive Reflexes

Primitive reflexes are automatic stereotyped movements which assist with the birthing process and survival of the infant in the early months of life. Primitive reflexes can be seen in behaviours such as in the involuntary movement of the arms and legs when the head is turned - to assist with open airways, or crying when hearing sudden loud noises – to alert help, all of which assists the newborn to adapt to the new environment outside the womb (see Table 1) (Berk, 2009; Goddard Blythe, 2010; Santrock, 2014). This unconscious movement of the physical body engages the senses and muscles which react to the environment and create motor feedback, this in turn, actives genes and matures the motor system (Melillo et al., 2022). Primitive reflexes also facilitate changes in the distribution of muscle tone throughout the body which affects posture and voluntary movement (Berne, 2006). As highlighted by seminal research, primitive reflexes should be present from in-utero up to 12 months of age, whereby postural reflexes begin to develop and should be fully present by four years of age, allowing for greater sophistication of voluntary movement (see Figure 1); (Goddard Blythe, 2023; Goddard, 2005; Melillo, 2011).

Table 1

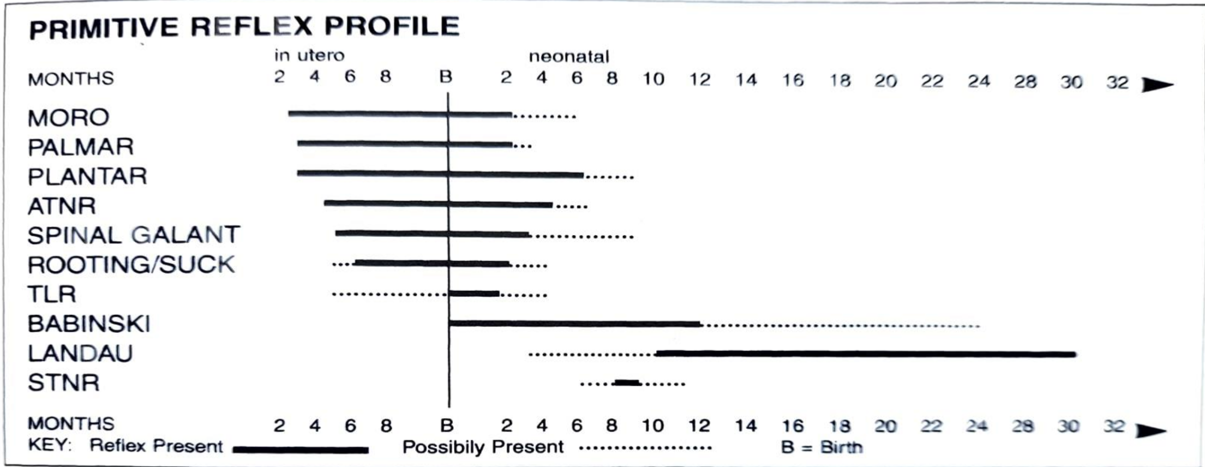
Description of three Primitive Reflexes

Reflex	**Physical Movement**	**Purpose**	**Age**	**Signs of retention**
Tonic Neck Reflex (TLR) Extension and Flexion	In extension, when the head moves backwards extensor muscles on the back of the body tighten. In flexion, when the head moves forward the shoulders droop, knees bend and muscles flex and become floppy.	Provides postural stability, and ability to defy gravity. Develops extensor and flexor muscle tone. Is the first trainer of the vestibular system in-utero.	In Utero until 3.5 years	Floppy or rigid muscle tone and posture Decreased balance Poor spatial awareness Motion sickness Toe walking Hypermobility of joints Speech delays Sensory and sensory-vestibular disorders (ie dyspraxia) Visual perceptual difficulties Poor sequencing and poor organisational skills Difficulties with math Poor head righting reflexes Lack of control of eye movements Atypical position of head in relation to body Under-developed proprioception
Asymmetrical Tonic Neck reflex (ATNR)	When the face of an infant is turned to one side, the ipsilateral (side the face is turned to) arm and leg extend straight, and the contralateral (side	Assists with movement through the birth canal. Separates left and right sides of the body	Birth until 6 months	Lack of hand-eye coordination Lack of bi-lateral movements Uncoordinated gait Poor handwriting and excessively tight pen grip Struggles to translate ideas into written text Poor eye tracking effecting reading Poor posture while writing Difficulty crossing the midline

	that the head is not turned to) arm and leg flex. This has been compared to a fencer's posture.	First trainer of hand-eye coordination		Difficulty riding a bike Poor manual dexterity Decreased balance Linked to ADHD and Dyslexia
Symmetrical Tonic Neck Reflex (STNR)	When the head and neck bend downwards it produces upper body flexion and lower body extension. When the head and neck extend upwards it produces upper body extension and lower body flexion.	Is needed for crawling to begin. Is a bridging reflex between primitive and postural reflexes.	Appears around 5-6 months and integrates around 9 – 11 months	Upper body and lower body coordination problems Difficulty swimming Poor muscle tone Slumping while sitting Sitting in a W Difficulties with binocular vision Clumsy movements Difficulties with sport and catching balls Difficulty sitting still and concentrating Poor hand-eye coordination

Figure 1

Process of Integration of Reflexes



ATNR = Asymmetrical Tonic Neck Reflex. TLR = Tonic Neck Reflex. STNR = Symmetrical Tonic Neck Reflex

Note. Timeline of integration of primitive reflexes. From *Reflexes, Learning and behavior* (p. 3), S. Goddard Blythe, Fern Ridge Press. Copyright 2005 by Sally Goddard Blythe. Reprinted with permission (Appendix B).

Primitive reflexes are eventually inhibited within the Central Nervous System (CNS) but are never eliminated, allowing for their reemergence if required (i.e., in the event of brain injury) (Goddard Blythe, 2023; Melillo, 2011). The presence of primitive reflexes is commonly assessed in infants upon birth, but is rarely examined again in the medical sphere, however, specific primitive reflexes are now beginning to be assessed in relation to children's academic learning. These reflexes include the: Asymmetrical Tonic Neck

Reflex (ATNR), (left/right); Tonic Labyrinthine Reflex (TLR), (flexion and extension); and the Symmetrical Tonic Neck Reflex (STNR), (flexion and extension) (Callcott, 2012; Gieysztor et al., 2015; Goddard Blythe, 2010; Goddard Blythe et al., 2022; Infante-Cãnetea et al., 2023; Madejewska et al., 2016; Pecuch et al., 2020; Pecuch et al., 2021). Primitive reflexes typically develop up to 12 months of age, and should be later inhibited as part of a young child's chronological development (Berk, 2009; Gieysztor et al., 2015). However, a study by Grzywniak (2016) challenged the assumption that the presence of primitive reflexes naturally reduces with age, suggesting that primitive reflexes may intensify over time without intervention. Infante-Cãnetea et al. (2023) also found that primitive reflexes were not inhibited spontaneously when studying the effect of a reflex remediation intervention with 46 children aged 4-7 years, (control group (n = 25); intervention group (n = 26)). Niklasson et al. (2015) found that primitive reflexes may be present in adulthood, leading to a range of sensorimotor disorders, neck pain, postural issues, proprioceptive and vestibular disturbances, and agoraphobia. Additionally, different primitive reflexes retained at a range of 14% – 47% were found in a study with 30 participants with Down syndrome in comparison to the control group (n = 45), concluding that the persistence of primitive reflexes is indicative of developmental or neurological problems (Sigafoos et al., 2021).

There are differing theories proposed regarding why primitive reflexes, may still be present past the time of normative development, though research is limited on this issue. For example, it has been suggested that changes in societal practices involving child restraints (i.e., high chairs, prams, car seats) which impede children's movement in the early years, the lack of early movement experiences such as tummy time, crawling etc, the increased use of devices with younger children, and poverty may contribute to the prolonged presence of primitive reflexes (Goddard Blythe, 2023; Goddard, 2005).

1.3 General Outcomes of Prolonged Primitive Reflexes

The prolonged presence of primitive reflexes reflects immaturity in the CNS and cortical brain structures (Goddard Blythe, 2023; Goddard, 2005; Melillo, 2011), and is referred to as neuromotor immaturity (Goddard Blythe, 2010; Goddard, 2005). While neuromotor maturity reflects efficient processing of impulses between nerves and muscles, neuromotor immaturity reflects dysfunction in these processes (Goddard Blythe, 2023). The study of primitive reflexes in the medical sphere has been explored since Descartes (c. 1596), as cited in Bilbilaj et al. (2017). The prolonged presence of primitive reflexes has been linked to a range of neuromotor disorders, such as cerebral palsy, stroke, spina bifida, and muscular dystrophy which are caused by damage to the CNS via illness or injury (Gieysztor et al., 2018; Goddard Blythe, 2023). The grasp reflex and Babinski are

two primitive reflexes that are consistently recognised as indications of this (Melillo et al., 2020). Melillo and colleagues (2022) also suggest that the prolonged presence of primitive reflexes, may be an early marker of developmental delay, and will eventually lead to neuro-behavioural disorders such as Autism Spectrum Disorder and Attention Deficit Hyperactivity Disorder. Other studies also emphasise the occurrence of underdeveloped movement skills in children with Autism Spectrum Disorder (Green et al., 2009) and links the prolonged presence of primitive reflexes with impaired balance and oculomotor dysfunction (McPhillips, 2004). Prolonged primitive reflexes have also been linked with other disorders such as sensory-vestibular disorders, dyspraxia – (developmental coordination difficulty), and postural disorders (Pecuch et al., 2020), as well as Opposition Defiance Disorder (Hickey & Feldhacker, 2021; Pecuch et al., 2020).

Growing evidence also links the prolonged presence of primitive reflexes with educational underachievement (Goddard Blythe, 2010, 2012a, 2023; Goddard, 2005; Grigg, 2018; Grigg et al., 2023). Educational achievement relies on effective cognitive function, including a range of executive function skills (i.e., planning, working memory), and visual perception (McMorris et al., 2009). These cognitive abilities rely on the development of a mature motor system and CNS (Goddard Blythe, 2005; Goddard, 2005; Melillo, 2011). Therefore, neurological dysfunction is linked to educational performance. Early evidence of links between prolonged retention of primitive reflexes and poor academic achievement was provided by Rider (1972), who studied the presence of primitive reflexes in children aged 6-13 years, with ($n = 20$) and without ($n = 38$) learning disabilities. Children in the learning disability group had significantly more abnormal reflex responses than the control group ($p < .02$).

Primitive reflexes have also been associated with academic delay (Grzywniak, 2016), reading problems (Ivanović et al., 2019; McPhillips, 2004), difficulty in telling time (Kalemba et al., 2023), poorer educational outcomes (Goddard Blythe, 2023; McPhillips, 2004), dysfunctional walking gait and truncal rotation (Gieysztor et al., 2022; Gieysztor et al., 2018) and lack of school readiness abilities, such as cutting with scissors, holding a pencil, drawing, and sitting still (Callcott, 2012; Goddard Blythe, 2023; Goddard Blythe et al., 2022; Seniloli, 2020). Pecuch et al. (2020) examined 75 Polish children aged 4 – 6 and found that higher levels of retained primitive reflexes were associated with poorer gross motor control, fine motor control, emotional regulation, cognitive performance, visual and auditory perception, and verbal articulation. Gieysztor et al. (2022) examined 50 preschool children (aged 3.5 - 6 years) and found links between primitive reflexes and impairments in spontaneous movement such as free play, demonstrating the potential impact of primitive reflexes on children's everyday activities. Primitive reflexes have also been linked to sensori-motor disorders leading to emotional immaturity in children and

isolation from peers (Goddard, 2005; Pecuch et al., 2020). Taken together, primitive reflexes have been associated with various developmental challenges for children, including developmental delay and educational problems.

Further, the prolonged presence of specific primitive reflexes has also been linked to adverse child development. For example, higher rates of the ATNR has been linked with dyslexia (Goddard Blythe, 2012a; Hazzaa et al., 2023; McPhillips, 2004) effecting movement skills, manual dexterity, hand-eye coordination, mid-line crossing, handwriting, balance, and eye tracking (Callcott, 2012; Goddard, 2005; Goddard Blythe, 2012, 2003). In addition, strong links have been made between a retained ATNR and Attention Deficit Hyperactivity Disorder (Konicarova & Bob, 2013; Konicarova et al., 2013). As another example, the TLR influences the vestibular system that is located in the inner ear impacting balance, muscle tone, and proprioception, due to the impact it has on the messages being sent from the body through the vestibular-cerebellar loop and the vestibular-ocular loop to the brain (Goddard Blythe, 2023). The TLR can adversely impact head righting reflexes that are necessary for correct head alignment, control of eye movements and overall posture (Connell & McCarthy, 2014; Goddard, 2005). The prolonged presence of the TLR has been linked to a speech delays (Goddard Blythe, 2023; Goddard, 2005; Matuszkiewicz & Gałkowski, 2021), sensory disorders such as dyspraxia, and sensory-vestibular disorders (Pecuch et al., 2020; Pecuch et al., 2021), difficulties in maths, visual perceptual difficulties, spatial problem, poor sequencing skills, poor posture and poor organisational skills (Feldhacker et al., 2021; Goddard, 2005). Madejewska et al. (2016) examined 131 children aged 4-7 years in Kamienna Góra and found that the TLR was the most commonly retained primitive reflex. Pecuch et al. (2020) also found the TLR present in 81% of children aged 4 to 6 years. While the Gieysztor et al. (2015) study of 135 children, aged 4 to 6 years, found that the ATNR and TLR were the least integrated of the reflexes.

Clear links have been established between the prolonged presence of primitive reflexes and adverse physical and educational outcomes in school-aged children. Specific, targeted physical movement that works on the reduction of primitive reflexes has been the focus of research since the 1970's (Goddard Blythe, 2012a; Goddard, 2005; Grigg, 2018; Infante-Cãnetea et al., 2023). Most research to date has examined physical movement and primitive reflexes using the INPP programme in school-aged children (≥7 years) (Goddard Blythe, 2005; Goddard Blythe, 2010; Grzywniak, 2016; Ivanović et al., 2019; Marlee, 2008; McPhillips, 2004; Wahlberg & Ireland, 2003) and have found links between more advanced motor development and a reduced presence of primitive reflexes (Gieysztor et al., 2015).

1.4 Prevalence of Primitive Reflexes in Children

While primitive reflexes should be inhibited in the first year of life and postural reflexes fully developed by four-years of age, there is growing evidence that this is not the case in the general population (Callcott, 2012; Gieysztor et al., 2017; Gieysztor et al., 2015; Goddard Blythe, 2010; Goddard Blythe et al., 2022; Infante-Cãnetea et al., 2023; Madejewska et al., 2016; Pecuch et al., 2020; Pecuch et al., 2021). Infante-Cãnetea et al. (2023) examined 46 children aged 4-6 years and found that 100% of children had primitive reflexes present to some degree. Preedy et al. (2022) found 85% of 120 children 4 – 6 years had primitive reflexes. Pecuch et al. (2021) found 93% of 44 children aged 4 – 6 had retained primitive reflexes. Feldhacker et al. (2021) found 100% of 53 children aged 5-7 years had at least one retained primitive reflex. Similarly, Goddard Blythe et al. (2022) study of 4 – 5 year old children over four schools (n = 120) found 97% of children had primitive reflexes. Of 108 children starting school in the UK, who were assessed for primitive reflexes, 75% had primitive reflexes present beyond age four-years (Goddard Blythe et al., 2022). However, lower rates of prevalence have also been reported. Goddard Blythe (2010) examined 25 children aged 4-6 years and found that 40% had primitive reflexes present. Similarly, Pecuch et al. (2020) found that 14% of 44 healthy 4 – 7-year-olds had primitive reflexes present to a medium or high level. Goddard Blythe (2005) examined 339 children in Northern Ireland and found that 48% of 5 – 6 years olds still had primitive reflexes, with elevated levels of primitive reflexes correlated with educational under-achievement. Gieysztor et al. (2015) examination of 135 4-6-year-olds found 65% of children had retained primitive reflexes. Importantly, there is some evidence to suggest that prevalence rates are higher in children with physical disabilities, learning difficulties and neurodevelopmental disorders (Melillo et al., 2020). Taken together, these findings clearly highlight the presence of prolonged primitive reflexes in the general population ranging from 20% to 100% of 4–6-year-old samples, with a large proportion of studies reporting prevalence rates above 50%. It is acknowledged that historically retained primitive reflexes have been thought to be only linked to neurological damage and/or developmental delay, however, new research is contradicting this assumption.

1.5 Neuromotor Interventions to Reduce Primitive Reflexes in Children

Despite the range of movement intervention programmes available, not all of them address primitive reflexes and there is often a separation between movement programmes for physical fitness and those that support emotional, social and intellectual outcomes (Tomporowski et al., 2011). Some programmes aim to improve fitness to support cardiovascular development and academic achievement, such as the *Physical*

Fitness across the Curriculum Project and *Preschoolers in the Playground* (Barber et al., 2016; Donnelly & Lambourne, 2011). Other physical movement interventions have focused on reducing the presence of primitive reflexes to remedy dysfunction in children's neuromotor abilities and to support academic and motor development such as the *INPP Programme*, *Primary Movement Programme* or *Movement for Learning Programme* (Goddard Blythe, 2012a; Pecuch et al., 2021). Further programmes have focused on fundamental perceptual sensory programmes such as the *Moving Smart Perceptual Motor Programme* (PMP) (Connell & McCarthy, 2014) or movement skill development like *Jump Start* (Jones et al., 2016; Jones et al., 2011; Preedy et al., 2022). Others still, such as the *Damon-Delacato Method of sensorimotor patterning*, claims to heal neurologically handicapped individuals (Doman, 1974), however, this programme has seen strong criticism with research providing no evidence of its effectiveness (Bridgman et al., 1985). More generally, further criticism have been levelled at perceptual programmes due to a lack of rigorous evaluation and research of the programmes efficacy in supporting positive outcomes (Melillo et al., 2020; Stephenson et al., 2007). Other criticisms of movement programmes include a lack of generalisability of benefits beyond the classroom setting with some interventions considered to help child-adult movement experiences in the classroom but not beyond (Archer & Siraj-Blatchford, 2015).

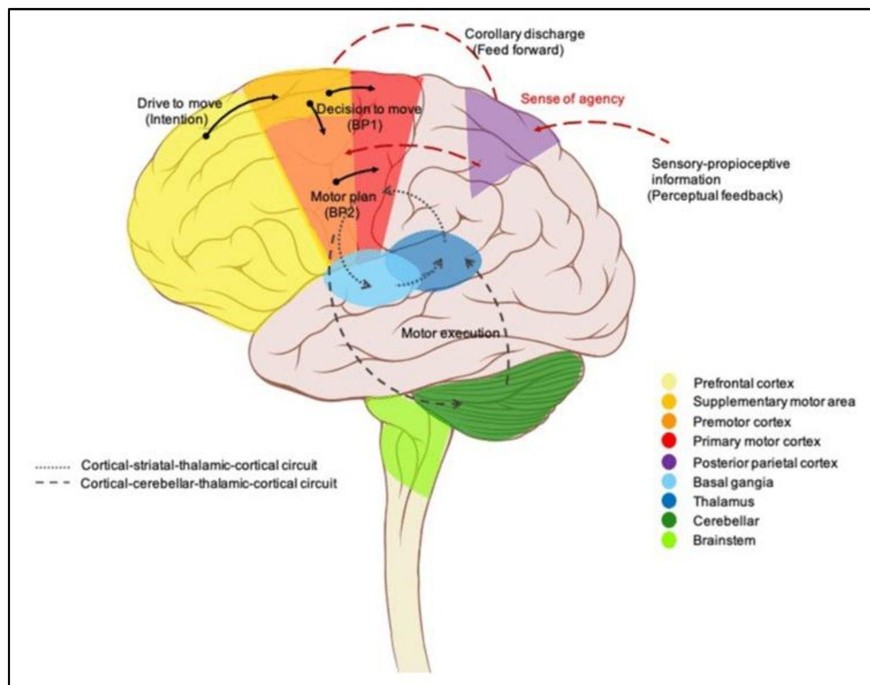
Prior research examining associations between neuromotor interventions and the presence of prolonged or retained primitive reflexes has tended to examine school-aged children in Europe, using the *Institute of Neuro Physiological Psychology's (INPP)* schools programme (Bilbilaj et al., 2017; Brainbox, 2004; Erdei, 2011; Gieysztor et al., 2015; Goddard Blythe, 2010, 2012a, 2023; Infante-Cãnetea et al., 2023; Konicarova & Bob, 2013; Konicarova et al., 2013; Marlee, 2008). The INPP schools programme is a structured series of developmental exercises carried out over the course of one school year. The aim of the INPP intervention is to reduce the presence of primitive reflexes in children and promote the development of more mature and developmentally appropriate postural reflexes, neuromotor function and associated developmental outcomes (Goddard Blythe, 2012a, 2023).

Ayres (1970), the founder of sensory integration therapy, conceptualised that physical exercises mature the CNS and develop mature patterns of movement which supress primitive reflex interference. While this may work in cases where primitive reflexes are present to a weak or lesser extent, interventions based only on physical exercise may be less effective in the presence of stronger or more widespread primitive reflexes (Goddard, 2005). Motor programmes, perceptual programmes and sensory programmes have had some effect on inhibiting primitive reflexes, however interventions specifically

targeting primitive reflex stimulation and inhibition are more successful (Goddard Blythe, 2012a). Olivé (2001), as cited in Infante-Cãnetea et al. (2023), suggested that changes to children's genetic, anatomical and cognitive functioning can be achieved by repeating specific physical movements. Both conscious and non-conscious control of the sensory motor system relies on the interactions between all areas in the brain, particularly the brainstem, cerebellum, basal ganglia, vestibular system and motor cortex (Figure 2). These paramount findings have informed current theories of development and lead to the understanding that by repeating specific physical movements, voluntary control of movements is improved. This improvement shows the cortex's ability to override subcortical behaviour and stereotyped movement patters particular to primitive reflexes (Goddard, 2005). Essentially the brain develops from a brainstem response to a cortically controlled response (Gieysztor et al., 2018). This gives insight into the ability of neuromotor programmes to mature the CNS, resulting in more sophisticated movement patterns, the reduction of primitive reflexes and enhanced academic development.

Figure 2

An Overview of the Production of Physical Movement



Note: From *We Move or Are We Moved? Unpicking the Origins of Voluntary Movements to Better Understand Semivoluntary Movements.* S. Virameteekal & R. Bhidayasiri, 2022. ResearchGate. Available from: https://www.researchgate.net/figure/Brain-circuits-control-voluntary-movement-Voluntary-movements-are-executed-consciously_fig2_358750386. Creative

Studies have also shown that children's educational development has been improved by integrating retained primitive reflexes and supporting the development of more mature

adult postural reflexes (Goddard Blythe, 2008; 2012; Gieysztor, 2018; Connell, 2014; Brainbox, 2004). For example, evidence suggests that school-aged children completing the INPP programme have greater improvement in reading, and the children who make the most progress are the ones who are underachieving at school subjects (Goddard Blythe, 2005; Ivanović et al., 2019). Previous studies have found associations between the INPP intervention and improvements in children's academic performance, including reading, writing, spelling, and math (Gieysztor et al., 2015; Goddard Blythe, 2005; Grigg, 2018; Ivanović et al., 2019; Wahlberg & Ireland, 2003), behavioural adjustment, gross motor abilities, and attention (Erdei, 2011; Goddard Blythe, 2005; Goddard Blythe, 2010, 2023; Goddard Blythe et al., 2022; Infante-Cãnetea et al., 2023; Zielińska & Goddard Blythe, 2020) – all important attributes to support children's capacity for learning and cognitive development (Veldman et al., 2019).

Though some progress has been made in assessing the efficacy of neuromotor interventions among school-aged children, relatively few studies have examined primitive reflex remediation programmes in younger age groups. Even fewer studies have examined the feasibility of conducting large scale trials in younger age groups and the acceptability of such intervention programmes from teacher and parent perspectives, within the early childhood education setting. Furthermore, to the best of our knowledge, there have been no prior studies of neuromotor interventions for the remediation of primitive reflexes among pre-school-aged children in New Zealand. This is particularly concerning given recommendations that primitive reflex assessments should be included in pre-screening tools to determine children's neuromotor readiness for formal education, and, if present, that intervention is needed to enhance children's physical, emotional, and cognitive development (Bilbilaj et al., 2017; Callcott, 2012; Gieysztor et al., 2017; Gieysztor et al., 2015; Goddard Blythe, 2023; Hickey & Feldhacker, 2021; Infante-Cãnetea et al., 2023; Madejewska et al., 2016; Matuszkiewicz & Gałkowski, 2021; Pecuch et al., 2020; Pecuch et al., 2021). This area of research is beginning to find traction, but is still lacking robust, definitive empirical evidence specific to the New Zealand context, especially concerning the feasibility and acceptability of delivering neuromotor intervention programmes to younger, preschool-aged children.

Therefore, this study aims to address current knowledge gaps by examining a reflex based physical movement intervention among pre-school aged children in New Zealand – Moves4LilMinds (M4LM). The M4LM Programme is a one-year intervention, incorporating the INPP assessment methods (Goddard Blythe, 2012a) and schools exercise programme. It is aimed at reducing the presence of primitive reflexes in 4 - 6 year olds by combining primitive reflex integration exercises with bi-lateral integration exercises (Dobie, 2008) to develop postural reflexes and assist with positive school

outcomes. The M4LM programme was selected for study because it is in use but has not been evaluated in New Zealand or in the age group suggested. Two research questions drive this research: To what extent is conducting a future full-scale randomised trial of the M4LM programme, to test efficacy, feasible in the New Zealand context? And what are teacher's and parent's impressions of the acceptability of the M4LM programme? The aim of this study was to evaluate the impact of a reflex based physical movement intervention among pre-school aged children in New Zealand. The first step in doing so was to conduct a literature review to identify existing published studies concerning neuromotor interventions with children under 7 years of age with feasibility and/or acceptability criteria among young children, which is presented in the next chapter.

Chapter 2

Literature review

2.1 Literature Review Methods

A comprehensive database search was undertaken to identify existing published studies concerning neuromotor interventions with children under 7 years of age with feasibility and/or acceptability criteria among young children. Spanning 2010 to 2023, the databases *PsychINFO*, *PubMed*, *EBSCO, Research Gate and Google Scholar* were searched for relevant articles. Study selection criteria included: 1) study sample of children aged 3-7 years, and/or 2) feasibility and/or 3) acceptability studies examining physical movement interventions.

Forty-four studies were initially identified and reviewed by the lead researcher for the above criteria. Four studies met criteria and were included in the review. Of the four studies examined in this literature review, two examined feasibility and acceptability and efficacy (Barber et al., 2016; Jones et al., 2011) and two examined efficacy and acceptability only (Preedy et al., 2022; Vidoni et al., 2014). The methodology and findings of each study are summarised in Table 2, including details of the study samples, study measures, developmental domains examined, key findings, effect sizes, and strengths and weaknesses.

Table 2

Summary of Feasibility and Acceptability Studies of Physical Movement Interventions in Young Children

Authors Date	**Title**	**Age & Sample**	**Design**	**Domain**	**Measures**	**Findings**	**Effect Sizes**	**Strengths and *Limitations***
Barber, S; Jackson, C; Hewitt, C; Ainsworth, H; Buckley, H; Akhtar, S; Bingham, D; Routen, A; Summerbell, C; Richardson, G; Moore, H; Pickett, K; O'Malley, C; Brierley, S; Wright, J. (2016)	Assessing the feasibility of evaluating and delivering a physical activity intervention for pre-school children: a pilot randomised controlled trial	164 children aged 18 months – 4 years, in 10 schools 15 staff	52 week two-armed pilot cluster RCT Feasibility & Acceptability Study Preschoolers in the Playground (PiP) intervention	PHY	Feasibility: recruitment, retention and completion rates of primary (daily moderate-to-vigorous physical activity (MVPA)) and secondary (anthropometric, quality of life, self-efficacy) outcomes Teacher semi-structured interviews Acceptability: of recruitment, study design and accelerometers, intervention attendance and content, schools' capability to deliver intervention	Recruitment rates: 37 % of schools (n = 10 schools) and 48% of pre-school children (n = 164 children) Retention at 52 weeks = 83%. 39% had valid data at BL and FU Response rates for secondary outcome ranged from 52% to 88% at 10 weeks and 59% to 80% at 52 weeks A trial is feasible but is weather sensitive high implementation fidelity: 81% (82% during summer to 50% autumn/spring) Parents & teachers found the intervention acceptable and beneficial	At 52 weeks, the adjusted mean daily MVPA was 75.6 (95% CG 63.4 to IG 87.8) and 75.2 (95 % Confidence Interval 64.2 to 86.3) minutes in the control arm (mean difference 0.4, 95 % Confidence Interval 16.3 to 17.0, p = 0.96)	Multiple school study CG - normal curriculum High implementation of intervention Follow up at 10 and 52 weeks Used CONSORT *Lack of data collection by parents* *Attendance was low and preliminary data showed no evidence of intervention effectiveness* *Strategies to increase accelerometer wear-time needed*

Authors Date	Title	Age & Sample	Design	Domain	Measures	Findings	Effect Sizes	Strengths and *Limitations*
Jones, J; Riethmuller, A; Hesketh, K; Trezise, J; Batterham, M; Okely, A. (2011)	Promoting Fundamental Movement Skill Development and Physical Activity in Early Childhood Settings: A Cluster Randomised Controlled Trial	97 children, aged 3-5 years in 2 ECE centres 7 staff	20-week, two-arm Parallel pilot cluster RCT IG - Jump movement programme Feasibility & Acceptabilit y Study	PHY	Test of Gross Motor Development Body Mass Index Feasibility: fidelity, dose, reach Acceptability: Checklist evaluations of lessons, Teacher individual semi-structured interviews	IG statistically sig. improvements in movement skill proficiency Study was feasible & acceptable: 100% of professional development and lessons were delivered; staff reported 90% of programme was appropriate with high satisfaction Retention goals succeeded Intervention highly appropriate	IG (adjust diff.= 2.08, 95% Confidence Interval 0.76, 3.40; Cohen's d = 0.47) Significantly greater increases in objectively measured physical activity (counts per minute) during the preschool day (adjust diff. = 110.5, 95% Confidence Interval 33.6, 187.3; Cohen's d = 0.46)	Multiple assessment sessions beneficial for maintaining FU completion CG - normal curriculum Designated centre person to liaise with participants *Small sample size* *Government chosen schools (Similar demographics)* *Initial results not maintained at FU*
Preedy, P; Duncombe, R; Gorely, T. (2022)	Physical development in the early years: the impact of a daily movement	120 children aged 4 – 5 years in three schools	10 week two-armed RCT	Primitive Reflexes PHY	INPP Developmental Screening Test TLR Symmetrical Tonic Neck Reflex	CG = no improvement in scores and decrements of up to 9 percentile points	Effect sizes for IG *p*= .008 for balance *p*= .013 manual dexterity	Multiple schools CG -normal curriculum

Authors Date	Title	Age & Sample	Design	Domain	Measures	Findings	Effect Sizes	Strengths and *Limitations*
	programme on young children's physical movement	15 staff	IG - Movement for Learning Efficacy & Acceptability Study		ATNR Movement Assessment Battery -2 Teacher Survey Questionnaire	No differences between groups at BL for any variables (p > .05) IG at BL 20 percentile points lower than CG IG - Teacher reported improvement in writing, listing, following instructions, and stamina IG – Improvement in coordination, handwriting, cutting, balance, gross and fine motor skills, agility Least impact on social skills Medium statistically significant findings in balance, manual dexterity and ABC scores in IG compared to CG	*p*= .281 aiming and catching .	Use of state and privately funded schools *Small sample sizes* *No schools in low socio-economic*
Vidoni, C; Lorenz, D; Terson de Paleville, D. (2014)	Incorporating a movement skill programme into a preschool	33 children aged 3.9-5 years in two ECE centres	11 week two-arm RCT	PHY	Bruinicks- Motor Proficiency Teacher Survey Questionnaire	Both groups same with motor proficiency at BL IG more likely to improve (or remain stable) in three tasks (a) tapping feet and	Improvement in motor proficiency in both groups CG (p =.02) and IG (p= .001)	Anonymous survey CG – normal physical play

Authors Date	**Title**	**Age & Sample**	**Design**	**Domain**	**Measures**	**Findings**	**Effect Sizes**	**Strengths and *Limitations***
	daily schedule	8 staff	Efficacy & Acceptabilit y Study IG – Maze movement programme			fingers, (b) standing on one leg on a balance beam, and (c) dribbling a ball CG more likely to improve in fine motor precision such as (a) drawing lines through paths, (b) folding paper, and (c) transferring pennies Motor skills which improved do not naturally develop through children's growth and maturation. Teachers found the structured activities acceptable	Significant improvement observed in the IG greater than CG ($p = 0.04$)	IG run inside at the same time every day to minimise variables in findings *Small sample size*

Notes: IG = Intervention Group; CG = Control Group; BL = baseline; FU = follow up; PR = Primitive reflexes; PHY = physical domain.

2.2 Feasibility Findings

Barber et al. (2016) studied the feasibility and acceptability of the *Preschoolers in the Playground* intervention programme with 164 children (aged 18 months – 4 years) in the United Kingdom (Barber et al., 2016). The intervention was run in playgrounds at primary schools at drop off and pick up times and consisted of six 30-min sessions per week for 30 weeks. Parents were asked to attend three sessions per week and were given a ActiGraph GT3X+ accelerometer on a waistbelt to use on their child during waking hours, seven days per week. Each session consisted of 2 five-minute structured-play activities for parents and children to engage in together and 15 minutes of free play (during which handouts and guided discussions were conducted) and an active tidy-up. The study was conducted in two phases. The first initiation phase ran for 10 weeks and was facilitated by a school staff member. The second, final maintenance phase ran for 20 weeks and included unsupervised movement sessions at the same playground. Children received play equipment each week to take home and keep; valued at £15. Families in the control group did not have access to a playground intervention and continued with their daily routines as normal. Outcome measures included trial feasibility (recruitment, retention, feasibility of collecting outcomes measure, preliminary assessment of intervention effectiveness) and intervention feasibility (intervention fidelity, attendance, capability of the school to deliver the intervention), including intervention acceptability as rated by parents, facilitators and head teachers.

Jones et al. (2011) measured the feasibility and acceptability of the *Jump Start* physical activity programme in two Australian preschools with 97 children (aged 3-5 years). Delivered over a 20-week period, this intervention focused on children's development of specific movement skills. Delivered by staff in ECE centres, the intervention involved four 30-minute professional development workshops for staff including theory and practical components, and structured lessons and unstructured movement activities for children. The ActiGraph MTI 7164 accelerometers measured physical activity and were worn for two consecutive days while attending childcare. Structured lessons were delivered three times per week for 20 minutes and focused on one fundamental movement skill: (e.g., running: fast and slow). Structured lessons were followed by periods of unstructured play where children practice the newly acquired skill, through activities and games. The control group implemented their usual programme, including outside free play. Feasibility outcome measures included intervention fidelity, dose, and reach. Acceptability outcome measures included delivery of professional development lessons and staff reported acceptability of the programme.

Common feasibility measures across the two studies were the assessment of participant recruitment and retention, intervention adherence, and participant burden that typically

focused on the extent to which study assessments and measures were completed. Acceptability was assessed across both studies based on teacher-report. In addition, Barber et al. (2016) also focused on attendance, acceptability to parents along with the capability of the school to deliver the intervention. Jones et al. (2011) also assessed dose, reach and attendance to teacher training. Both studies deemed the interventions to be feasible in all areas with Jones et al. (2011) exceeding the desired retention rates.

Participant recruitment and retention

Barber et al. (2016) found that 37% of schools consented and 48% of children were recruited. Of this, 5% withdrew, 16% were lost to follow-up and 83% provided some data over the 52 weeks. Conversely, Jones et al. (2011) chose the centres to be included and therefore did not have data for the recruitment of centres, and reported a higher recruitment rate with 89% of children recruited. Participant (child) retention in the Barber et al. (2016) trial was 83% at 52-weeks. Similarly, Jones et al. (2011) retained 89% of child participants at 20 weeks. While retention is similar in both studies the length of intervention effected the Barber et al. (2016) trial as participant drop out occurred in the autumn and spring months, whereas the Jones et al. (2011) study did not measure the trial over different seasons and weather conditions. Further explanation could be due to the nature of recruitment with the government choosing the centres to participate in the Jones et al. (2011) study. The chosen centres may have had a greater need for intervention programmes or may have been limited to centres that had previously consented to take part in government led research.

Intervention adherence

Barber et al. (2016) assessed intervention adherence according to *NIH Behavior Change Consortium guidance,* observed eight sessions, and measured delivery, supervision, support, encouragement of children, and play equipment. Findings were that intervention protocol was adhered to 81% of the time. The group mean total fidelity score was 29.1 (SD 5.7), out of a maximum total score of 36. Notably with this intervention being run in the outdoors attendance was higher (82%) during summer (82%) compared to autumn or spring initiations (50%). While Jones et al. (2011) did not report figures there was mention of intervention adherence being maintained via evaluations of structured lessons using a standardised checklist.

Participant burden

Barber et al. (2016) found 39% of children had valid primary outcome, accelerometer data at baseline and 52 weeks. In centre and in home assessments were offered to participants to encourage retention and teachers noted that parent attendance and child participation was lower when teachers were not in the playground in the maintenance phase. Response rates for secondary outcome measures ranged from 52% to 88% at 10 weeks and ranged from 59% to 80% at 52 weeks. Jones et al. (2011) reported higher rates of assessment completion and attributes much of this success to the high levels of support from the centre director and staff and perception of benefits from the parents. At baseline, 94% of children completed movement assessments. At follow-up, 97% of children completed movement assessments. The authors of the Jones et al. (2011) study also attribute the higher rates of assessment completion to the availability of multiple measurement sessions and close working relationships between families and centre management and staff.

2.3 Acceptability Findings

All four studies used a mixed methods approach including semi-structured interviews or questionnaires to measure intervention acceptability (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014). Barber et al. (2016) used a mixture of face to face and telephone semi-structured interviews with 15 parents from the intervention (n = 83) and control (n = 81) groups, seven intervention facilitators and two head teachers. Parents and facilitators were interviewed at the 10-week follow-up mark, while head teachers were interviewed at the end of the intervention (52 weeks). Acceptability was measured by recruitment and retention, study design (accelerometers), views on the intervention attendance and intervention content. Additional questions covered staff capability and capacity for delivering the intervention. Researchers found that the recruitment method, being approached in the playground, was acceptable. Whereas feedback about the acceptability of the accelerometer was mixed with most participants saying it was easy to use the belt, or they forgot to put it on. Reasons for the low attendance rates were due to the timing and location of the sessions, with wet weather also being a barrier to adherence as the sessions were run outside. Most (80%) parents and all facilitators saw the programme as fun and noted the variety of physical activities. While head teachers had incorporated the programme into their normal daily routines, the extra financial costs to the school were noted with a preference for a shorter programme. Additionally, the intervention was found acceptable and beneficial by facilitators and head teachers for children, parents and schools. Families also reported that often it was family issues that occurred which hindered the attendance to sessions, and that also the timing and location of the sessions were a barrier. However, this

contrasted the feedback from parents who attended regularly stating that the timing and locations of sessions fit well with school pick up and drop off. Teacher feedback was split with two teachers stating that someone needed to take the lead for the sessions to be successful and the other two being more positive that parents could develop the sessions to lead. The lead teachers saw the programme from a logistical viewpoint where staff allocation was needed, and the subsequent impact of this on workload, breaks and budget.

The other studies in this review focused solely on intervention evaluation and/or acceptability, based on teacher reports. Jones et al. (2011) evaluated acceptability measures and pre-defined acceptability as 100% of the professional development and structured lessons being delivered; staff reporting that 90% of the programme was appropriate; and were satisfied with the intervention. Staff strongly agreed that the length of the lessons, the activities provided, the number of activities, the equipment and the time needed to set up the equipment were highly suitable. Overall, there was high satisfaction with the programme and teachers suggested that children engaged with the activities were motivated to participate. Some staff attributed the difference in movement skill development of the children to the programme. Improvement in physical movement development, the variety of activities and the engaging professional development workshops were all highly valued. Teachers also reported finding the length of lessons, scope and number of activities, and time requirements to set up the lessons appropriate.

Preedy et al. (2022) recruited 108 children from three schools in the United Kingdom. Teachers were trained in the use of the intervention programme *Movement for Learning* which is a range of specific exercises designed to be delivered to the whole class on a daily basis for 15 – 20 minutes four times per week (Duncombe & Preedy, 2018; Preedy et al., 2022). The programme consisted of six units lasting four weeks, delivered over one school year. The intervention aimed to improve children's (aged 4-6 years) fine and gross motor movements, balance, and presence of primitive reflexes. Additional aims included improving a range of academic and behavioural outcomes for children. The underlying mechanisms of the intervention were based on allowing children to re-visit key infant developmental stages (e.g., rolling and crawling) while focusing on fundamental movement skills (e.g., jumping, throwing, catching, and running). The control group participated in normal centre activity. The *Movement Assessment Battery - Version 2* was used to assess physical balance abilities when they started school, including tests of balance, one leg stand (both legs tested), jumps, walking with heels raised, aiming and catching, manual dexterity, drawing, posting, and threading. Acceptability and evaluation were conducted through an emailed an online survey to gain an insight into the effectiveness of the programme from those who participated, to identify

any issues teachers encountered in running the programme, and to evaluate its acceptability. Teachers were asked about ways in which the programme had impacted children across four developmental domains: academic, personal/social, physical and behavioural Overall, teachers reported that the programme was acceptable and that improvements could be seen in children's academic, social, and physical skills. Improvements in children's writing, listening, following of instructions and greater stamina in written tasks was reported. Personally, and socially, teachers reported the least progress, and nine out of 15 teachers did not reply. Physically, teachers reported that children moved with agility and confidence with improvement in coordination, cutting, balance, and gross and fine motor skills. Behaviourally, most teachers noticed improvements immediately following sessions, and that children were 'more ready to learn', however four teachers did not notice any behavioural changes. Some teachers found the repetitive nature of the programme effective as it allowed children to catch up if they had missed earlier sessions. Challenges to delivering the programme included the time required to plan, implementation, timetabling, other curriculum pressures and access to physical space.

Finally, Vidoni et al. (2014) examined the acceptability of a physical movement intervention in 33 American children (aged 3.9 to 5 years) across two ECE centres. Children assigned to the intervention participated in the *Maze* approach which is aligned with *NASPE Active Start* and *Appropriate Practices in Movement Programs for Children Ages 3–5* publications (National Association for Sport and Physical Education, 2009). The intervention included 30 minutes of structured physical activity per day for 11 weeks in a designated physical room. The purpose of this study was to assess the effectiveness of the *Maze* movement programme implemented by classroom teachers to support children's physical, social and emotional development. The *Bruinicks-Motor Proficiency Test* was used to assess children's fine and gross motor skills in the areas of fine motor control, manual coordination, body coordination and strength and agility. Teacher acceptability was measured via a seven-question questionnaire with the four intervention teachers. Teachers were asked about how acceptable the procedures were in improving student motor skills, and developing social or emotional behaviours, how willing they would be to implement this intervention daily the acceptability of the 30-time frame and how well they would be able to do this on their own, to gauge the ease of implement and benefit to children. Similarly, to Preedy et al. (2022) teachers found it acceptable to use, but were unsure if the programme itself had been the cause of the improvements in children's development. There were generally mixed results from the four teachers, with two finding most aspects of the intervention very useful and the other two finding it neutral for the acceptability questions. This was further seen in the amount of time and duration that teachers were willing to give to implement the programme as half of the teachers

wanted it to take less time due to concerns about the lack of free play time. This is consistent with the Barber et al., (2016) and Preedy et al. (2022) studies where users preferred 15-20 minutes of intervention per day.

Across studies, barriers to implementation included a lack of time, staff shortages, curriculum pressures (Jones et al., 2011; Preedy et al., 2022), the time taken to implement the programme long term (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014) financial and management barriers (Vidoni et al., 2014), and lack of children's participation in the programme (Barber et al., 2016). However, overall, interventions were considered acceptable across all four studies, with most teachers seeing positive improvements in children's physical and at times social and emotional development (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014). As only the Barber et al., (2016) study measured parent acceptability, these findings are not comparable, however, parents who participated in the programme were positive of the benefits for children, showing that there is an acceptability of such interventions with young children.

Methodological strengths of the current literature

The studies summarised in Table 1 provide useful initial findings for understanding the feasibility and acceptability of delivering physical movement programmes among young children. Common strengths of the identified studies include all studies being RCT's designed to measure intervention efficacy and each RCT included baseline and follow up assessments to measure quantitative outcomes over time (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014). Both Barber et al. (2016) and Jones et al. (2011) included blinding, trained assessors, validated instruments, interventions run by setting staff and designs aligned with Consolidated Standards of Reporting Trials (CONSORT) protocols (Moher et al., 2010). Examining both feasibility and acceptability within a single study design provides more robust findings and a wider range of knowledge about a given intervention compared to studies focused solely on feasibility or acceptability (Azorín & Cameron, 2010).

Therefore, while the aims of each study differ, the design of each study meets scientific expectations and rigour by being randomised and using an intervention and control group (Moher et al., 2010). Additionally, all studies (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014) used a control group that ran normal centre or school curriculum. This adds scientific rigour as the intervention's efficacy is compared to normal 'best practice' allowing the more effective practice to be seen (Taylor-Thompson & Schoenfeld, 2007). In addition, the Jones et al., (2011) study enhanced

processes by ensuring that assessors were blinded to groupings of children to minimise bias through the use of allocation concealment (Day & Altman, 2000).

Each study in this review approached randomisation differently, both individually and cluster. Barber et al. (2016) used a cluster randomised trial design, with randomisation by school. Preedy et al. (2022) did not specify how randomisation occurred but the study appears to be a cluster randomised trial due to it running in three schools. Jones et al. (2011) randomised individually by computer generated number randomisation, and Vidoni et al. (2014) was a cluster randomisation by classroom. How studies are randomised are an important part of study design and the most robust way to ensure intervention is without prejudice is to make the allocation of control and intervention groups completely random (Moher et al., 2010). In this instance only the study by Jones et al. (2011) meets this standard. However, as the phenomenon of each study is a group based intervention, cluster randomisations are appropriate as these programmes are not designed to be run with individual children (National Institute of Health, n.d).

The inclusion of interviews for teachers ensures that pilot studies can gauge if the programme is effective and acceptable to users. This allows qualitative evidence of an intervention’s success to be understood and supports quantitative findings through triangulation of data for a fuller understanding of findings (Noble & Heale, 2019). Studies looking into the acceptability of intervention programmes need to consider the opinion of the stakeholders using them, such as teachers, children and whānau (Riethmuller et al., 2009).

Methodological weaknesses of current literature

Despite several strengths, the four identified studies are not without limitations. Common limitations, as discussed below, include issues regarding generalisability of findings and variations in study designs and assessment methods.

Lack of generalisability of findings

The studies reviewed revealed a clear dearth of literature examining the feasibility and acceptability of physical movement interventions in preschool samples. Further, the sample sizes of the studies are all relatively small, ranging from 33 children aged 3.9-5 years (Vidoni et al., 2014) to 164 children, aged 18 month-4 years (Barber et al., 2016). Jones et al. (2011) examined 97 children aged 3-5 years and Preedy et al. (2022) examined 120 children aged 4-5 years old. The sample size does impact the design of these studies as they are feasibility and/or acceptability pilot studies. The smaller study

(Vidoni et al., 2014) used one school or centre, whereas the larger studies ranged from 2 centes (Jones et al., 2011) to 3 schools (Preedy et al., 2022) to 10 schools (Barber et al., 2016). As these studies are relatively small the generalisability of the findings cannot occur which limits the reach and impact of the studies themselves. The Barber et al. (2016) study provides the best design in this instance for data saturation and generalisability of findings due to the larger sample size and multiple school approach.

Variations in study design and assessment measures

There were widespread differences in the studies identified in terms of study designs and the measurement of feasibility and acceptability. Differences in sample sizes, participant age, location, the nature of interventions, and outcome measures makes it difficult to compare feasibility and acceptability findings across studies. For example, the duration of the four trials range from 10 weeks (2.5 months) (Preedy et al., 2022) to 52 weeks (12 months) (Barber et al., 2016). The duration of the intervention programmes themselves differed across studies also. The Preedy et al. (2022) intervention ran for 20 minutes, five days per week. The Jones et al. (2011) intervention also ran for 20 minutes, but was delivered less at three days per week. The Barber et al. (2016) intervention included six 30 minute sessions per week, with parents encouraged to attend a minimum of three sessions. The intervention tested by Vidoni et al. (2014) ran for 30 minutes per day 5 days per week. While there are similarities in the regular duration of sessions per week, typically ranging from 20-30 minutes each session, such differences may impact the feasibility of intervention delivery along with teacher and parent impressions of acceptability. Further differences between the studies are the setting they are run in. One study was run in a school setting due to the education norms of children starting reception level, or formal schooling at 4 years of age (Preedy et al., 2022). However the other three studies in this review were set in an early childhood centre (Barber et al., 2016; Jones et al., 2011; Vidoni et al., 2014). This is a geographical and societal difference rather than a developmental difference, but the setting may impact the availability of time and resources for intervention delivery.

While the paramount focus of all studies was on young children's movement abilities, all studies measured progress in children's physical development differently. Preedy et al. (2022) assessed children's balance, fine and gross motor movements and inhibition of primitive reflexes pre and post-intervention, and also linked this to reading, handwriting and spelling. Jones et al. (2011) assessed children's movement development, objectively measured physical activity, and body mass index. Vidoni et al. (2014) assessed children's motor efficiency and Barber et al. (2016) measured children's daily

moderate-to-vigorous physical activity and body mass index. Additionally, there were differences in the measures used. Preedy et al. (2022) used the *Movement Assessment Battery*, Vidoni et al. (2014) used the *Bruinicks-Motor Proficiency* test. Whereas Jones et al. (2011) used the *Test of Gross Motor Development* and Barber et al. (2016) compared the minutes spent in moderate to vigorous physical activity between groups.

The scientific value of studies examining feasibility and acceptability could be improved if studies considered similar measures. A starting point for this would be the consistent use of CONSORT protocols (Moher et al., 2010), and the use of flow diagrams capturing participant flow in the trial, at the four key stages of enrolment, intervention allocation, follow-up, and analysis (Alger et al., 2023). Using this diagram allows explicit information about the study details and numbers making the results transparent and replicable, ensuring that findings are reliable for health interventions (Moher et al., 2010). Informed by *Design and analysis of pilot studies: recommendations for good practice (*Lancaster et al., 2002) outcome measures that are comparable across studies, such as a clear list of aims and objectives within a framework, is explicitly stated to encourage methodological rigour. This also enhances the quality of the work, making it scientifically valid and publishable, and will ultimately strengthen RCT reporting to improve the overall evidence of interventions. It will also safeguard against pilot studies being conducted simply because of small numbers of available patients by ensuring that recruitment and drop out numbers are clearly reported and data is not ‘hidden’ (Moher et al., 2010). Both documents aim to raise the standard and consistency of reporting across trials and pilot studies by increasing transparency and enhancing the level of detail reported (Lancaster et al., 2002; Moher et al., 2010). However, the findings in all four studies reviewed here were reported differently with some publications stating acceptability questions and full qualitative descriptions of findings, while other publications were limited to a brief summary of the main findings. Overall, based on the literature reviewed, there is a clear need for more research on the feasibility and acceptability of neuromotor interventions, along with the efficacy of such programmes, among young children.

2.4 Rationale for Current Study based on Literature Review Findings

These studies show that physical movement interventions and structured movement lessons offer numerous benefits to children’s gross motor, fine motor, physical abilities, and social development. Based on the acceptability and feasibility findings of the current studies reviewed, suggestions from researchers and findings pave the way for future trials to be run. However, it is essential that these future studies have tested and proven design and methodology to ensure full transparency and inform robust and feasible studies of interventions that are considered by relevant parties to be safe and acceptable.

The limitations highlighted from the reviewed studies demonstrate the need for feasibility studies, focusing on both trial and intervention feasibility, and acceptability studies to allow for the evaluation of methods and design prior to undertaking large-scale and costly intervention trials.

2.5 Research Aims

Physical movement interventions and structured movement lessons offer numerous benefits to children's overall physical, social and academic development. While it is imperative to undertake efficacy studies, it is firstly paramount to undertake feasibility and acceptability studies to inform the design of subsequent studies. The current study is novel in that its overall aim was to examine the feasibility and acceptability of delivering a reflex based physical movement intervention among preschool aged children in New Zealand, including parent and teacher perceptions. Specifically, the current study examined the feasibility and acceptability of delivering the 'Moves4LilMinds' movement intervention.

Specific research aims were to:

1. Assess the feasibility of i) conducting a full scale randomised controlled trial of, and ii) delivering the Moves4LilMinds movement programme in New Zealand; and
2. Explore teacher's and parent's impressions of the acceptability of the Moves4LilMinds programme.

Chapter 3

Methodology

3.1 Introduction

This research involved conducting a randomised control pilot study of a neuromotor intervention programme, including quantitative measures to examine feasibility of delivery and outcome measurement, and qualitative measures to explore programme acceptability to teachers and parents in New Zealand. The literature, reviewed in Chapter 2, provided the basis for the methodological decision to include both quantitative data to determine statistical significance and qualitative data to understand users' perspectives. Outlining these processes increases the transparency of the research and the possibility for replication. The theoretical positioning has provided direction as to how the research question was developed via clear links to appropriate methods and procedures.

3.2 Theoretical Orientation

According to Crotty (1998), epistemology is the theory of knowledge that explains what kind of knowledge is possible and legitimate. How knowledge is viewed and how things are said to be known is the foundation for theoretical perspectives and viewpoints. The range of viewpoints stemming from individuals' belief of knowledge is varied and conflicting. As informed by current theory, this researcher has adopted an objectivist epistemology when analysing quantitative data, and a subjectivist epistemology when analysing qualitative data as seen in Figure 3.

3.2.1 Quantitative Data: A Positivist Framework

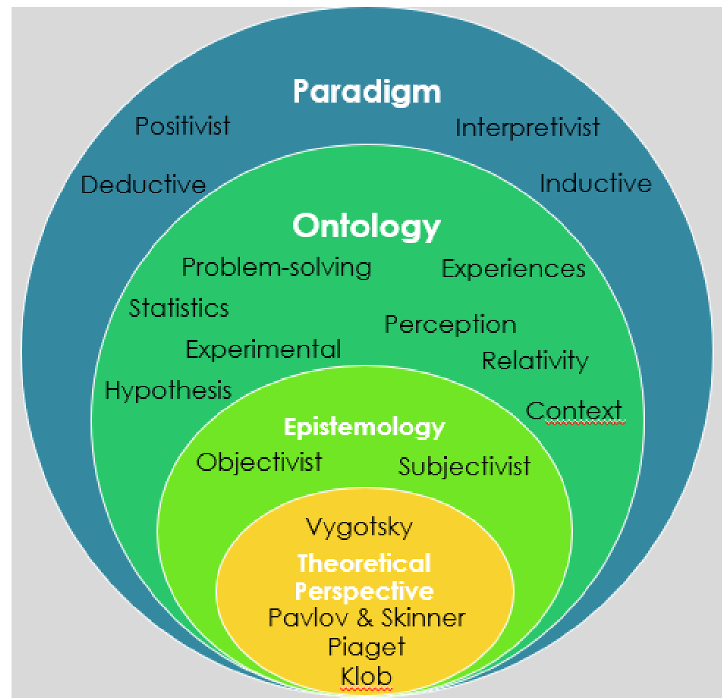
The quantitative aspect of the study adopts an objectivist epistemology within a positivist framework and is deductive. The objectivist epistemology emphasises the logical construction of theories based on empirical facts. The use of this epistemology allows measurement, statistical analysis, questionnaires, and interviews to be included as methods (Feast & Melles, 2010). Quantitative measures in this study thus provide useful information about the feasibility of delivering the intervention.

The positivist approach is linked with the hypothetico-deductive model of science. This approach works to verify or confirm a prior hypothesis. It allows the use of experimentation in study design and the results from testing such hypothesis can be used to advance findings in specific fields (Park et al., 2020). A theory consists of logical statements and beliefs that seek to describe

behaviour or causal relationships in varying instances (Feast & Melles, 2010). Positivism seeks to predict or control phenomena (Park et al., 2020) and in this case fits with the purpose of the study to find out about the feasibility of intervention delivery.

Figure 3

Methodological Framework of the Current Study



Note. Methodological Framework of the Current Study. Created by the student researcher and informed by the seminal work *Foundations of Social Research* (Crotty, 1998).

Positivism adopts the stance that knowledge can and must be developed objectively and as such the values and beliefs of the researcher and participants are set aside. As a pragmatic researcher interested in improving children's neuromotor physiology, a positivist viewpoint allows intervention programmes to enhance development (Newman, 2014). Therefore, knowledge is viewed as certain and can be trusted, when developed and proven via measurement of real life occurrences (Park et al., 2020). The quantitative nature of data collection modes supports the use of the positivist framework.

The strengths of this methodology include explicitly defined criteria, consistent data gathering, use of a control group, and a replicable model. Additionally, the inclusion of a general exercise control group, alongside the neuromotor intervention group, establishes a direct relationship between the programme specific exercises and children's neuromotor development (see section 4.1.2). This isolates the impact of the intervention from normal developmental growth and creates a baseline of data from which change can be measured. Being able to establish this causal relationship relies heavily on the logical, fact-finding framework of positivism.

The objectivist ontology is also adopted to incorporate the use of both prediction and estimation (Feast & Melles, 2010). By using this framework theories can be tested and proved or disproved leading to firm empirical evidence for future use. A positivist, objectivist approach will help to answer the following research questions that underpin the current study:

- Is a full-scale trial of the Moves4LilMinds Programme feasible?
- Is delivery of the intervention feasible?

- And is the intervention considered acceptable by ECE teachers and parents in Auckland, New Zealand?

Participant observation and standardised questionnaires are used within an objectivist epistemology and a positivist framework (Crotty, 1998). This framework is evidenced in the design of this study. The use of video recordings of the children completing the movements for observation and moderation, as well as the parent and teacher reported versions of the standardised Strengths and Difficulties Questionnaire (SDQ) (Goodman & Goodman, 2009) all fall within an objective positivism. Positivism also allows statistical measures of neurological, physical, behavioural, and academic abilities to be measured (Goddard Blythe, 2005; Grigg, 2018) with sequential and systematic processes to gauge changes in children's development over time. Furthermore, a positivist framework allows an experimental approach to be taken which can inform the design of larger studies (Swingewood, 1984). The inclusion of randomisation and standardised study processes also help to reduce the presence of any systematic bias (Walker, 2005). However, positivist methodologies have, at times, been criticised for not fully addressing health questions, or not recognising the human bias (Grant & Gillings, 2002). Furthermore, a positivist approach does not typically capture, at least in any great depth, the personal experiences of stakeholders and end-users. Due to this an interpretivist framework has been included to ensure that participants perceptions of the intervention are considered.

3.2.2 Qualitative Data: An Interpretivist Framework

Qualitative methods describe and decipher the contextualised experiences of research participants (Denzin & Lincoln, 2017). The research phenomenon is explored within the context in which it occurs, and interpretation identifies the socially constructed, or group attributions and meanings ascribed to these phenomena (Chowdhury, 2014; Vygotsky, 1926). The qualitative part of this study adopts a subjectivist epistemology within an interpretivist framework and is inductive. The qualitative methods adopted in this study have no paradigm that is distinctively its own, nor distinct methods that are entirely its own (Denzin & Lincoln, 2017). Instead, it relies on content analysis which examines the communication of messages (Mohajan, 2018) and adopts the current trend in health care research to focus on user experiences of interventions to determine acceptability (Vasileiou et al., 2018). Since 2010 and onwards; qualitative research has now focused on evidence-based practice for relevance in social science (Denzin & Lincoln, 2005). This allows the researcher's goals for understanding user experience of programmes, and theoretical positions; to be aligned closely in this study, enhancing the overall quality of findings (Mohajan, 2018).

Subjectivist epistemology views people as meaning makers of experiences, and in relation to research, this does not include the object studied. Therefore this implies that what is true is a

matter of perception, and that there is no fundamental true reality (Feast & Melles, 2010). A theoretical perspective that underpins subjectivism is postmodernism where truth is relative, and this is congruent with the qualitative epistemology. In understanding that truth is relative to the person holding it, insight can be gained into user experience (Feast & Melles, 2010). By adopting a subjectivist epistemology user experience is analysed and interpreted to gain a fuller picture of the experiences for stakeholders. The resultant data collected from qualitative research is thus of an in-depth nature and focuses on participants' intellectual reflection of their experience and is seen as the medium through which knowledge is attained (Feast & Melles, 2010).

In this study, qualitative measures provided valuable participant feedback regarding the acceptability of the programme for use in New Zealand preschools. It allowed the researcher to go into the setting where the people are, and interact, interview, and test theories (Mohajan, 2018). Essentially, the use of interpretivism and subjectivism ascertained the opinions of the users through the semi-structured interviews of parents and teachers. In this way the research gained a fuller understanding of the thoughts and attitudes of the participants (Mohajan, 2018). Furthermore, quantitative measures examined feasibility of intervention delivery and study processes (i.e., outcome measurement). While qualitative measures explored teacher and parent perceptions of the acceptability of the intervention, taking both an inductive and deductive approach allowed for more comprehensive research findings (Azorín & Cameron, 2010).

3.3 Methodological Approach: Multi-methods Design

The theoretical orientation for this research has been outlined above and provides the rationale for the choice of a multi methods design. This design is gaining traction in the disciplines of psychology, education and health sciences (Azorín & Cameron, 2010) and suits the research aims to access a broader range of knowledge. The application of qualitative and quantitative methods to enhance the outcomes of the study are discussed next.

By defining the methodology of this thesis, the strategy, plan, and process of designing this research is aligned to the desired outcomes (Crotty, 1998). The multi methods approach is a methodology which uses both qualitative and quantitative modes of research to provide a fuller, complete, robust and in-depth understanding of a phenomenon leading to broader interpretations (Azorín & Cameron, 2010; Gray, 2014). This maximises the strengths of each mode and balances the limitations (Flynn, 2022; Gray, 2014). In fact, the use of qualitative methods assists in exploring difficulties that arise in quantitative research (Bugge et al., 2013).

In the current study, quantitative and qualitative data were collected pre and post-intervention delivery in line with other research in the field (Grigg, 2018; Pecuch et al., 2020). Quantitative data were collected from teachers and parents using the valid, reliable, and standardised SDQ at baseline and follow up, while children completed a valid and reliable neuromotor assessment

(Goddard Blythe, 2012) at baseline and follow up. At the end of the study, parents of children in the intervention group and teachers delivering the intervention were invited to participate in a semi-structured interview to share their experiences and impressions of the programme. This approach often contains a predetermined set of open-ended questions but allows for flexibility in the conversation to elicit the in-depth opinion of the user experience. This allows for qualitative data to be gathered from both the parents and teachers and analysed for themes (Braun & Clarke, 2006). The subjective experiences of the participants expressed during interviews allowed for an understanding of whether (or not) the programme was acceptable for use in the New Zealand context. Contextual understanding is important as the acceptability of the programme for use in New Zealand preschools is being measured. It is recognised that context shapes participant perceptions and experiences, and this is acknowledged through subjectivism. This methodological approach also recognises that both parents and teachers bring with them their own unique perspectives about the programme, which may result in multiple interpretations of these experiences. However, once thematic analysis occurred the common interpretations as well as the differences in experience was identified. The analysis across interview groups also reflected the understanding that knowledge is socially constructed. It highlighted the differences in social understandings of the teachers and parents comparatively and created a nuanced interpretation of participant experience. Once the themes were identified, a comparative analysis of the data across parent and teacher groups was undertaken to identify any recurring themes that could provide a more comprehensive view of the acceptability of the intervention.

Quantitative and qualitative data sets remained separated for the duration of all analyses in this multi methods approach (Azorín & Cameron, 2010). The findings run parallel to each other and do not overlap. Each data set stands on its own, in its own epistemology, and offers insights in research processes and user experience.

Chapter 4

Methods

Chapter 4 provides a detailed overview of the specific methods used in this study including: study criteria, participant recruitment, randomisation and blinding, and a detailed description of the intervention. Data collection measures for both qualitative and quantitative aims are explained along with the sample size, ethical considerations, quality control procedures, data management and analysis. This chapter ends with a discussion on trustworthiness, rigour and reflexivity.

Ethical approvals

This study was approved by the Health and Disability Ethics Committee (HDEC reference: 11628) (Appendix A). Written informed consent was gained from the early childhood centre manager (Appendix C), parents (Appendix D) and children (in the form of assent) (Appendix E) prior to the collection of any study data.

4.1 Study Design

This study was an investigator-initiated, prospective, single-centre, two-arm, individually randomised pilot study. The study included quantitative evaluations to measure feasibility of a future full-scale trial and intervention delivery, and qualitative semi-structured interviews to assess acceptability of the intervention.

4.1.1 Inclusion Criteria

Children were eligible to participate if they met the following inclusion criteria: a) attending the consented early childhood centre to ensure feasibility; b) ability to converse in English to support full study participation; and c) parental written informed consent. Children were excluded if they had any parent-reported physical developmental delay to ensure children's physical capacity for full participation in the intervention or general exercise programmes (Gieysztor et al., 2017).

4.1.2 Sample Size

The original intended target sample size was 20 children and one of each of their parents (10 assigned to intervention and 10 to control). This number is similar to other neuromotor pilot studies (Erdei, 2011; Goddard Blythe, 2010). A sample of 20 child-parent dyads and a minimum of two

teachers was considered sufficient for a feasibility and acceptability study testing research methods and was deemed feasible within the scope of a masters' project.

4.1.3 Participant Recruitment

This study was conducted in Auckland, New Zealand. A study information poster (Appendix F) was sent to all Early Childhood Centre's (ECC) in the Auckland region (Education Counts, 2022) and one participating ECC was identified via expressions of interest. The centre was chosen based on the following criteria: 1) first centre responding, 2) a minimum of 20 4-year-olds enrolled, 3) management consent to the study. The lead researcher met with the centre management and staff in person to discuss the study protocols and requirements, answer any questions, and gain written consent. Potentially eligible children and one of their parents were informed of the study by the distribution of information posters (Appendix F) at the childcare centre, and through discussions with the centre manager. The lead researcher was also available to discuss the study with parents during pick-up and drop-off times at the participating childcare centre. Parents who were interested in the study were given a consent form (Appendix D) by the centre manager. The centre manager informed families about the study and supported the completion of consent forms at pick up and drop off times. One week later, the researcher followed-up with the centre manager to collect completed consent forms. Many parents preferred contact with the centre manager rather than the lead researcher and the support and facilitation by the centre in this process was vital. Potentially eligible families were then contacted by the researcher, either in-person or by phone, to explain the study, and answer any questions. If eligible, a set of 19 further developmental screening questions were asked to gauge if the potential for neuromotor immaturity may be present (Goddard Blythe, 2012a). The validity of the screening measure was established in the 1990's when Goddard-Blythe and Hyland (1998) found with 98% confidence that a score of 7 or more affirmative answers on the *INPP Screening Questionnaire* was indicative of neuro developmental specific learning difficulties. Once families had consented, child assent was gained via the child assent form.

4.1.4 Randomisation and Blinding

Following screening and written consent processes, families were randomised to either the intervention or GE groups. The primary supervisor conducted randomisation using a free online computer-generated block randomisation sequence (Qmimin). To minimise confounding bias, 1:1 allocation randomisation ensured groups were balanced for these key prognostic factors: age (3.10-4.5 years; 4.6-5.0 years, inclusive); sex (male; female), and ethnicity (Māori; non-Māori). The primary supervisor advised the centre manager of the results of randomisation. The lead

researcher was blinded to group allocation during the intervention period, followed by unblinding post intervention to conduct the semi-structured interviews.

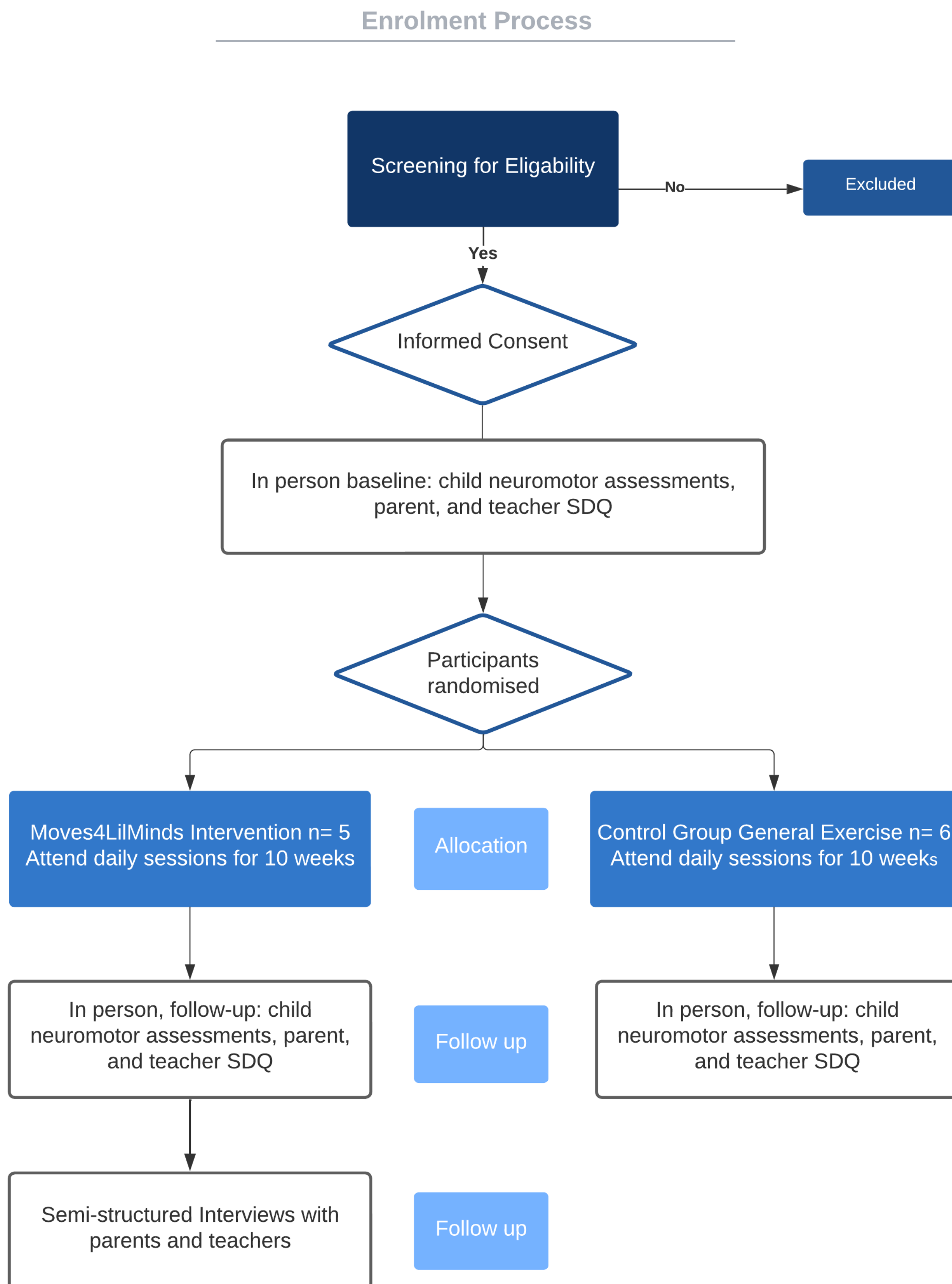
4.2 Procedures

Following screening, consent processes, and randomisation, one parent and teacher of each participating child were invited to complete a SDQ baseline assessment. In addition, children's primitive reflexes and balance were assessed at the centre by the researcher using Goddard Blythe's (2012a) *INPP Developmental Screening Assessment*. The same baseline questionnaire and assessments were completed across both study groups. Following baseline data collection, child participants were randomised to the Intervention Group (IG) (n = 5) or General Exercise (GE) group (n = 6). The IG participated in daily 15-minute M4LM's sessions via playback of video recording and teacher facilitation. The GE group participated in normal centre designed curriculum programme over 10 weeks. The content and delivery of the GE programme was determined by the teacher/s delivering this programme and included gross motor exercises of their discretion such as running, jumping hopping etc. Post-intervention, children completed the child neuromotor assessment, while teachers and parents completed the SDQ again. Subsequently, both parents and teachers were invited to participate in semi-structured interviews to share their impressions of the intervention.

Semi-structured open questions explored the experiences of parents, as beneficiaries of the intervention, and teachers as users of the intervention. While data collection from parents was sought online, in-centre visits and phone calls supported the completion of baseline and follow-up questionnaires for parents. Semi-structured interviews of parents and teachers took place in the ECC at a time that suited both parents and teachers with multiple session times being available. Semi-structured interview data, about parents' and teachers' impressions of the intervention, was transcribed verbatim from audio recording by the lead researcher. Two separate levels of transcription were made, first verbatim, without grammar or editorial work, and then informing this with notes on conversation analysis, what could be found by the tone of voice, etc (Seale & Silverman, 1997). To protect the identity of participants and maintain confidentiality no names were attributed to any comments keeping in line with ethical standards (Dempsey et al., 2016). An overview of study processes, aligned with rigorous scientific standards, is shown in the enrolment process (Figure 4).

Figure 4

Flow Diagram Showing an Overview of Study Processes



4.2.1 The Intervention

Children randomised to the intervention were invited to complete the M4LM programme. Children participated in developmentally and progressively appropriate physical exercises, based on the *Institute of Neuro Physiological Psychology (INPP) Schools programme* (Goddard Blythe, 2012a), and more appropriately for four-year-olds *Wings of Childhood* (Goddard Blythe, 2008) along with appropriate *Bilateral Integration* exercises (Dobie, 2008; Dobie et al., 2002). The programme works on inhibiting prolonged primitive reflexes and stimulating the development of postural reflexes in the CNS enhancing cortical control and neuromotor maturity.

The M4LM intervention was delivered by early childhood teachers (herein referred to as teachers) who had undergone independent training in the theory and movements of the programme. Training was provided by the lead researcher who is a qualified and registered early childhood teacher and lecturer and qualified licentiate of INPP UK for 10 years. Training consisted of 3 pre-recorded video training sessions that two teachers of the intervention group watched. Sessions included basic theory of how the movements support development and how to complete the movements accurately. The lead researcher also administered the child neuromotor assessments (while blinded to group status) and performed the videos to music, for the intervention exercises. Additionally, all moderation was conducted by a qualified INPP practitioner with over 25 years of experience. As all assessments were recorded scoring could be compared and corrected later, ensuring moderation was synergistic.

Once baseline assessments and randomisation had occurred the intervention teachers were also given a set of three pre-recorded videos of the lead researcher demonstrating the three exercises, to music, via an online google drive link. Movements were then performed by intervention teachers, with children for 15 minutes every school day for 5 days per week. The intervention classes were run initially in the afternoons in a specific part of the ECC room that was away from the control group. However, the teachers had flexibility to choose when and where the exercises were done in the day to enhance flexibility with the curriculum. After a few weeks, upon teacher reflection, the intervention was moved to the morning and to a less distracting area of the ECC. Exercises included a range of movements enhancing vestibular development, such as slowly turning in opposite directions, controlled bilateral movements, such as when lying in supine and moving arms and legs in and out at the same time, and developing isolated control over the head, such as when curled in a ball in prone and only lifting the head. In the fifth week a new set of three videos showing the three new exercises to music, were sent to the centre via a google drive link so teachers could stop the previous exercises and implement these with the children. Ongoing support by the lead researcher and supervision team was available to the teachers for the 10-week period to support centre staff in the implementation of the programme.

The control group - General Exercise

Children assigned to the control group continued with their usual physical activities in a separate space at the early childhood centre under the supervision of a teacher not participating the in M4LM training or intervention. Sessions consisted of unstructured, normal free-play curriculum, and were child led. This is the normal physical curriculum for the children at the participating centre. Consistent with the intervention, these free-play sessions ran for five days per week. The sessions were also flexible to the needs of the centre, with the only requirement being that the children in the control group could not observe the intervention group when the programme was being delivered. This was to ensure that the physical movements of children in the control group were not influenced by the movements delivered in the intervention.

4.2.2 Ethical Considerations

Seedhouse (2008) describes ethics as the personal, in-depth deliberation of the pros and cons of decision, which encompasses our whole being. In this case, the consideration was primarily the wellbeing of the participants in the study (World Health Organization, 2020). Ethical consideration was specified at the outset of this study in line with the INPP licensee contract (Paynard, 2023), and the Auckland Health and Disability Ethics Committee (HDEC) (Ministry of Health, 2023) (Appendix A). Study participants were guaranteed an equitable selection process where cultural and economic wellbeing was promoted (National Ethics Advisory Committee, 2010). This research was run by an experienced and qualified teacher and therapist, trained in the INPP method, and the number of children limited to what is scientifically needed (National Ethics Advisory Committee, 2010). Once ethical approval was obtained further considerations were made in gaining permission from the participants. Consistent with Lindeke et al. (2000), children were given the opportunity to provide their own informed assent to be active participants in the research process. Additional, further permissions included:

a. Informed parental consent
b. Informed preschool managers consent – due to a duty of care

Informed consent ensured that there was no deception; the participants understood their right to withdraw; and confidentiality was maintained throughout the study period by the removal of any personal identifiers. If any participant were to withdraw from the study then this would have been managed in a way that avoided harm to the child (National Ethics Advisory Committee, 2010). However, there were no participant withdrawals from the study. Further ethical responsibilities were required of the researcher, such as informing the residing supervisor of any changes or events that impacted the research (Ministry of Health, 2023). Additionally, participants had the right to request a lay summary of study results as stated on the study consent forms (Smith et al.,

2019). Such requests could be made at the time of consent or any other time prior to the conclusion of the study.

As this study included a control group an important consideration was equality (Grimes & Schulz, 2002). Equality safeguarded the study by providing teachers overseeing the control group with access to the training materials as well as giving the children the opportunity to benefit from participating in the M4LM programme post intervention (Walker, 2005). In this way all the children in the study had the same opportunities for participation and benefit.

4.2.2.1 Cultural Considerations

Culture is at the essence of ones wellbeing and identity, and researchers need to ensure a person's culture and organisational culture is respected (Macfarlane & Macfarlane, 2019) as research is culturally mediated (Audrey & Trainor, 2014). All research in Aotearoa-New Zealand must demonstrate consideration of tikanga Māori as a commitment to the bi-cultural partnership of T*e Tiriti o te Waitangi (The treaty of Waitangi*) (Hudson & Russell, 2008; Masters-Awatere & Nikora, 2017). Moreover, there are cultural and ethical responsibilities regulated by the Ministry of Education and the Ministry of Health, to ensure equitable practice in early childhood education (Health Research Council, 2021; Ministry of Education, 2017). The Māori policy framework Vision Mātauranga (Ministry of Business Innovation & Employment, 2023) guided the researcher in best practice in the study design to develop culturally safe research and the lead researcher also completed the Foundations in Cultural Competency course through the Ministry of Health (2022) (Appendix J). Throughout the study design process, consultation with a cultural advisor occurred to receive guidance on study procedures, koha and hui (Appendix K) (Macfarlane & Macfarlane, 2019).

Cultural consideration was shown in the development and preservation of whanaungatanga (kinship/ reciprocal relationships) between the researcher and the participants, (Macfarlane & Macfarlane, 2019), as relationship building is a key strategy for research with indigenous peoples (Glover et al., 2014). The lead researcher adhered to their centre tikanga (practices), for example the removal of shoes when entering the building, joining in with hui (meetings). As mana (pride, life-source) of people is cherished in te ao Māori, this research ensured assessments were culturally responsive (Masters-Awatere & Nikora, 2017) by considering the Māori worldview of the physical body. The neuromotor assessments undertaken needed the physical touching of the child's head by the researcher, to assess for the presence of primitive reflexes (Goddard Blythe, 2012a). As the head is considered tapu, it is sacred and it directly influences a person's wairua (the spirit/essence of a person) (Elder, 2013), therefore, explicit information was given to the families and teachers about this process and consent was gained from whānau (family) and children.

Cultural considerations was also given to Pacifica peoples, particularly due to the research being conducted in an area where a high proportion of Pacifica residents live (south Auckland) (Stats NZ, 2023). Therefore, cultural rigour was maintained via consultation with a pacific advisor (Appendix L) and respect to the individual heritage of each participant was maintained by identifying specific nationalities, i.e. Samoan, Tongan, rather than grouping people into a Pacific Island cluster. Parents also had the support of the centre manager and teachers to translate information into their first language as needed. It was imperative that the principles, values, norms, and opinions of each group be considered (National Ethics Advisory Committee, 2010) which is why the inclusion of the SDQ and semi-structured interviews were necessary.

4.2.3 Quality Control

Child neuromotor assessments were carried out by the lead researcher who is certified and experienced in administering these assessments. All neuromotor assessments were video recorded, and 20% were reviewed and scored by an external moderator (blinded to child group status) for quality control purposes. Any discrepancies in scoring were resolved by discussions with the moderator, while watching the video recordings to reach consensus based on the scoring criteria from the *Assessing Neuromotor Readiness for Learning* manual (Goddard Blythe, 2012a). In the second week of the intervention, quality control was undertaken in the form of the sessions being recorded by the centre and sent to the supervision team. The supervision team then used the Moves4LilMinds Quality Control Programme Adherence Form (Appendix G) to measure how well the teachers were giving feedback to the children about the movements and how well they were adhering to the programme. The forms are based on the standardised Likert Scale Assessment. In the fifth week a new set of three videos showing the three new exercises to music, were given to the teachers via google drive link to implement with the children and the same moderation process occurred as above in week six.

Multiple processes were put in place to minimise the risk of potential bias in the study. Non-response bias was managed by ensuring that alternative contact details were gathered from all participants and koha was offered to all families at the end of the study. Measurement bias was managed by using standardised tests and questionnaires. Ascertainment bias was managed by ensuring that all eligible children (total n = 20) can be included, and that no child was refused participation based on income, gender or ethnicity. Reporting bias was reduced by creating a specific data analysis plan prior to the start of data collection.

As the lead researcher has prior experience delivering the intervention examined in the current study, there is a vested interested in the outcomes of this study. The lead researcher acknowledged this potential conflict of interest and took the following steps to ensure objectivity.

a. A declaration of a potential conflict of interest was made to both ethics' committees approving this study (Auckland University of Technology Ethics Committee & HDEC), and key stakeholders at in-person meetings.
b. Video recordings were taken of each child's neuromotor assessment and a sample of these were moderated by an independent practitioner trained in the INPP method.

4.2.4 Measures

Process measures assessed the feasibility of trial procedures, and the intervention itself along with impressions of how acceptable the intervention was for users (see Table 3). These areas of focus warrant the classification of this study as a pilot feasibility and acceptability study (Shanyinde et al., 2011; Thabane et al., 2010).

4.2.4.1 Aim 1: Feasibility

Feasibility was quantitively assessed and included two main areas of focus, these being:

1. Feasibility of running a full-scale trial was assessed by measures of rate of centre and participant recruitment, acceptance of randomisation, and participant burden.

Rate of recruitment: Time taken to recruit a participating centre; participant recruitment rate (proportion of children recruited in relation to the number of children screened and eligible; time taken to recruit sample).

Acceptance of randomisation: The proportion of families accepting the results of randomisation.

Effectiveness of randomisation: Whether randomisation processes effectively assigned children to groups to ensure balance by sex, age and ethnicity (Māori/non-Māori).

Participant burden: The proportion of participants dropping out of the study (and reasons for drop out). The proportion of parents and teachers completing baseline and follow-up questionnaires. The proportion of children completing baseline and follow-up neuromotor assessments.

2. Feasibility of the intervention itself was assessed using measures of intervention adherence and safety:

Intervention adherence: Was measured via video recordings of the intervention. Ten percent of sessions were recorded and sent to the supervision team throughout the programme. In Week Two of the intervention, teachers video recorded their movements and the movements of participating children. Video recordings were independently reviewed and rated by each research

supervisor in terms of adherence to the intervention protocol. Both supervisors then met to review ratings for moderation, with final agreed ratings captured using the Quality Control Programme Adherence Form (Appendix G). This process of independent review and moderation occurred again after the second set of movements were provided to teachers in Week Six.

Safety: Was measured by the total number of severe adverse events recorded during the study.

4.2.4.2 Aim 2: Acceptability of the Intervention

Acceptability was qualitatively assessed using semi-structured interviews with parents of participating children and teachers who delivered the intervention similar to other studies (Callcott, 2012; Calvin & Ramli, 2020; Pecuch et al., 2020). Parent interviews were offered as a hui, group session, or individual session. Parents opted for a joint time and participated in a group interview session. Teachers, due to staffing requirements were interviewed separately. The following prompt questions were used to facilitate discussions - "What did you find most helpful about the programme?" "What did you find least helpful about the programme?" "What suggestions do you have for improving the programme?" See Appendix H for the full list of Teacher Interview questions and Appendix I for the full list of Parent Interview questions.

Table 3

Feasibility and Acceptability Measures

Measure	Researcher	Teacher	Parent
Feasibility of running a full-scale trial (Aim 1)			
Rates of recruitment	✓		
Acceptance of randomisation	✓		
Effectiveness of randomisation	✓		
Participant Burden	✓		
Feasibility of the intervention (Aim 1)			
Intervention adherence	✓		
Safety	✓		
Intervention Acceptability (Aim 2)			
Semi-structured interviews of teacher's and parent's impressions of the intervention		✓	✓

4.2.4.3 Child outcome measures

Child outcome measures included assessment of child neuromotor functioning and child behaviour and emotional adjustment.

Neuromotor function

Child primitive reflexes and balance were assessed using the standardised tests in the *INPP Developmental Screening Test* (Goddard Blythe, 2012a). The assessment consists of tests for balance, crawling, midline crossing, dysdiadochokinesia and primitive reflexes using 15 tests. The Erect test for TLR was assessed in flexion and extension with eyes open and closed; the Ayres test for ATNR was assessed on both the left and right (Ayres, 1970); the Romberg test was assessed with eyes open and closed (Romberg, 1853) and the one leg stand test was assessed on both the left and right (Schrager, 1994).

Supporting tests include creeping on hands and knees, two tests for mid-line crossing (hand through the mid-line, hand over the head), and a finger and thumb opposition test on both hands for dysdiadochokinesia. Scores for each test range from 0, no abnormality detected, to 4, reflex fully retained, (Goddard Blythe, 2012a). Higher scores reflect greater presence of primitive reflexes or underdeveloped movements. A total reflex profile score was compiled by adding individual scores together with a minimum score of 0 and a maximum score of 60. Any score above 0 indicates the presence of primitive reflexes to some extent ranging from mild (<25%) to moderate (50%) to high (75%) to fully retained (100%) (Goddard Blythe, 2012a). Many other studies of four-year-olds have included the *INPP Developmental Screening Assessment* for 4-7 year olds (Calvin & Ramli, 2020; Gieysztor et al., 2022; Gieysztor et al., 2017; Gieysztor et al., 2018; Gieysztor et al., 2015; Infante-Cãnetea et al., 2023; Madejewska et al., 2016; Preedy et al., 2022). These set of tests are used as a screening tool to assess the likelihood of neuromotor immaturity in children, however, the reflex tests and balance test are standardised medical tests and used throughout many disciplines (Goddard Blythe, 2012a; Goddard, 2005).

Behavioural and emotional adjustment

Parent and teacher report versions of the SDQ (Goodman & Goodman, 2009) were used to assess children's behavioural and emotional adjustment. The SDQ is a reliable 25-item behavioural screening tool for use with children aged 4 to 17 years. Parents and teachers completed the SDQ based on their perceptions and experiences with the child. Responses were documented on a scale from 0 = Not true to 2 = Certainly true. Scoring was undertaken using SPSS syntax available from the SDQ website (www.sdqinfo.org) (Youth in Mind, 2016). The SDQ assesses child functioning in five areas - emotional symptoms, conduct problems, hyperactivity –

inattention, peer relationship problems and prosocial behaviour (Goodman & Goodman, 2009). A total difficulties score is also calculated.

The hyperactivity/inattention subscale assessed children's severe inattention and overactivity. Sample items include restlessness, fidgeting, distractibility and seeing tasks through to the end. A hyperactivity/inattention score signifies the total of the 5 items in this subscale. The minimum possible score was 0 and the maximum was 10. Two items (item 21, 25) required reverse scoring. The conduct problems subscale assessed children's ability to regulate their emotions physically and psychologically. Sample items include tantrums, obedience, fighting, and spitefulness. One item (item 7) required reverse scoring. The emotional problems subscale assessed children's ability to self-regulate emotion. Sample items include happiness, worries, fears and physical symptoms such as headaches and sickness. The peer problems subscale assessed children's ability to interact positively with peers of their own age. Sample items include solitary play, friendships, and being bullied. Two items (items 11 and 14) required reverse scoring. The prosocial behaviour subscale assessed children's ability to engage in empathy and kindness with others. Sample items include solitary play, friendships, and being bullied. Higher scores indicate poorer outcomes, except for the prosocial subscale where higher scores indicate better social outcomes. The SDQ is similar to other established measures of parent and teacher-reported child behaviour in discrimination and proven test-retest internal reliability. The SDQ is a comprehensively validated measure with proven screening efficiency in clinical and community samples around the world (Allwood et al., 2018; Croft et al., 2015; Klasen et al., 2000; Matsuishi et al., 2007; Stone et al., 2015; Warnick et al., 2008). The SDQ has also been used in population surveys in New Zealand, including the New Zealand Health Survey with a child population 3-14 years old (Ministry of Health, 2018).

Additionally, child and family demographic information were collected using a study specific questionnaire. Child characteristics included: age; sex; ethnicity; and typical number of days of attendance at preschool. Family characteristics included: parent age; sex; ethnicity; relationship to the child; employment status; time employed; source of income; and the occupation of the main income earner in the household. Family Socio-Economic Status (SES) was estimated using the Australian New Zealand Classification of Occupation Scale (ANZSCO) (Trewin & Pink, 2006). Family SES scoring was based on the highest-ranking occupation in the family, ranging from 1 = managerial to 9 = unemployed.

4.3 Data Management

A study protocol was developed to record agreed study processes, including management of descriptive and structural metadata e.g. processes for participant recruitment, data management and access, etc. All study documents included a version number and date of creation. All study

documents were created by and managed by the lead researcher. A secure online REDCap survey at baseline collected demographic information about each child (age, sex, ethnicity) and family (e.g., parent age, sex, ethnicity, family socio economic status) using study-specific questions. A REDCap Data Dictionary was used to capture structural metadata for all information collected by parent and teacher questionnaires, and all other data were entered into the REDCap database. De-identified data were downloaded from the secure study REDCap database at the end of the data capture phase and stored long-term on a secure AUT One-drive account with two-step authentication where only the supervision team had access. Copies of all master study case record forms and related documents were stored in a dedicated study folder on AUT's OneDrive and managed by the lead researcher. Study data will be stored securely for a minimum of 10 years in line with legislation for health research (Ministry of Health, 2023). Designated by the lead researcher following a documented process, all study data were de-identified and assigned a study registration number. All hard copy data were stored securely in a locked cabinet on AUT premises. Any data that has identifiable information (i.e., consent forms) were stored securely in a separate locked cabinet at the AUT premises. File formats include *Microsoft Word, Microsoft Excel, and REDCap* data. As part of AUT University data management processes, the REDCap platform complies with national regulatory requirements for electronic data capture systems in New Zealand.

Data analysis

4.3.1 Quantitative Data Analysis

Baseline characteristics between the two study groups were compared using t-tests for continuous variables and chi-square tests for categorical variables. Feasibility (Aim 1) outcomes were assessed using descriptive statistics (e.g., frequencies, percentages, counts). All quantitative data analyses were undertaken using Statistical Package for the Social Sciences – version 28 (SPSS 28.0). Where relevant, statistical significance was set at two-sided $p = 0.05$.

4.3.2 Qualitative Data Analysis

Using Braun and Clarke (2006) six phases of thematic analysis, qualitative data were sourced through semi-structured interviews conducted with parents and teachers. Similarities and differences were considered across the two participant groups.

In terms of analysis processes, on completion of the interviews, the lead researcher became familiar with parent interview responses. This was achieved by listening to, transcribing and

reading all feedback multiple times to analyse nuances in words and tone (Seale & Silverman, 1997). This process was then repeated examining the interview responses from teachers.

The second phase of thematic analysis involved the numerical coding of potential patterns and themes through the data to classify information. In larger studies this is often done with computer generated algorithms. In this study, coding was not applicable as the data set was small enough to manage manually with headings. Teacher and parent comments were grouped according to the overall theme or topic in a word document.

Third, commonly recurring themes were identified and discussed, using inductive analysis. Initially two tables of themes, capturing important patterns of data, for parents and teachers, were created separately and adapted regularly as further insights were gained from the analysis (Braun & Clarke, 2006).

Fourth, findings were reviewed in relation to subthemes in conjunction with the supervision team. Each response was analysed individually, however at times responses were not relevant to the question so they were moved to other parts of the analysis.

Fifth, findings were simplified and defined by regular discussion of the emergent analysis with the supervision team which led to the combining of parent and teacher data to solidify common themes across both groups.

Sixth, findings were written in report form and reviewed by the research team. Once agreed, direct quotations to support themes were identified to reflect participants' perceptions and commonly recurring themes (Braun & Clarke, 2006).

4.3.3 Rigour in Quantitative Research

Rigour in quantitative research refers to the extent in which quality was maintained in a study and how accurately the study subject has been measured (Heale & Twycross, 2015; Noble & Heale, 2019). This is primarily determined by the validity and reliability of the testing instruments and the generalisability and replication of the study (Angen, 2000; Heale & Twycross, 2015).

Reliability

Reliability demonstrates how dependable an instrument is for accurate and consistent measurement in repeated circumstances (Heale & Twycross, 2015). The reliability of the INPP screening tests (Gieysztor et al., 2022; Gieysztor et al., 2017; Gieysztor et al., 2018; Gieysztor et al., 2015; Goddard-Blythe & Hyland, 1998; Goddard Blythe, 2005; Goddard Blythe, 2010, 2023; Goddard Blythe et al., 2022; Kalemba et al., 2023; Madejewska et al., 2016; Pecuch et al., 2020;

Pecuch et al., 2021; Zielińska & Goddard Blythe, 2020) and the SDQ tests have shown stability and equivalence over multiple international studies (Allwood et al., 2018; Croft et al., 2015; Klasen et al., 2000; Matsuishi et al., 2007; Stone et al., 2015; Warnick et al., 2008). Due to the data sets of this study being small, and as the focus of this study was not on efficacy, internal consistency could not be measured (Heale & Twycross, 2015). Rigour was also enhanced by the research processes, such as the use of information sheets for clear communication of the studies aims, and detailed accounts of procedures, methods and recruitment so that study processes can be followed by others (Thomas & Magilvy, 2011).

Validity

Validity refers to how accurately something is measured and is described in the three categories of content validity, construct validity and criterion validity (Heale & Twycross, 2015). Validity is also enhanced by the method of triangulation (Noble & Heale, 2019).

Content validity measures how well a data gathering instrument measures what it intends to measure (Heale & Twycross, 2015). In this study, the SDQ quantitatively measures children's social and emotional behaviours and is an accepted and standardised testing instrument in multiple countries (Allwood et al., 2018; Croft et al., 2015; Klasen et al., 2000; Matsuishi et al., 2007; Stone et al., 2015; Warnick et al., 2008). Additionally, the use of the INPP reflex screening assessment by Goddard Blythe (2012a), ensures content validity as each different reflex is assessed by standardised reflex tests. Each assessment stands separately to the others and is only used for the specific reflex it measures and in this demonstrates homogeneity and construct validity (Heale & Twycross, 2015). Furthermore, inferences and beginning theory evidence is seen in the similarities between reflex scoring and qualitative data from teachers on children's behaviour and development. While this has not been extensively measured in this multi methods review, early findings do indicate that similarities may be seen between the data sets leading to predictive validity.

Finally, criterion validity encompasses convergent, divergent and predictive validity, measuring how well data gathering instruments are correlated to other measures, different variables or future criteria (Heale & Twycross, 2015). In this study divergent validity is seen in the SDQ and INPP tests as each question or testing procedure cannot measure other items or reflexes being assessed. Additionally, early anecdotal evidence suggests that there may be predictive validity between these two instruments as higher reflex scores on the INPP test did align with teacher feedback on the SDQ at both baseline and follow up.

4.3.4 Rigour in Qualitative Research

As the concept of validity is not a goal of qualitative research (Stahl & King, 2020) rigour is maintained by ensuring study procedures are trustworthy so that the study is accurate and dependable (Angen, 2000). To ensure the participants experiences transfer from research to the real world appropriate research strategies are needed to ensure the study's rigour and trustworthiness (Angen, 2000). This study has demonstrated rigour in the qualitative methods through credibility, dependability, confirmability, and transferability (Korstjens & Moser, 2018).

Credibility

Credibility endeavours to ensure the research is trustworthy and plausible (Tracy, 2010). Trustworthiness has been maintained through this study by the replicable research design, implementation, and detailed reporting (Angen, 2000; Noble & Heale, 2019). Additionally, the continued discussion, refining and feedback on the thematic analysis provides investigator triangulation and trustworthiness in the processes (Noble & Heale, 2019; Thomas & Magilvy, 2011). The diversity and balance of expertise in the supervision team also enhanced the rigour, with each supervisor being experts in both quantitative and qualitative research respectively (Thomas & Magilvy, 2011). Credibility of participant voice was demonstrated by the inclusion of quotes from the participants in the research findings making the data rich (Flynn, 2022).

Dependability

If a study is dependable then it is more likely to be replicable. Enhancing dependability in a study is achieved through peer scrutiny, peer review, and reflexive auditing (Stahl & King, 2020). By using these mediums trust is maintained in the integrity of the research, with full acknowledgement of the researcher's passions and bias and the impact of these on the research. This ensures that others are also aware of how these biases are viewed in the research, and confirm it's dependability (Stahl & King, 2020). As mentioned, the consistent review of processes and moderation in this study has allowed the results to be scrutinised by others through the process of reflexivity. The reflectiveness of the lead researcher and transparency of personal expectations allows others to weigh up the findings to ascertain if they are applicable to their own context.

Confirmability

Confirmability seeks for research to get as close to reality as it can, and thus leans to a positivist approach (Stahl & King, 2020). Confirmability establishes the fact that data and interpretations of

the findings are grounded in the data, and are validated, not based on researcher bias (Angen, 2000; Korstjens & Moser, 2018). This study has been clear and precise in its reporting of procedures and findings and has accurately kept research records according to ethical standards, and thus demonstrates confirmability. While confirmability is applicable to the quantitative data in this study it does not support the qualitative epistemology of subjectivism, where reality is constructed from individual experiences (Feast & Melles, 2010).

Transferability

Transferability demonstrates the ability of research findings to be used in other studies (Mohajan, 2018), but more than that it allows the reader to see the results of the research in their own context (Tracy, 2010). Transferability allows resonance, where the reader is affected by the content and findings of the research (Tracy, 2010). This study has demonstrated transferability by transparently describing not just the participants comments but the context in which they are made (Korstjens & Moser, 2018). Additionally, a full account of data, such as the setting, participants, sample size, demographics, socio-economic status, inclusion and exclusion criteria, and interview questions have been clearly outlined and explained (Korstjens & Moser, 2018). These have been further enhanced by the CONSORT diagram and chart of participant flow (Moher et al., 2010).

4.4 Reflexivity

Reflexivity is a defining feature of qualitative research that acknowledges the researcher as central to the research process and enhances the rigour and integrity of the research (Denzin & Lincoln, 2017). Researchers actively collect, select and interpret the data (Finlay, 2003), exploring the phenomenon, in the context in which it occurs, and constructing the reality of the research along with the participants (Merriam & Tisdell, 2016; Stahl & King, 2020). In this, the theoretical orientation of social constructionism embraces the researcher as part of the social context that determines the findings of the research. Reflexivity seeks to understand the extent to which the researcher's bias, beliefs and prior experiences shape the way in which research is undertaken (Angen, 2000). Walsh (2003) proposes four overlapping areas of reflexivity, these being: personal, interpersonal, methodological and contextual reflexivity.

Personal reflexivity is the ability to reflect on one's expectations, assumptions and reactions as a researcher as well as to assess ones views on participants and the data collected (Olmos-Vega et al., 2023). The potential for bias in this study has been acknowledged in the previous chapter and chosen study measures have attempted to minimise these biases. However, the research cannot be separated from the researcher in qualitative studies and it is for this reason that reflexivity is key (Merriam & Tisdell, 2016). This researcher's personal experience in the field of

education, primarily early childhood, but also encompassing primary, tertiary and high school governance, for over twenty years has informed and concreted viewpoints of educational success and barriers to this success. This, along with qualification and experience as a neuro developmental therapist for ten years has refined an understanding of how to support children's development and education. These experiences have subjectively biased the researchers' expectations as to the success of the intervention in remediating children's neuromotor issues as long-term anecdotal evidence gained during this time has consistently shown success. Continual study and professional supervision in this approach has also allowed the researcher to keep abreast of new and current worldwide research and trends and has informed this study's theoretical orientation and methods. However, as this study is determining the feasibility and acceptability of the intervention and study processes, the subjective view of the intervention's success was mitigated. Only minor reflections were made of the potential of the intervention success. This was further supported by the blinding of this researcher to the randomisation of the groups and the supervisory feedback on the implementation of the intervention throughout the duration of the study. This ensured that any assumptions about the progress of neuromotor development would not be applicable until after all study assessments were complete. A further assumption on the part of this researcher was that the parents would be eager to engage in this intervention due to benefits that have been demonstrated in literature. This assumption was quickly tempered when parents did not attend hui, were delayed in completing forms, and when children were not brought into the centre for follow up neuromotor assessments. It became clear that the parents were not aware of what the intervention entailed, or the potential benefits for their children. This demonstrated the need and benefit of constant evaluation of assumptions and bias's throughout the duration of the study (Stahl & King, 2020).

Interpersonal reflexivity refers to the relationship dynamics of stakeholders in the research process (Olmos-Vega et al., 2023). In this study the close working relationships between researcher and supervisors, having worked together for over two years, enhanced the research process by the development of whanaungatanga and investigator triangulation of the qualitative data (Noble & Heale, 2019). The researcher has ensured reflexivity was maintained throughout the research process through continuous reflection and discussion with the supervision team embracing member reflections (Olmos-Vega et al., 2023; Tracy, 2010). In addition, long-term, established relationships between the researcher and moderator as well as the purposely nurtured relationships with centre staff have provided a place where expertise could be maximised. This also minimises power relationships through participatory methodologies that empower participants rather than objectify them (Mohajan, 2018). To support the minimisation of bias, interviews were conducted with groups of participants in the early childhood setting to allow them to feel familiar and comfortable with the environment. Additionally, open-ended questions were asked to ensure participants could contribute as much or as little as they wanted to.

Methodological reflexivity involves the consideration of the impact of methodological approaches in research (Olmos-Vega et al., 2023). This impact has been discussed extensively in chapter three. The careful adoption of a multi methods approach to this research ensures that the most appropriate method can be utilised at different stages of the research (Newman, 2014). This also enhances triangulation of data and provides a robust approach (Noble & Heale, 2019). The objectivist epistemology within positivism supports the qualitative research, through empirical facts gained through the standardised testing (Feast & Melles, 2010). Whereas, the qualitative methods uses inductive, subjectivist epistemology within an interpretivist framework fully embraces the nuances of personal experience and opinion through interviews (Denzin & Lincoln, 2017). The researcher is thus acknowledged as an integral part of the research process and the focus is not on minimising the researchers influence, but rather on being explicit as to how the researcher's influence potentially impacted research outcomes (Mohajan, 2018).

Contextual reflexivity acknowledges the unique setting of the research (Olmos-Vega et al., 2023). The centre was located in south Auckland in a low socio-economic area. The ethnicity of child participants were 45.45% Māori, 18.18% Samoan, 18.18% Tongan and 18.18% Indian. Participant ethnicity is not representative of the general New Zealand population (Environmental Health Intelligence New Zealand, 2023). The culture of the centre aligns with its families and location and adopts kaupapa Māori values and practices. Acknowledgement of cultural views were considered in the gathering of data from participants and perceptions of power and authority were acknowledged and minimised where possible (Dempsey et al., 2016). For example Parent Two often repeated the answers of other participant responses and wasn't as confident in her replies when asked a question first, demonstrating through body language that she was uncomfortable and unsure about how to answer. The content or manner of the questions may not have been appropriate, and a different approach such as having the centre manager present, or giving them the questions before hand may have worked better to build the trust needed for face-to-face interviews (Thomas & Magilvy, 2011). This type of mismatch was also found when interviewing Teacher 1. The researcher asked if there was anything that didn't work well, to ascertain improvements in the programme. She answered *"not really"* but it could be seen from her tone of voice that there was more she wanted to say but didn't. However, the use of 'talanoa' or conversation was undertaken with Teacher 1 and in most cases elicited open, honest and extensive conversation appropriate to the cultural setting (Moeke, 2020).

Modern reflexivity acknowledges that it is nearly impossible and problematic, to ensure the researcher is as a 'blank slate' in their perceptions of the research, and therefore neutralising attempts in qualitative research are no longer deemed favourable (Olmos-Vega et al., 2023). A subjective approach to the research process is thus accepted and researchers are encouraged to acknowledge their perspectives and possible vested interest in the research upfront (Olmos-

Vega et al., 2023). While every effort has been made to minimise researcher viewpoints throughout these means, it is acknowledged that this research is still interpreted through a personal viewpoint. This acknowledgement leads to a more transparent and credible dissemination of research findings (Thomas & Magilvy, 2011).

Chapter 5

Results

Eleven children (63.6% male) were recruited between July – August 2022 with 5 randomised to the intervention and 6 to control. Baseline characteristics of children and parents were similar between the two groups (see Table 4). The intervention and control groups were balanced for child age (IG mean = 4.54, CG mean = 4.28), sex (IG = 60% male, CG = 66.7% male) and ethnicity (IG = 45% Māori, CG = 33.3% Māori). Figure 5 shows participant flow using CONSORT reporting.

Figure 5

CONSORT 2010 Flowchart of Participants

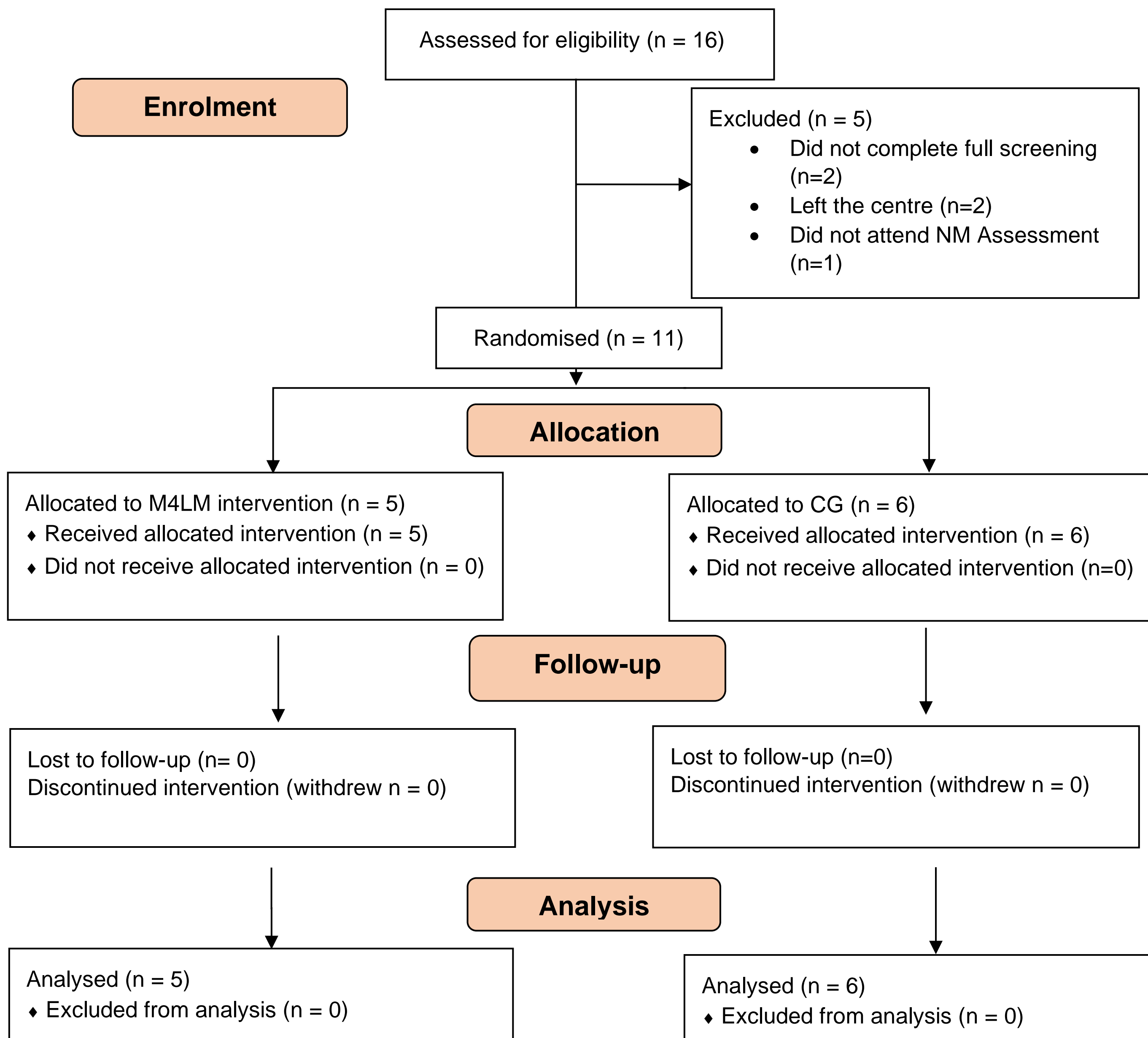


Table 4

Participant Characteristics at Baseline, by Group

	Intervention (n = 5)	GE (control) (n = 6)	Test of difference (intervention versus controls)	p
Child characteristics				
Mean (SD) Age (years) at baseline	4.54 (0.35)	4.28 (0.61)	*t* (n=11) = -0.813	0.375
Sex, n (%)			χ2 (n=11) = 0.052	0.819
Male	3 (60.0)	4 (66.7)		
Female	2 (40.0)	2 (33.3)		
Ethnicity, n (%)			χ2 (n=11) = 2.127	0.547
Māori	3 (60.0)	2 (33.3)		
Samoan	1 (20.0)	1 (16.7)		
Tongan	1 (20.0)	1 (16.7)		
Indian	0 (0.0)	2 (33.3)		
Mean (SD) number of days of child attendance to intervention	16.17 (7.38)	-		
Primitive reflexes present at baseline, n (%)	5 (100%)	6 (100%)	N/A	N/A

N/A = Not Available (No statistics were computed because primitive reflexes were a constant).

Parent and family characteristics				
Sex, n (%)			χ2 (n=11) = 0.917	0.338
Male	0 (0.0)	1 (16.7)		
Female	5 (100.00)	5 (83.3)		
Ethnicity, n (%)			χ2 (n=11) = 2.127	0.547
Māori	3 (60.0)	2 (33.3)		
Samoan	1 (20.0)	1 (16.7)		
Tongan	1 (20.0)	1 (16.7)		
Indian	0 (0.0)	2 (33.3)		
Employed, n (%)	2 (40.0)	2 (33.3)	χ2 (n=11) = 0.52	0.819

	Intervention (n = 5)	GE (control) (n = 6)	Test of difference (intervention versus controls)	p
Family SES, n, (%)			χ2 (n=11) = 2.933	0.231
Professional (1-2)	1 (20.0)	0 (0.0)		
Semi-skilled/ unskilled (3 – 8)	0 (0.0)	2 (33.4)		
Other/Unemployed (9)	4 (80.0)	4 (66.6)		

n = sample size. SD = Standard deviation. NMI = neuromotor immaturity. SES = socio-economic status at 4-years. Dash (-) indicates data not applicable.

5.1 Feasibility findings

5.1.1 Rates of Recruitment

It took four weeks to recruit a participating ECE centre. It took a further three weeks to recruit 11 participating families (averaging 1.5 families per week). Out of the 16 families screened for study criteria, 11 families were eligible (see Figure 5). All 11 families (100%) consented to take part.

5.1.2 Acceptance of Randomisation

All families (n = 11, 100%) accepted the results of the randomisation.

5.1.3 Effectiveness of Randomisation

The randomisation method successfully balanced the two study groups for age, sex and ethnicity (Māori, non- Māori).

5.1.4 Participant Burden

Baseline and follow-up questionnaires for 11 children were completed by all teachers (n = 2, 100%). Baseline questionnaires were completed by all parents (n = 11, 100%). Follow-up questionnaires were completed by 10 out of 11 (91%) parents, with one family being uncontactable at follow-up.

Ten (91%) children completed a baseline neuromotor assessment, with one child unable to perform the physical movements. Of the 10 children completing a baseline assessment, six (6/10, 60%) children completed a follow-up neuromotor assessment. Reasons for children not

completing a follow-up neuromotor assessment included families being on holiday (n = 2), families being uncontactable (n =2).

Three out of 11 parents (27.7%) and all teachers (n = 2, 100%) participated in a semi-structured interview.

Feasibility of the intervention

5.1.5 Intervention Adherence

Intervention adherence was measured using a study-specific *M4LM Quality Control Programme Adherence Form* (Appendix G, based on a standardised Cognitive Behavioural Therapy Quality Criteria Instrument, (Blackburn et al., 2001)). A seven-point Likert scale was used to measure adherence, ranging from 0 (absent or highly inappropriate adherence) to 6 (excellent adherence) and the quality of feedback provided to children during each exercise, ranging from 0 (absent or highly inappropriate feedback) to 6 (excellent use of feedback). To assist in the application of adherence and feedback ratings, key features of each possible numerical rating were provided at the top of each section.

Teachers consistently showed improvements in adherence and feedback across the two assessment timepoints (see Table 5). Initial adherence ratings relevant to Week Two exercises revealed opportunities for improvements in adherence and feedback to children. Following feedback to the centre, the same measures based on Week Six exercises revealed greater adherence and improved delivery of feedback.

Table 5

Intervention Adherence

TEACHER	WEEK #	ITEM	AGREED RATING AND DESCRIPTION FOLLOWING MODERATION
1	2	Feedback	**2** - Appropriate feedback, but not given frequently enough by teacher.
1	2	Adherence	**2** - Evidence of competent teacher. Some evidence that session content aligns with the prescribed content but lacks consistency.
2	2	Feedback	**5** - Highly appropriate feedback given, facilitating shared understanding and enabling significant gains. Minimal problems.
2	2	Adherence	**5** - Teacher systematically applies an appropriate range of methods in a creative, resourceful and effective manner. Minimal problems.
1	6	Feedback	**6** - Excellent use of feedback, or highly effective feedback given regularly in the face of difficulties.
1	6	Adherence	**6** - Excellent performance. Skilled alignment of session content with the prescribed content, using a suitable approach even in the face of difficulties.
2	6	Feedback	**5** - Highly appropriate feedback given, facilitating shared understanding and enabling significant gains. Minimal problems.
2	6	Adherence	**5** - Teacher systematically applies an appropriate range of methods in a creative, resourceful and effective manner. Minimal problems.

5.1.6 Safety

No severe adverse events were reported during the study.

5.2 Acceptability Findings (Aim 2)

Themes

Three key themes were identified in terms of parent and teacher impressions of the intervention (Table 6), being 'benefits of the intervention', 'challenges of the intervention', and 'teacher initiative' within the intervention.

Table 6

Themes

Themes
Benefits of the Intervention
Challenges of the Intervention
Teacher Initiative within the M4LM Intervention

5.2.1 Theme One – Benefits of the Intervention

All parents and teachers reported high satisfaction with the M4LM intervention, and stated their children made progress while participating. Children were motivated to participate and were seen to be making progress, developing confidence, strengthening focus in activities, achieving developmental gains and demonstrating improved behaviour.

> Parent One: *"For her, she's more friendly and sharing. Normally at home she is always fighting with the brother and the sister. For her every time I pick her up, we have to sit down and ask what has she been learning at school? And she keeps explaining everything."*
>
> Parent Two: *"She's more confident now. Yes, she talks about what she was doing, the activities."*
>
> Parent Three: "*He thinks he's an adult now. His confidence* (has developed) *to stand up and speak."*

Teacher One: *"It was good having to work together with the kids that I had on my list in terms of development, developing their reflexes. How well they focus, how well they are able to follow through with instructions. So, I did see a lot of the benefits, especially some of our children who did find it hard to focus and concentrate on some of the movements. So, it was really good. Having to go through the step-by-step exercises that they were able to become familiar with it and also confident as well."*

Teacher One: "*We did have a few kids who are really confident, eager to learn, eager to just get into it, dive into it, whereas there were other kids who did find it hard at first. But then as we kept going, I noticed near the end, they started to pick up, and when, every time we mentioned 'exercise time', they quickly came in. And some of them actually took lead. It was really good seeing that."*

Teachers could also pinpoint tangible improvement in specific children such as improved concentration, attention, body/mind connections, self-management skills, and balance.

Teacher One: *"I think child XXX, before he did it, I struggled with him and, his behaviour. But then after a while I started to gradually see him, being able to self-regulate, so he was able to sit still, focus without fidgeting or moving around. It was so good to see that. I think it probably took like a month before I started to see him calm down during our group time. He was a huge improvement actually."*

Teacher Two: *"Another thing I have noticed is that child XXX when I called him, rather than turning his whole body to answer, he just moved his head. In the past I had noticed that he would move his whole body I have also seen a change in his personality, rather than asking for help from the teachers to put his shoes on or take an item of clothing off, he is now confident and capable to do this by himself. There are so many of these examples that I have seen with our tamariki that were in the intervention group that I would like us to spend time doing these exercises with all our tamariki."*

Teacher One: "I think they improved a lot more in their concentration. It does encourage them to pay attention and also to be confident with their own body. And it also helps them like connect their mind, their bodies, and managing themselves as well, which is really good."

Additionally, both teachers reported that the intervention held many benefits for the teacher child relationship, that it was fun and that it allowed the children leadership.

> Teacher One: *"It was really good to connect… They really liked the counting one that you did with the round and round – the spinning. Yeah, that was really fun."*

> Teacher Two: *"I found that the programme was easy to do, and it became part of the daily flow of our day. When Teacher One was absent we were a little forgetful, but the children would always remind us that it was big kids move time."*

As well as the children benefiting from the M4LM intervention, the teachers also saw benefits for themselves. Part of the training for the teachers to take part in the study included both instructional and theoretical videos. Some of this was information about primitive and postural reflexes, about the impact of these on children's development if prolonged, and also about how to complete the exercises correctly.

> Teacher Two: *"The videos were helpful for us in the beginning. We were able to go back and make sure we were doing all the exercises correctly." "Having time to discuss the programme with the researcher as a whole team at our staff hui (was a benefit) …. Considering the timeframe, we had to work with, I was impressed with the programme."*

> Teacher One: *"Easy to understand because you gave us the examples."*

While both parents and teachers have found significant benefits for children, for the teachers and the teacher/child relationship from the M4LM Intervention, there were also challenges in its' implementation. The next section discusses these from both participants' perspectives.

5.2.2 Theme Two – Challenges of the Intervention

While the parents could articulate their children's progress while on the M4LM intervention, there was also a lack of awareness about what the children were doing on the intervention. In addition, the differences between everyday early childhood educational practices and the M4LM intervention were not distinguished.

> Parent Two: "*He likes it. Not really aware* (of what is happening in the intervention)*. Don't need to know more."*

> Parent One: *"For me I used to work in a centre, so I know for this age group that's where I used to work, that's how I know the process."*

The teachers, however, did not have this concern as continued support in the implementation of the intervention was given. Despite this, there was some juxtaposition between the teacher's

knowledge of the theory, and the implementation of the intervention. The dichotomy between awareness of the potential value of the intervention, then overcoming the uncomfortableness of doing or explaining the movements to the children was not always easy or comfortable on a personal level.

> Teacher One: "*When I first watched it, you took us through the whole theory side of the exercises and what's the benefits. And then having to do it myself, felt really weird at first."*

> Teacher One: *"Especially with the movements as well because we keep repeating it over and over again and some of our kids were asking; 'Why are we doing this? Like why do we have to do this? It's the same thing over and over.'"*

However, personal feelings of discomfort reduced over time.

> Teacher One: *"But I think it's just gaining the understanding of 'What's the whole purpose?' Having to have that mindset, that the focus is on kids and this thing helps them to develop their reflexes and stuff. It was quite interesting……and actually doing this, like we feel like the butterfly."*

In addition, several challenges to delivering the intervention in a consistent manner were identified.

> Teacher One: *"It was having to remember to do it. In the beginning there was that constancy and then you know after a while I'd forget about it, it was behind our heads, so I think it was just that. Like having to be consistent with it. I think that's what I found most challenging…."(due to) short staff and then change of routine."*

> Teacher Two: *"In the first weeks five times a week, but then 3-4 times a week at the end."*

> Teacher One: *"The first five weeks, like every day. When it came to the middle… we did it maybe twice a week."*

> Teacher One: *"Having to do it myself, felt really weird at first … and then we started introducing the one where you crawl around. And that didn't go well the first time because they would crawl around everywhere instead of in a circle."*

A further challenge for teachers was the uncertainty of how to engage children with additional learning needs.

> Teacher One: *"I had one child who comes to school …and he found it really hard because, I didn't know if he was on the spectrum, and it was really difficult for him to participate and engage. So how do we deal with those kids?"*

Therefore, the teachers' challenges to the intervention were more centered on implementation and consistency of delivery, whereas parents did not report any barriers, but demonstrated a lack of awareness about the intervention. The challenges, however, did offer an opportunity for teacher initiative within the intervention and for parent suggestions on its delivery.

5.2.3 Theme Three – Teacher Initiative within the M4LM Intervention

Teachers and parents offered several suggestions for future implementation of the intervention. The teachers also undertook several initiatives to support the implementation of the intervention in ways that aligned with the center's philosophy.

> Teacher One: *"Well, I wasn't quite sure. From our teaching perspective, that shared leadership, sharing it with the kids, but I wasn't sure if I was allowed to do that. Is it OK to have the kids lead? It's just so that it makes it fun and more engaging, instead of just the adult leading it."*

> Teacher One: *"So we had a sticker chart, just to kinda encourage them and get them to participate."*

> Teacher One: *"I mean, our kids did really well, keeping it really basic, and then having terminologies for each, like naming the movement. Having real fun names for it."*

Teachers found it helpful to explain the benefits of the intervention to children and noted the importance of finding a suitable time of day and location for delivering the intervention.

> Teacher One: *"But then we just kind of explained to them, in their own like understanding that this helps your development, helps your brain and how well you focus and able to follow instructions … It was really good. I just had to give them clear instructions and break down the moves and show them, model to them, first before they joined in, and then we started."*

> Teacher One: *"When we first started, we used the Playroom. We just used that space, but then it got a bit too distracting, distracting for the kids, 'cause too many colours and too many toys around. And so, we moved to the baby side just outside*

the patio. And then sometimes we would do it near the end, in this room when all the kids were outside."

Teacher One: *"The first time we started; we started in the afternoon. So, during the afternoon session, and then we changed it. Because it was more suitable to do it in the morning when there was a lot of staff present."*

Teacher Two: *"Before lunch in the class by ourselves or after lunch outdoors."*

Teachers created additional written resources that they found useful for supporting intervention delivery and one parent had a suggestion to improve the study.

Teacher Two: *"I found it easier to take the exercises having a little reminder sheet with me. I know that other teachers also used prompts to keep them on track. I found that setting an alarm helped keep us on track when doing the exercises."*

Teacher Two: *"I think having a reminder sheet will help in the future for the teachers taking the exercises."*

Teacher One: *"So, I don't know, like (music) already available, for us to just have it. So that way it helps them become familiar, have that kind of pattern. I don't know if that's, you know, how you do it?"*

There was one suggestion from a parent on how to improve the intervention.

Parent Two: *"Updates on progression halfway through (could be helpful)."*

The initiative and ideas offered through the intervention allowed the M4LM intervention to be contextualised to the needs of the centre and provided clear points of improvement for future studies. Overall, many benefits were seen from parents and teachers in the children's development, and some of the barriers to the implementation of the intervention were overcome by the teacher's initiative.

5.2.4 Post-hoc Analyses

While not included in the stated aims for the study, post-hoc analyses were undertaken to compare intervention and control groups in terms of parent and teacher reported total SDQ scores and children's total neuromotor scores at baseline and follow-up. These analyses were undertaken to gain an initial sense of preliminary efficacy of the intervention (acknowledging the small sample size). Shapiro-Wilk tests supported non-parametric tests as assumptions of

normality were not met for child total neuromotor and parent and/or teacher report SDQ scores (ps <.001). Descriptive statistics and Mann-Whitney U tests were undertaken to compare group median baseline and follow-up scores for child neuromotor assessment and parent, and teacher reported outcomes. Group medians and interquartile ranges (IQR) showing the 25th and 75th percentiles were reported to determine the distribution of data and to provide a reliable representation of central tendency (Selvin, 2015). Alpha level was .05 for all statistical tests. Cases and controls with missing data were excluded from related analyses. All analyses were completed using IBM SPSS for Windows version 28.0 (IBM, 2022).

As shown in Table 7, the presence of primitive reflexes among all children participating in the study was evident by scores above zero on the neuromotor test. At baseline, group-level primitive reflexes were more apparent in the intervention than control group (though not significantly so). At follow-up, both the IG and CG showed a group-level reduction in the extent to which primitive reflexes were present (though again not significantly so). Parents in the IG reported a greater reduction in overall child behaviour problems at follow up compared to the CG. Teachers reported that overall child behaviour problems reduced in both groups at follow-up, but larger reductions were seen in the intervention group with a trend towards statistical significance (p <.10). These patterns of findings must be interpreted cautiously given the small sample size and further research with larger samples is required to determine whether (or not) the intervention may be associated with significant reductions in child neuromotor functioning and/or parent and teacher reported child behaviour problems.

Sample and power: Using a single-subject case study design, a total sample size of 130 (52 per group, allowing for 20% drop-out) will have 80% power (2-sample T-tests) to detect differences with 95% confidence (SD=7.64).

Table 7

Child Neuromotor Functioning and Behaviour at Baseline and Follow-up, by group

Measure	Intervention (n = 5) Median (IQR)	GE (control) (n = 6) Median (IQR)	Z-value	P-value
Child neuromotor performance	(n = 3)*	(n = 3)*		
Baseline neuromotor score	27.00 (14.00-27.00)	23.00 (21.00-23.00)	4.000	.827
Follow-up neuromotor score	9.00 (9.00-9.00)	13.00 (1.00-13.00)	3.500	.653
Parent report (SDQ)				
Total child behaviour problems	(n = 5)	(n = 5)		
Baseline child behaviour	12.00 (8.00-13.50)	13.00 (2.25-15.75)	16.000	.854
Follow-up child behaviour	9.00 (6.50-13.50)	12.00 (2.50-24.00)	11.500	.834

Teacher report (SDQ)				
Total child behaviour problems	(n = 5)	(n = 6)		
Baseline child behaviour	10.00 (5.00-17.00)	11.00 (6.50-19.25)	13.500	.783
Follow-up child behaviour	3.00 (1.50-9.00)	5.50 (4.57-23.25)	6.000	.097

* Reduced numbers due to children not attending NM assessments

Chapter 6

Discussion

6.1 Overview of Study

Children with primitive reflexes that are present beyond the first few years of life are known to be at increased risk of a range of developmental impairments that impact their readiness for school and learning. However, relatively little is known about the feasibility, safety and acceptability of delivering movement-based interventions aimed at reducing the presence of primitive reflexes in early childhood. Drawing on pilot data from a small cohort of children with primitive reflexes present at age 4 years and including parent and teacher feedback, the current study aimed to assess the feasibility of conducting a full scale randomised controlled trial and intervention delivery of the M4LM movement programme in New Zealand; and to explore teacher's and parent's impressions of the acceptability of the M4LM programme. Strengths of the current study, followed by a discussion of findings in relation to relevant literature and study limitations are discussed below. Practical implications of study findings for future studies are also reviewed, acknowledging where changes could be beneficial.

Strengths of the current study are as follows: 1) inclusion of a control group; 2) assessor blinding to group status; 3) quality control processes for monitoring intervention delivery; 4) the use of standardised tests (Riethmuller et al., 2009); and 5) 100% representation of Māori and/or Pacifica in the study sample leading to indigenous viewpoints being strongly represented. Prior studies in this area have predominantly examined 'white' participants at a range of 60 – 66% whereas representation of ethnic minorities is often as low as 10% (Barber et al., 2016; Vidoni et al., 2014). Having a key contact person for the study to serve as the liaison and support, facilitating communication between participating whānau and the researcher also enhanced participant recruitment and retention, as also reported by Barber et al. (2016), Callcott (2012) and Jones et al. (2011) and was critical to intervention success (Logan et al., 2012; Riethmuller et al., 2009). The approach in the current study aligns with Dempsey et al.'s (2016) acknowledgement that the "gatekeepers" of vulnerable groups are essential in healthcare research to support the inclusion of indigenous peoples. Additionally, health research is calling for studies with indigenous peoples to move from describing health issues, to providing data to aid change, of which this study is a beginning step forward (Sanson-Fisher et al., 2006).

Regarding the feasibility of running a future large-scale RCT of the intervention, findings were mixed but largely supported feasibility. In terms of recruitment, a participating study centre was able to be identified within the study timeframe and all eligible families took part in the study suggesting the feasibility of participant recruitment. The results of randomisation were fully

accepted by participants, and the randomisation method was effective in providing two study groups that were comparable for age, sex, and ethnicity. Furthermore, no safety issues were reported. Moderation processes to monitor the quality of intervention delivery were also proven feasible and effective, with noticeable improvement in teacher and child adherence to the programme following the initial round of feedback provided by the study team. Though moderation can be a subjective experience in educational settings (Adie & Klenowski, 2016), this was mitigated by a clearly documented process adhering to specific criteria (Appendix G) which supported the intervention to align with INPP guidelines (Goddard Blythe, 2012a). This procedure was similar to that used by Barber et al. (2016) who observed at least one session per school and reported findings on a five point fidelity scale. Similarly, other studies have also implemented a range of ways to monitor and support programme adherence, including the use of a standardised checklist (Jones et al., 2011; Kim et al., 2019), and ensuring the presence of at least one researcher and assistant during programme delivery (Vidoni et al., 2014).

The passionate and committed team of teachers, enhanced the implementation of the M4LM intervention which aligns with a meta-analysis of preschool interventions studies carried out by Riethmuller et al. (2009), showing that the early childhood setting is the most effective place for interventions. Teachers in the current study demonstrated considerable initiative to create ways to engage children in the intervention, reflective of high quality teaching (Hattie, 2009). The teacher's ability to adapt how the intervention is run is a strength of the intervention, allowing ownership and uniqueness within the neuromotor parameters. This further enhanced the acceptability of the intervention as the children's attitudes and values developed as children began to take leadership in running the movement sessions (Culpan & Stevens, 2017). Kim et al. (2019) who examined the acceptability of a mindfulness intervention with 170 3–5-year-olds also found that implementation was supported by children's ownership and commitment of the intervention. Therefore, flexibility within the study parameters is needed for the centre to take ownership of the intervention and enhance consistency of delivery (Jones et al., 2011). Allowing the children some degrees of autonomy and opportunities to engage in movement experiences that promote motor control and allow increasing control over their bodies also aligns with New Zealand curriculum (Ministry of Education, 2017).

While baseline and follow-up questionnaire-based assessments proved feasible with parent and teacher completion rates ranging from 91% - 100%, follow-up rates for child participation in neuromotor assessments were low. The low rates of participation were partially attributed to families being on holiday or families being uncontactable. Overall participant numbers were lower than expected and a different approach to recruit larger numbers of participants will need to be considered in a larger-scale trial, such as recruiting multiple centres or centres with larger numbers of 4-year-old enrolments (Goddard Blythe et al., 2022; Grigg, 2018; Pecuch et al., 2020).

In the current study, both parents and teachers reported benefits of the M4LM intervention for children, including improvements in children's confidence, focus, following instructions, behaviour and physical development which is similar to other studies examining neuromotor interventions (Goddard Blythe, 2005; Goddard Blythe, 2023). Additionally, teachers observed improvements in concentration, attention, self-regulation, and body/mind connections. Teacher reported benefits are similar to those stated by Kim et al. (2019), who reported general calmness and positive effects of a mindfulness programme to connect body and mind in the classroom, and Preedy et al. (2022) who found that children's listening, capacity to follow instructions, and stamina all improved following the completion of a neuromotor intervention. Current study findings also highlighted the intervention's positive impact on teacher-child relationships, fostering child leadership and providing a fun learning environment. Similar to findings reported by Jones et al. (2011), teachers found the intervention easy to incorporate into their daily routine and valued the instructional and theoretical videos provided during the training. Teacher feedback supported acceptability of using the intervention with four-year olds, showing along with other studies, that teachers and parents see the need and value of interventions and are open to implementing these types of interventions in the early childcare setting (Barber et al., 2016; Jones et al., 2011; Kim et al., 2019; Vidoni et al., 2014; Williams & Holmes, 2004). Intervention acceptability may have been enhanced by the professional development of teachers provided by a researcher familiar with the intervention, the semi-flexible implementation schedule regarding time and location, and the group approach to delivering the intervention (Jones et al., 2011). However, it acknowledged these findings must be considered in the context of the participating centre and cannot be generalised elsewhere (Vasileiou et al., 2018). Additionally, while more commonly reported in terms of experimental studies, it is important to acknowledge the potential presence of Hawthorne effects or observer bias, being that people behave differently when they know they are being observed (Bk et al., 2019). Teachers in the current study may have altered their behaviour when being video recorded as part of study quality control processes. It is also important to acknowledge the potential presence of GroupThink - the group phenomenon of unconscious agreement in decisions without critical reasoning, which may have occurred when parents participated in group interviews (Encyclopædia Britannica, n.d).

Challenges to delivering the intervention were also reported. Parents reported a lack of awareness about what the children were doing in the intervention. This could be improved via weekly communication about the exercises and how they support children's development (Riethmuller et al., 2009). This challenge has not been reported by other similar studies included in the earlier review and may be due to parents participating in the intervention with their children (Barber et al., 2016) or parents not being part of the study. Teachers reported some challenges to delivering the intervention: having to remember to do it consistently; initially feeling uncomfortable modelling the exercises; uncertainty of engaging children with additional learning

needs; and lack of implementation due to staffing issues/sickness or roster changes. Some of these findings are similar to those reported in other prior studies (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022). For example, Jones et al. (2011) found that staff faced challenges with implementation and sustainability of the *Jump Start* physical activity programme in two Australian preschools due to the researcher's absence, conflicting workload priorities and staff motivation. Overwhelmingly, the most commonly reported challenge to consistent implementation of such interventions have been a lack of time and staffing (Barber et al., 2016; Jones et al., 2011; Preedy et al., 2022; Vidoni et al., 2014). These barriers to intervention delivery require effective solutions that might include allocating specific staff members to a roster and/or sharing the responsibility of leading the intervention across a wider number of staff; scheduling time with teachers post training to answer specific questions and weekly communication to staff to support adherence to intervention delivery. Consistency of intervention delivery may also be supported by setting a fixed time for the intervention in the day, the use of assistive tools (i.e., use of a bell to remind children what time it is, a reminder sheet for teachers), praise and encouragement of teachers, the use of visual aids to help teachers and children remember the specific exercises and linking the intervention to national curriculum and centre planning (Kim et al., 2019).

Post-hoc analyses tentatively examined the potential efficacy of the intervention and revealed greater decreases in children's neuromotor scores in the intervention group compared to the control group. Interestingly, both parents and teachers reported fewer overall child behaviour problems in the IG compared to the CG on the follow-up SDQ. While there is the potential for bias with the teacher's awareness of grouping, this is not the case for parents, which supports potential intervention efficacy. However, as previously acknowledged, replication is required in larger study samples and the findings of the current study cannot be generalised and must be interpreted with caution.

6.2 Limitations of the Study

Informed by a current model of feasibility trial evaluation, *'A process for Decision-making after Pilot and feasibility Trials'* (ADePT), was applied to ensure robust and systematic appraisal of the trial and its limitations (Figure 6) (Bugge et al., 2013).

Figure 6

Model of Feasibility Trial Evaluation – ADePT Model

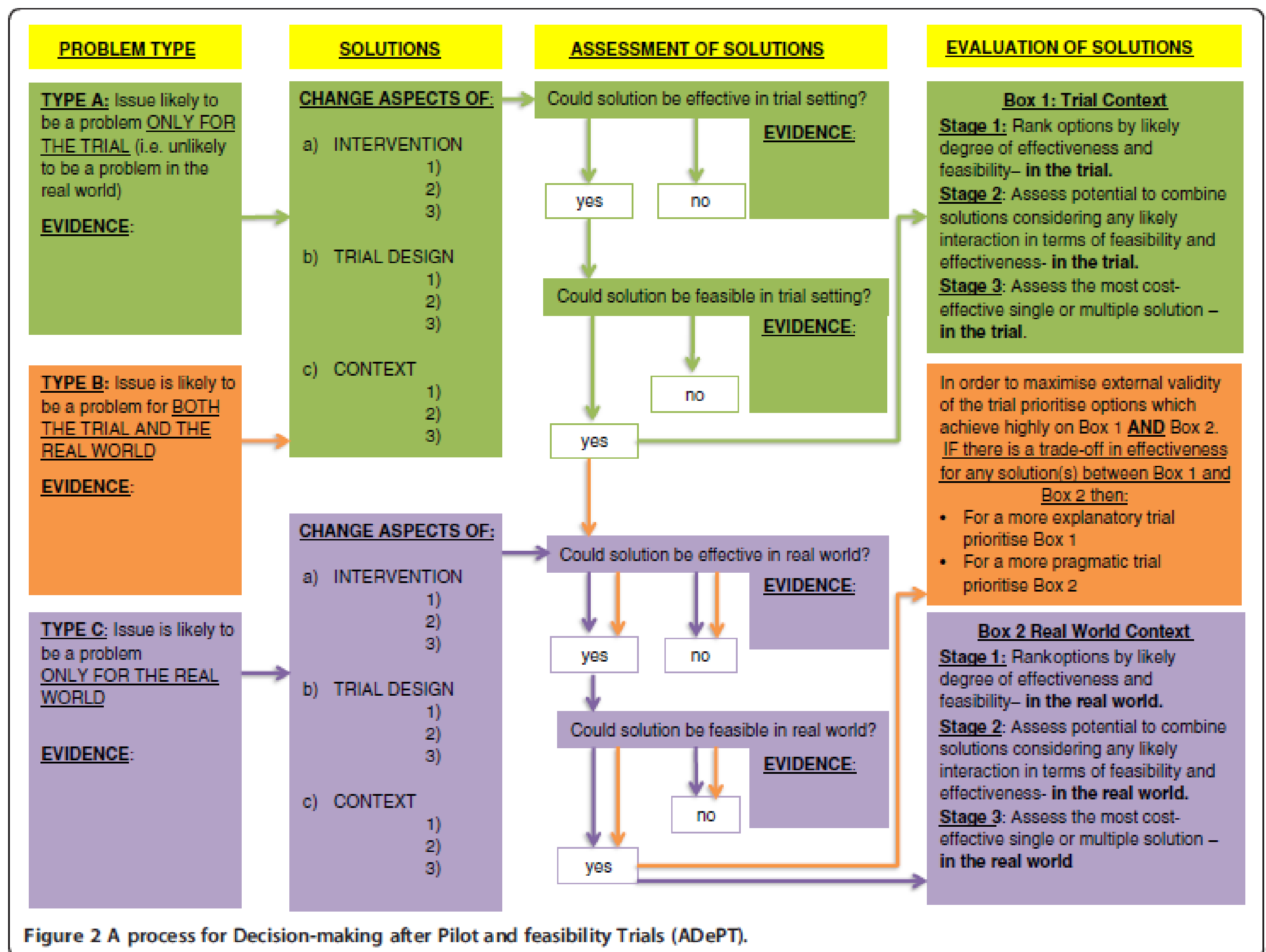


Figure 2 A process for Decision-making after Pilot and feasibility Trials (ADePT).

Note. From *A process for Decision-making after Pilot and feasibility Trials (ADePT): Development following a feasibility study of a complex intervention for pelvic organ prolapse.* C. Bugge, B. Williams, S. Hagen, J. Logan, C. Glazener, S. Pringle, L. Sinclair, 2013, *Trials, 14(353)*, (p. 9). DOI:10.1186/1745-6215-14-353. Copyright 2013 by Carol Bugge. Reprinted with permission (Appendix M).

Post-trial the current study was found to have a Type A - trial - problem (small sample size, unblinded teachers) and a Type B - trial and real-world problem (lack of children's participation in follow up neuromotor assessments). While a small sample size may not have impacted the qualitative findings of the current study in terms of reaching data sufficiency (Vasileiou et al., 2018), it did impact the generalisability of study findings (Bilbilaj et al., 2017; Bugge et al., 2013; Gieysztor et al., 2015; Goddard Blythe, 2010; Haapala, 2013; Kalemba et al., 2023; Srinivasan et al., 2023). It is also acknowledged that teachers who scored the SDQ were not blind to children's group status and therefore there was a potential for bias in these findings. However, in many ways the study design has been true to its pilot methodology, and RCT parameters, and in this

sense provides initial findings and methodological rigour for the planning of future research (Bugge et al., 2013; Lancaster et al., 2002; Moore et al., 2011; Shanyinde et al., 2011; Thabane et al., 2010).

The Type B - study and real-world problem - children's lack of participation in follow-up assessments, have been reported in prior studies (Barber et al., 2016). This limitation highlights the need to incorporate strategies to support children's continued participation and completion rates, so that future studies have full data sets, and pragmatically, teachers can gauge the success of the intervention (Jones et al., 2011). Completion of baseline and follow-up assessment measures were 94% in the Jones et al. (2011) study, 39% in the Barber et al. (2016) study, and 60% in the current study. Follow up assessments in the current study coincided with the end of year holiday period, and this was likely a factor in the observed attrition. It is also important to note that in the current study the intervention was delivered over a condensed 10-week timeframe. The condensed timeframe may have increased levels of burden placed upon participating parents. All study assessments required completion within a total of 13 weeks. Delivery of the intervention over a longer timeframe would provide greater scope to avoid school holiday periods for follow-up assessments, reduce parent burden in terms of follow-up timeframes, and would also allow greater opportunities for observing benefits of the intervention (i.e., efficacy due to changes in synaptic myelination (Leaf, 2018)).

Children's participation in follow-up neuromotor assessments could also be further supported by commencing intervention delivery earlier in the year, securing research funding to support family travel to assessments, and offering incentives (i.e., koha and otherwise) throughout the study to recognise on-going participation (Barber et al., 2016; Riethmuller et al., 2009). Additionally, staff at participating centres could be engaged to clearly communicate to parents the benefits of the intervention as found helpful by Jones et al. (2011). Furthermore, in-home assessments could be offered to encourage participant retention as found successful by Barber et al. (2016), with consideration given to post-pandemic research environments (Singh, 2020; Tran et al., 2021). Nevertheless, the current study addresses to some extent the limited research of neuromotor interventions in young children. Limitations identified in the current study offer valuable information to further inform the design of future research examining neuromotor interventions in the early childcare setting and beyond, across the fields of education, health science and psychology (Orsmond & Cohn, 2015).

6.3 Future Recommendations

Based on findings of the current study, the following recommendations are made to support future research examining neuromotor interventions in young children. Future studies should investigate

associations between the amount of time children take part in the intervention and the presence of primitive reflexes. Examining whether greater participation leads to greater reduction in reflexes and the development of coordination and academic abilities, or if any dose-response relationships exist, in terms of intervention attendance and outcomes, could provide valuable insights for informing ‘real world’ intervention delivery (Gieysztor et al., 2015; Goddard Blythe, 2005; 2010, 2012b; Grigg, 2018; Pecuch et al., 2020; Zielińska & Goddard Blythe, 2020). The current study indicated that the mean number of child days of attendance to the intervention was low (n=16 days), though it is not clear if this is due to child absenteeism or non-participation, or lack of implementation of the intervention by teachers. Therefore, a key component of future research would be to monitor children’s daily participation in the intervention and frequency of teacher delivery in both intervention and control group periods to determine the extent of any dose-response relationships in terms of intervention efficacy. For this reason, future researchers may also consider running similar studies in primary school term time as younger children may not attend childcare when older siblings are on holidays, and also having longer follow-up periods to sustain changes (Grigg, 2018; Grigg et al., 2023; Jones et al., 2011). Additionally, the inclusion of additional outcome measures to assess children’s progress in academic development is recommended. These may be the Tansley figures and the Draw-A-Man test to measure fine motor control, visual-perception and intellectual maturation, along with assessments of the Symmetrical Tonic Neck Reflex which is used extensively in other trials and has been linked to problematic behaviours (Callcott, 2012; Goddard Blythe, 2010, 2012a, 2012b; Goddard Blythe et al., 2022; Infante-Cãnetea et al., 2023; Preedy et al., 2022).

While data gathered from post-hoc analysis is secondary to the primary aims of this study, it can shed light on this study’s methodological positions. As an acceptability study, the multi methods approach to qualitative and quantitative findings allowed data to remain separate, treating each as individual to the other, individualising the interpretation of the data (Azorín & Cameron, 2010). The multi methods approach is beneficial to methodological triangulation but could be further enhanced by a mixed methods approach to support quality analysis, meaningful coherence and investigative triangulation in an efficacy study (Moher et al., 2010; Tracy, 2010). Researchers may consider adopting a mixed methods methodology so that the teacher and parent reported difficulties can be measured against neuromotor assessments and further analysis can look at the relationship between children’s behaviour and prolonged primitive reflexes to determine accuracy of the qualitative data, alleviate any confounding data sets, and allow for programme evaluation (Anguera et al., 2018). Additionally, changing the design of the study to a Single-Subject Case Design can support the findings of Effect Sizes which characterises the degree of change from pre to post treatment (Beeson & Robey, 2006). This allows measurement of the efficacy of intervention for individuals rather than group norms (Gierut, et al., 2015), and supports the comparison of intervention outcomes between individuals (Beeson & Robey, 2006). Taken together a mixed method single case research design may support a deeper understanding of

individual response to intervention, and more accurately represent the diverse nature of children's development, measuring change from individual starting points rather than group norms (Onghena, et al., 2019).

Given that all children in the current study were found to have primitive reflexes present to a certain extent, future research to determine the prevalence of prolonged primitive reflexes in young children in New Zealand would help to determine the extent of the problem. International studies suggest that 20% to 100% of children aged 4-years have prolonged primitive reflexes (Gieysztor et al., 2018; Gieysztor et al., 2015; Goddard Blythe et al., 2022; Hickey & Feldhacker, 2021; Infante-Cãnetea et al., 2023). However, accurate data are not available for New Zealand, and for this reason research examining prevalence is needed.

6.4 Conclusion

Children who have prolonged primitive reflexes face increased risks for neurological immaturity and developmental delay, leading to uncoordinated motor development, behavioural issues, poor academic achievement and neuro-behavioural disorders. Children with prolonged primitive reflexes rarely make developmental gains equal to their chronological age without intervention. Neuromotor interventions have been seen to mature primitive reflexes and support children with coordination, following instructions, focus, self-help skills and school progress such as writing, reading, spelling and math. In the current study, teachers found the intervention acceptable to use in the early childhood centre, and both parents and teachers reported benefits for children's confidence, focus, behaviour and coordination. Study findings suggest that a future full-scale trial is likely to be feasible, with changes to the study design to increase participant completion of assessments and intervention delivery. As in any small-scale pilot study, the findings of the current study cannot be generalised to the wider population. However, few studies have examined the feasibility and acceptability of delivering neuromotor interventions designed to reduce the presence of primitive reflexes among young children, and to the best of our knowledge, there have been no prior studies of this kind in four-year-olds in New Zealand. This creates a pivotal opportunity for researching the efficacy of neuromotor programmes in four-year-olds as an intervention pre-primary school. Further studies can draw on the strengths and recommendations of the current study, to improve future research in this area, which offers the potential to enhance children's learning, behaviour and physical development in New Zealand and beyond.

References

Adie, L., & Klenowski, V. (2016). Moderation and Assessment. *Encyclopedia of Educational Philosophy and Theory*, 1-7. https:/doi.org/10.1007/978-981-287-532-7_393-1

Alesi, M., Bianco, A., Luppina, G., Palma, A., & Pepi, A. (2016). Improving Children's Coordinative Skills and Executive Functions: The Effects of a Football Exercise Program. *Perceptual and Motor Skills, 122*, 27-46. https://doi.org/10.1177/0031512515627527

Alger, E., Zhang, Y., & Yap, C. (2023). Reporting quality of CONSORT flow diagrams in published early phase dose-finding clinical trial reports: Improvement is needed. *Contemporary Clinical Trials, 131*, 107277. https:/doi.org/10.1016/j.cct.2023.107277

Allwood, M., Allen, K., Price, A., & Hayes, R. (2018). The reliability and validity of the pupil behaviour questionnaire: a child classroom behaviour assessment tool. *Emotional and Behavioural Difficulties, 23*(4), 361-171. https://doi.org/10.1080/13632752.2018.1478945

Angen, M. (2000). Evaluating Interpretive Inquiry: Reviewing the Validity Debate and Opening the Dialogue. *Qualitative Health Research, 10*(3), 378-395. https://doi.org/10.1177/104973230001000308

Anguera, T., Blanco-Villasen, A., Luis Losada, J., Sànchez-Algarra, P., & Onwuegbuzie, A. (2018). Revisiting the difference between mixed methods and multi methods: Is it all in the name? *Quality & Quantity, 52*, 2757-2770. https:/doi.org/10.1007/s11135-018-0700-2

Archer, C., & Siraj-Blatchford, I. (2015). Measuring the quality of movement-play in Early Childhood Education settings: Linking movement-play and neuroscience. *European Early Childhood Education Research Journal, 23*(1), 21-42. https://doi.org/10.1080/1350293X.2014.890351

Audrey, A., & Trainor, A. (2014). Development and preliminary analysis of a rubric for culturally responsive research. *The Journal of Special Education, 47*(4), 203-216. https://doi.org/10.1177/0022466912436397

Ayres, A. (1970). *Sensory Integration and the child.* Western Psychological Services.

Azorín, J. M., & Cameron, R. (2010). The Application of Mixed Methods in Organisational Research: A Literature Review. *The Electronic Journal of Business Research Methods, 8*(2), 95-105. www.ejbrm.com

Barber, S., Jackson, C., Hewitt, C., Ainsworth, H., Buckley, H., Akhtar, S., Bingham, D., Routen, A., Summerbell, C., Richardson, G., Moore, H., Pickett, K., O'Malley, C., Bierley, S., & Wright, J. (2016). Assessing the feasibility of evaluating and delivering a physical activity intervention for pre-school children: a pilot randomised controlled trial. *Pilot and Feasibility Sutdies, 2*, 12. https:/doi.org/10.1186/s40814-016-0052-4

Beeson, P. M., & Robey, R. R. (2006) Evaluating Single-Subject Treatment Research: Lessons Learned from the Asphasia Literature. *Neuropsychology Review, 16*(4), 161-169. https://doi.org/10.1007/s11065-006-9013-7

Berk, L. (2009). *Child Development* (8th ed.). Allyn and Bacon.

Berne, S. (2006). The Primitive Reflexes: Considerations in the Infant. *Optometry & Vision Development, 37*(3), 139-145.

Bilbilaj, S., Gjipali, A., & Shkurti, F. (2017). Measuring primitive reflexes in children with learning disorders. *European Journal of Multidisciplinary Studies 2*(5), 176-189. https://doi.org/10.26417/ejms.v5i1.p285-298

Bjorklund, D. (1998). Physical Play and Cognitive Development: Integrating Activity, Cognition and Education. *Child Development, 69*(3), 604-606. https://doi.org/10.1111/j.1467-8624.1998.tb06229.x

Bk, S., Reddy, M., & Pathak, P. (2019). Camouflage in research - The Hawthorne Effect. *International Journal of Development Research, 9*(4), 26996-26999.

Blackburn, I. M., James, I. A., Milne, D. L., Baker, C., Standart, S., Garland, A., & Reichelt, F. K. (2001). The Revised Cognitive Therapy Scale (Cts-R): Psychometric properties.

Behavioural and Cognitive Psychotherapy, 29(4), 431-436. https://doi.org/10.1017/S1352465801004040

Brainbox. (2004). *An evaluation of the pilot INPP movement programme in Primary schools in the North Eastern Education & Library Board, Northern Ireland.* Brainbox Research Ltd.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77-101. https://doi.org/10.1191/1478088706qp063oa

Bridgman, G., Cushen, W., Cooper, D., & Williams, R. (1985). The evaluation of sensorimotor-patterning and the persistence of belief. *British Journal of Mental Subnormality, 31*, 67-79.

Bugge, C., Williams, B., Hagen, S., Logan, J., Glazener, C., Pringle, S., & Sinclair, L. (2013). A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse. *Trials, 14*, 1-13. https://doi.org/10.1186/1745-6215-14-353

Butcher, P., Braeckel, K., Bouma, A., Einspieler, C., Stremmelaar, E., & Bos, A. (2009). The quality of preterm infants' spontaneous movements: An early indicator of intelligence and behaviour at school age. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 50*(8), 920-930. https:/doi.org/10.1111/j.1469-7610.2009.02066.x

Callcott, D. (2012). Retained primary reflexes in pre-primary-aged Indigenous children: The effect on movement ability and school readiness. *Australasian Journal of Early Childhood, 37*(2), 132-140. https://doi.org/10.1177/183693911203700218

Calvin, N., & Ramli, Y. (2020). Detecting neurodevelopmental problems using the simple parent-reported screening tool in combination with primitive reflex assessment. *Paediatrica Indonesiana, 60*(1), 31-36. http:/dx.doi.org/10.14238/pi60.1.2020.31-6

Chowdhury, M. (2014). Interpretivism in Aiding our Understanding of the Contemporary Social World. *Open Journal of Philosophy, 4*(3), 432-438. https://dx.doi.org/10.4236/ojpp.2014.43047

Connell, G., & McCarthy, C. (2014). *A moving child is a learning child. How the body teaches the brain to think*. Free Spirit Publishing.

Croft, S., Stride, C., Maughan, B., & Rowe, R. (2015). Validity of the Strengths and Difficulties Questionnaire in Preschool-Aged Children. *Pediatrics, 135*(5), e1210–e1219. https://doi.org/10.1542/peds.2014-2920

Crotty, M. (1998). *The foundations of social research: Meaning and perspectives in the research process*. Sage Publications Ltd.

Culpan, I., & Stevens, S. (2017). Olympism, physical education and attitudes and values: what do graduating teachers in Aotearoa, New Zealand know and understand? *Asia-Pacific Journal of Health, Sport and Physical Education, 8*(3), 259-272. https://doi.org/10.1080/18377122.2017.1345284

Day, S., & Altman, D. (2000). Blinding in clinical trials and other studies. *British Medical Journal, 321*, 504. https://doi.org/10.1136/bmj.321.7259.504

Dempsey, L., Dowling, M., Larkin, P., & Murphy, K. (2016). Sensitive Interviewing in Qualitative Research. *Research in Nursing and Health, 39*(6), 480-490. https://doi.org/10.1002/nur.21743

Dennison, P. (2006). *Brain Gym and Me: Reclaiming the Pleasure of Learning*. Edu-Kinesthetics, Inc.

Denzin, N., & Lincoln, Y. (2017). *The SAGE Handbook of Qualitative Research*. Sage Publications Ltd.

Dobie, S. (2008). *Bilateral Integration: The Gateway to Achievement*. Movement and Learning Centre.

Dobie, S., Brown, K., & Dalziell, A. (2002). *Bilateral Integration: The gateway to achievement.* Bilateral Exercise Integration.

Doman, G. (1974). *What to do about your brain injured child*. Johnathan Cape.

Donnelly, J., & Lambourne, K. (2011). Classroom-based physical activity, cognition and academic achievement. *Preventive Medicine, 52 (Suppl 1)*, 36-42. https://doi.org/10.1016/j.ypmed.2011.01.021

Duncombe, R., & Preedy, P. (2018). Movement for Learning. In P. Preedy, K. Sanderson, & S. C. Bail (Eds.), *Early Childhood Education Redefined* (pp. 48-60). Routledge.

Education Counts. (2022). *ECE Directory Builder*. Education Counts. https://www.educationcounts.govt.nz/directories/early-childhood-services

Elder, H. (2013). Indigenous Theory Building for Māori Children and Adolescents with Traumatic Brain Injury and their Extended Family. *Brain Impairment, 14*(3), 406-414. https://doi.org/10.1017/BrImp.2013.28

Encyclopædia Britannica. (n.d). *Groupthink*. Britannica Academic. https://academic-eb-com.ezproxy.manukau.ac.nz/levels/collegiate/article/groupthink/600933

Environmental Health Intelligence New Zealand. (2023). *Ethnic Profile*. Massey University. https://www.ehinz.ac.nz/indicators/population-vulnerability/ethnic-profile/#regional-differences-in-ethnic-groups

Erdei, E. (2011). *Results of the INPP school exercise programme. Bakáts Tér Primary and Music school. INPP*. https://www.inpp.org.uk/wp-content/uploads/2011/07/Bakats-ter-Mainstrea-School-Budapest-Hungary-Report.pdf

Esteban-Cornejo, I., Ma Tejero-Gonzalez, C., David, M.-G., Del-Campo, J., Gonzalez-Galo, A., Padilla-Moledo, C., Sallis, J., & Veiga, O. (2014). Independent and Combined Influence of the Components of Physical Fitness on Academic Performance in Youth. *The Jourrnal of Paediatrics, 165*(2), 217-219. https:/doi.org/10.1016/j.jpeds.2014.04.044

Feast, L., & Melles, G. (2010). *Epistemological Positions in Design Research: A Brief Review of the Literature* CONNECTED 2010 – 2nd International Conference on Design Education, University of New South Wales, Sydney Australia.

Feldhacker, D., Cosgrove, R., Feiten, B., Schmidt, K., & Stewart, M. (2021). Relationship Between Retained Primitive Reflexes and Scholastic Performance. *American Journal of Occupational Therapy*, *(Suppl 2),* 75: 1-1. https://doi.org/10.1080/19411243.2021.1959482

Finlay, L. (2003). *Reflexivity: A practical guide for researchers in Health and Social Sciences*. Blackwell Publishing.

Flynn, S. (Ed.). (2022). *Research Design for the Behavioral Sciences: An applied approach*. Springer.

Gierut, J. A., Morrisette, M. L., & Dickinson, S., L. (2015). Effect Size for Single-Subject Design in Phonological Treatment. *Journal of speech, language, and hearing research: JSLHR, 58*(5), 1464-1481. https://doi.org/10.1044/2015_JSLHR-S-14-0299

Gieysztor, E., Kowal, M., & Paprocka-Porowicz, P. (2022). Primitive Reflex Factors Influence Walking Gait in Young Children: An Observational Study. *International Journal of Environmental Research and Public Health, 19*(7), 4070. https://doi.org/10.3390/ijerph19074070

Gieysztor, E., Sadowska, L., & Choińska, A. (2017). The degree of primitive reflexes integration as a diagnostic tool to assess the neurological maturity of healthy preschool and early school age children. *Nursing and Public Health Nursing and Public Health, 7*(1), 5-11. https://doi.org/10.17219/pzp/69471

Gieysztor, E., Sadowska, L., Choińska, A., & Paprocka-Borowic, M. (2018). Trunk rotation due to persistence of primitive reflexes in early school-age children. *Advances in Clinical and Experimental Medicine, 27*(3), 363-366. https://doi.org/10.17219/acem/67458

Gieysztor, E. Z., Choińska, A. M., & Paprocka-Borowicz, M. (2015). Persistence of primitive reflexes and associated motor problems in healthy preschool children. *Archives of Medical Science: AMS, 14*(1), 167-173. https://doi.org/10.5114/aoms.2016.60503

Glover, M., Kira, A., Johnston, V., Walker, N., Thomas, D., Chang, A., Bullen, C., Seagan, C., & Brown, N. (2014). A systematic review of barriers and facilitators to participation in randomized controlled trials by Indigenous people from New Zealand, Australia, Canada and the United States. *Global Health Promotion, 22*, 21-31. https://doi.org/doi:10.1177/1757975914528961

Goddard Blythe, S., & Hyland, D. (1998). Screening for Neurological Dysfunction in the Specific Learning Difficulty Child. *British Journal of Occupational Therapy, 61*(10), 459-464. https://doi.org/10.1177/030802269806101008

Goddard Blythe, S. (2003). Early learning in the balance: priming the first ABC. *Support for Learning, 15*(4), 154-158. https://doi.org/10.1111/1467-9604.00168

Goddard Blythe, S. (2005). Releasing educational potential through movement: A summary of individual studies carried out using the INPP test battery and developmental exercise programme for use in schools with children with special needs. *Child Care in Practice 11*(4), 415-432. https://doi.org/10.1080/13575270500340234

Goddard Blythe, S. (2008). *What babies and children really need*. Hawthorn Press.

Goddard Blythe, S. (2010). *Neuro-motor maturity as an indicator of developmental readiness for education*. Institute for Neuro Physiological Psychology.

Goddard Blythe, S. (2012a). *Assessing neuromotor readiness for learning*. Wiley-Blackwell

Goddard Blythe, S. (2012b). The Right to Move: Assessing Neuromotor Readiness for Learning: Why physical development in the early years supports educational success. In M. Matthes (Ed.), *Improving the quality of childhood in Europe 3* (pp 16-39). European Council for Steiner Waldorf Education.

Goddard Blythe, S. (2023). Are Immature Neuromotor Skills Significant Factors in Educational Under-achievement and Special Educational Needs? Literature review of the Role of Primitive Reflexes as Indicators and measures of neurmotor immaturity. *Szkola Specjalna, 2*, 111-123.

Goddard Blythe, S., Duncombe, R., Preedy, P., & Gorely, T. (2022). Neuromotor readiness for school: the primitive reflex status of young children at the start and end of their first year at school in the United Kingdom. *International Journal of Primary, Elementary and Early Years Education, 50*(5), 654-667. https:/doi.org/10.1080/03004279.2021.1895276

Goddard, S. (2005). *Reflexes, Learning and Behavior*. Fern Ridge Press.

Goodman, A., & Goodman, R. (2009). Strengths and difficulties questionnaire as a dimensional measure of child mental health: Erratum. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(4), 400-403. https://doi.org/10.1097/CHI.0b013e3181985068

Gordon, E., Tucker, P., Burke, S., & Carron, A. (2013). Effectiveness of Physical Activity Interventions for Preschoolers: A Meta-Analysis. *Research Quarterly for Exercise and Sport, 84*(3), 287-294. https://doi.org/10.1080/02701367.2013.813894

Grant, B., & Gillings, L. (2002). Making sense of methodologies: A pradigm framework for the novice researcher. *Contemporary Nurse, 13*(1), 10 - 28. https://doi.org/10.5172/conu.13.1.10

Gray, D. (2014). *Doing research in the real world* (3rd ed.). Sage Publications Ltd.

Green, D., Charman, T., Pickles, A., Chandler, S., Loucas, T., Simonoff, E., & Baird, G. (2009). Impairment in movement skills of children with autistic spectrum disorders. *Developmental Medicine & Child Neurology, 51*(4), 311-316. https://doi.org/10.1111/j.1469-8749.2008.03242.x

Grigg, T. (2018). *The influences of a primitive reflex integration programme within the classroom: Teacher/parent perspectives and student results.* https://ir.canterbury.ac.nz/handle/10092/16565

Grigg, T., Culpan, I., & Turnull, W. (2023). Primitive Reflex Integration and Reading Achievement in the Classroom. *Neurology & Experimental Neuroscience, 9*(1), 18-26. https://doi.org/ 10.17756/jnen.2023-103

Grzywniak, C. (2016). Role of early-childhood reflexes in the psychomotor development of a child, and in learning. *Neuropsychologica, 14*(2), 113-129. https://doi.org/10.5604/17307503.1213000

Haapala, E. (2013). Cardiorespiratory Fitness and Motor Skills in Relation to Cognition and Academic Performance in Children – A Review. *Journal of Human Kinetics, 36*, 55-68. https://doi.org/10.2478/hukin-2013-0006

Hannaford, C. (2005). *Smart Moves: Why learning is not all in your head*. Great Ocean Publishers.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Hazzaa, N., Shalaby, A., Hassanein, S., Khattab, A., Metwally, N., & Naeem, F. (2023). Balance functions and primitive reflexes in dyslexic children. *Hearing, Balance and Communication*, *21*(5), 169-174. https://doi.org/10.1080/21695717.2023.2176657

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence Based Nursing, 18*(3), 66-67. https://doi.org/10.1136/eb-2015-102129

Health Research Council. (2021). *Health research Ethics guidelines*. https://www.hrc.govt.nz/resources/hrc-research-ethics-guidelines

Hickey, J., & Feldhacker, D. (2021). Primitive reflex retention and attention among preschool children. *Journal of Occupational Therapy, Schools, & Early Intervention*, 1-13. https://doi.org/10.1080/19411243.2021.1910606

Hillman, C., Erickson, K., & Kramer, A. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature reviews neuroscience, 9*(1), 58 - 65. https://doi.org/10.1038/nrn2298

Hudson, M., & Russell, K. (2008). The Treaty of Waitangi and Research Ethics in Aotearoa. *Journal of Bioethical Inquiry, 6*, 61-68. https://doi.org/10.1007/s11673-008-9127-0

IBM Corp. (2022). *IBM SPSS Statistics for Windows, Version 28.0.* IBM Corp.

Infante-Cãnetea, L., Aguilar-Guerrerob, B., & Wallace-Ruizaa, A. (2023). Effect of a psychoeducational intervention on motor and perceptual-visual development through the inhibition of primitive reflexes in school children aged 4 to 7 years old. *Revista de Psicodidactica, 124*. https://dx.doi.org/10.1016/j.psicoe.2023.05.003

Ivanović, L., Stošović, D., Nikolić, S., & Medenica, V. (2019). Does neuromotor immaturity represents a risk for acquiring basic academic skills in school-age children? *Vojnosanitetski Pregled, 76*, 1062–1070.

Jensen, E. (2005). *Teaching with the brain in mind.* Association for Supervision and Curriculum Development.

Jones, R., Okely, A., Hinkley, T., Batterham, M., & Burke, C. (2016). Promoting gross motor skills and physical activity in childcare: A translational randomized controlled trial. *Journal of Science and Medicine in Sport, 19*(9), 744-749. https://doi.org/https://doi.org/10.1016/j.jsams.2015.10.006

Jones, R., Riethmuller, A., Hesketh, K., Trezise, J., Batterham, M., & Okely, A. (2011). Promoting Fundamental movement skill development and physical activity in early childhood settings: a cluster randomized controlled trial. *Pediatric Exercise Science, 23*(4), 600-615.

Kalemba, A., Lorent, M., Goddard Blythe, S., & Gieysztor, E. (2023). The Correlation between Residual Primitive Reflexes and Clock Reading Difficulties in School-Aged Children—A Pilot Study. *Environmental Research and Public Health, 20*(3), 1-9. https://doi.org/10.3390/ijerph20032322

Keenan, T., Evans, S., & Crowley, K. (2016). *An introduction to child development.* Sage Publications Ltd.

Kim, E., Jackman, M.M, Jo, SH., Oh, J., Ko, S., McPherson, C., & Singh, N. (2019). Feasibility and Acceptability of the Mindfulness-Based *OpenMind-Korea* (OM-K) Preschool Program. *Journal of Child and Family Studies, 28*(1), 2187-2198. https://doi.org/10.1007/s10826-019-01483-9

Klasen, H., Woerner, W., Wolke, D., Meyer, R., Overmeyer, S., Kaschnitz, W., Rothenberger, A., & Goodman, R. (2000). Comparing the German Versions of the Strengths and Difficulties Questionnaire (SDQ-Deu) and the Child Behavior Checklist. *European Child & Adolescent psychiatry, 9*(4), 271-276. https://doi.org/10.1007/s007870070030

Konicarova, J., & Bob, P. (2013). Asymmetric tonic neck reflex and symptoms of Attention Deficit and Hyperactivity Disorder in children. *International Journal of Neuroscience, 123*(11), 766-769. https://doi.org/10.3109/00207454.2013.801471

Konicarova, J., Bob, P., & Raboch, J. (2013). Persisting primitive reflexes in medication-naive girls with Attention-Deficit and Hyperactivity Disorder. *Neuropsychiatric disease and treatment, 9*, 1457–1461. https://doi.org/10.2147/NDT.S49343

Korstjens, I., & Moser, A. (2018). Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice, 24*(1), 120-124. https://doi.org/10.1080/13814788.2017.1375092

Lancaster, G., Dodd, S., & Williamson, P. (2002). Design and analysis of pilot studies: recommendations for good practice. *Journal of Evaluation in Clinical Practice, 10*(2), 307-312. https://doi.org/10.1111/j..2002.384.doc.x

Leaf, C. (2018). *Switch on your brain: The key to peak happiness, thinking, and health*. Baker Books.

Leisman, G., Moustafa, A., & Shafir, T. (2016). Thinking, Walking, Talking: Integratory Motor and Cognitive Brain Function. *Frontiers in Public Health, 4*, 1-19. https://doi.org/10.3389/fpubh.2016.00094

Lindeke, L., Hauck, M., & Tanner, M. (2000). Practical issues in obtaining child assent for research. *Journal of Pediatric Nursing, 15*(2). https://doi.org/10.1053/jn.2000.5447

Logan, S., Robinson, L., Wilson, A., & Lucas, W. (2012). Getting the fundamentals of movement: a meta-analysis of the effectiveness of motor skill interventions in children. *Child Care Health Development, 38*(3), 3015-3315. https://doi.org/10.1111/j.1365-2214.2011.01307.x

Macfarlane, A., & Macfarlane, S. (2019). Listen to culture: Māori scholars' plea to researchers. *Journal of the Royal Society of New Zealand, 49* (Suppl. 1), 48-57. https://doi.org/10.1080/03036758.2019.1661855

Madejewska, M., Choinska, A., Gieysztor, E., & Trafalska, A. (2016). Neuromotorical Assessment of Children Aged 4–7 from the Kamienna Góra District Based on Sally Goddard Tests. 6(3), 179-186. https://doi.org/10.17219/pzp/64033

Marlee, R. (2008). *Neurological developmental delay research programme*. Northumberland County Council.

Masters-Awatere, B., & Nikora, L. (2017). Indigenous programmes and evaluation: An excluded worldview. *Evaluation Matters, 3*, 40-66.

Matsuishi, T., Nagano, M., Araki, Y., Tanaka, Y., Iwasaki, M., Yamashita, Y., Nagamitsu, S., Iizuka, C., Ohya, T., Shibuya, K., Hara, M., Matsuda, K., Tsuda, A., & Kakuma, T. (2007). Scale properties of the Japanese version of the Strengths and Difficulties Questionnaire (SDQ): A study of infant and school children in community samples. *Brain development, 30*(6), 410-415. https://doi.org/10.1007/s10803-017-3245-7

Matuszkiewicz, M., & Gałkowski, T. (2021). Developmental Language Disorder and Uninhibited Primitive Reflexes in Young Children. *Journal of Speech, Language, and Hearing Research, 64*(3), 935-948. https://doi.org/10.1044/2020_JSLHR-19-00423

McMorris, T., Tomporowski, P., & Audiffren, M. (2009). *Exercise and cognitive function*. Wiley-Blackwell Ltd.

McPhillips, M., & Sheehy, N. (2004). Prevalence of persistent primary reflexes and motor problems in children with reading difficulties. *Dyslexia*, *10*(4), 316-338. https://doi.org/10.1002/dys.282

Melillo, R. (2011). Primitive reflexes and their relationship to delayed cortical maturation, under connectivity and functional disconnection in childhood neurobehavioral disorders. *Functional Neurology, Rehabilitation, and Ergonomics, 1*(2), 279.

Melillo, R., Leisman, G., Machado, C., Machado-Ferrer, Y., Chinchilla-Acosta, M., Kamgang, S., Melillo, R., & Carmeli, E. (2022). Retained Primitive Reflexes and Potential for Intervention in Autistic Spectrum Disorders. *Frontiers in Neurology, 13*.

Melillo, R., Leisman, G., Mualem, R., Ornai, A., & Carmeli, E. (2020). Persistent Childhood Primitive Reflex Reduction Effects on Cognitive, Sensorimotor, and Academic Performance in ADHD. *Frontiers in Public Health, 8*. https://doi.org/10.3389/fpubh.2020.431835

Merriam, S., & Tisdell, E. (2015). *Qualitative Research: A Guide to Design and Implementation* (4th ed.). Jossey Bass.

Ministry of Business Innovation & Employment. (2023). *Vision Mātauranga*. https://www.mbie.govt.nz/science-and-technology/science-and-innovation/agencies-policies-and-budget-initiatives/vision-matauranga-policy/

Ministry of Education–Te Tāhuhu o te Mātauranga. (2007). *The New Zealand Curriculum*. Learning Media Ltd. http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum

Ministry of Education. (2017). *Te Whāriki: He Whāriki Mātauranga mō ngā Mokopuna o Aotearoa Early Childhood Curriculum.* https://www.education.govt.nz/assets/Documents/Early-Childhood/Te-Whariki-Early-Childhood-Curriculum-ENG-Web.pdf

Ministry of Health. (2018). *Social, Emotional and Behavioural Difficulties in New Zealand Children: Technical Report*. https://www.health.govt.nz/system/files/documents/publications/social-emotional-behavioural-difficulties-nz-children-summary-findings-jun18-v2.pdf

Ministry of Health. (2022). *Foundation in Cultural Competence.* Ministry of Health. https://learnonline.health.nz/

Ministry of Health. (2023). *Health and Disability Ethics Committee*. Ministry of Health. https://ethics.health.govt.nz/

Moeke, M. (2020). Kaupapa Māori: Te Mauri o Māoritanga. In S. Probine & J. Perry (Eds.), *Provocations 2020* (pp. 37-54). Manukau Institute of Technology.

Mohajan, H. (2018). Qualitative Research Methodology in Social Sciences and Related Subjects. *Journal of Economic Development, Environment and People, 7*(1), 23-48. https://doi.org/10.26458/jedep.v7i1.571

Moher, D., Hopewell, S., Schulz, K., Montori, V., Gøtzsche, P., Devereaux, P., Elbourne, D., Egger, M., & Altman, D. (2010). CONSORT 2010 Explanation and Elaboration: Updated guidelines for reporting parallel group randomised trials. *Research Methods & Reporting*. https://doi.org/doi:10.1136/bmj.c869

Moore, C., Carter, R., Nietert, P., & Stewart, P. (2011). Recommendations for Planning Pilot Studies in Clinical and Translational Research. *Clinical and Translational Science, 4*(5), 332-337. https://doi.org/10.1111/j.1752-8062.2011.00347.x

National Association for Sport and Physical Education. (2009). *Appropriate practices in movement programs for children ages 3–5*. Human Kinetics, Inc.

National Ethics Advisory Committee. (2010). *Introduction to the Standards.* https://neac.health.govt.nz/national-ethical-standards/part-one/introduction-to-the-standards/

National Institute of Health. (n.d.). *Choosing Between Cluster and Individual Randomization.* https://rethinkingclinicaltrials.org/chapters/design/experimental-designs-and-randomization-schemes/choosing-between-cluster-and-individual-randomization/

New Zealand Government. (2023). *Health and physical education*. New Zealand Government. https://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum/Health-and-physical-education

Newman, L. (2014). *Social research methods: Qualitative and quantitative approaches* (7th ed.). Pearson Education Ltd.

Niklasson, M., Rasmussen, P., Niklasson, I., & Norlander, T. (2015). Adults with sensorimotor disorders: enhanced physiological and psychological development following specific sensorimotor training. *Frontiers in psychology, 6*, 480. https://doi.org/10.3389/fpsyg.2015.00480

Noble, H., & Heale, R. (2019). Triangulation in research, with examples. *Evidence Based Nursing, 22*(3), 67-68. https://doi.org/10.1136/ebnurs-2019-103145

Nowel, B., & Albrecht, K. (2019). A reviewer's Guide to Qualitative Rigor. *Journal of Public Administration Research and Theory 29*(2), 348–363. https://doi.org/10.1093/jopart/muy052

Olmos-Vega, F., Stalmeijer, R., Varpio, L., & Kahlke, R. (2023). A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Medical Teacher, 45*(3), 241-251. https://doi.org/10.1080/0142159X.2022.2057287

Onghena, P., Maes, B., & Heyvaert, M. (2019). Mixed methods single case research: State of t he art and future directions. *Journal of Mixed Methods Research*, 13(4), 461–480. https://doi.org/10.1177/1558689818789530

Orsmond, G., & Cohn, E. (2015). The Distinctive Features of a Feasibility Study: Objectives and Guiding Questions. *OTJR: Occupational Therapy Journal of Research, 35*(3), 169-177. https://doi.org/10.1177/1539449215578649

Park, Y., Conge, L., & Artino, A. R. (2020). The Positivism Paradigm of Research. *Academic Medicine 95*(5), 690-694. https://dx.doi.org/10.1097/ACM.0000000000003093

Paynard, C. (2023). *INPP Licensiates*. Integrated Learning. https://inppaustralia.com.au/index.php/inpp-licentiates/

Pecuch, A., Gieysztor, E., Telenga, M., Wolańska, E., Kowal, M., & Paprocka-Borowicz, M. (2020). Primitive Reflex Activity in Relation to the Sensory Profile in Healthy Preschool Children. *International Journal of Environmental Research and Public Health, 17*(21), 8210. https://doi.org/10.3390/ijerph17218210

Pecuch, A., Gieysztor, E., Wolańska, E., Telenga, M., & Paprocka-Borowicz, M. (2021). Primitive Reflex Activity in Relation to Motor Skills in Healthy Preschool Children. *Brain Sciences, 11*(8), 967. https://doi.org/10.3390/brainsci11080967

Preedy, P., Duncombe, R., & Gorely, T. (2022). Physical development in the early years: The impact of a daily movement programme on young children's physical development. *Education 3-13, 50*(3), 289-303. https://doi.org/10.1080/03004279.2020.1849345

Rider, B. (1972). Relationship of Postural Reflexes to Learning Disabilities. *American Journal of Occupational Therapy, 26*(5), 239-43.

Riethmuller, A., Jones, R., & Okely, A. (2009). Efficacy of Interventions to Improve Motor Development in Young Children: A Systematic Review. *Pediatrics, 124*(4), 782-792. https://doi.org/10.1542/peds.2009-0333

Romberg, M. (1853). *A manual of the nervous diseases of man*. Sydenham Society.

Sanson-Fisher, R., Campbell, E., Perkins, J., Blunden, S., & Davis, B. B. (2006). Indigenous health research: A critical review of outputs over time. *The Medical Journal of Australia 184*(10), 502-505. https://doi.org/10.5694/j.1326-5377.2006.tb00343.x

Santrock, J. (2014). *Child development* (14th ed.). McGraw-Hill Education.

Schrager, O. (1994). *Tonic postural reactions and language developments. Towards a neuropsychological model of dysphasic disorders.* Autonomous University of Madrid.

Seale, C., & Silverman, D. (1997). Ensuring rigour in qualitative research. *European rigour in qualitative research, 7*(4), 379-384. https://doi.org/10.1093/eurpub/7.4.379

Seedhouse, D. (2008). *Ethics the Heart of Healthcare* (3rd ed.). Wiley-Interscience.

Selvin, S. (2015). *A biostatistics toolbox for data analysis* (1st ed.). Cambridge University Press.

Seniloli, L. (2020). Reflexes and their relevance to education. *Early education, 66*, 79-84. https://eej.ac.nz/index.php/EEJ/issue/view/4

Shanyinde, M., Pickering, R., & Weatherall, M. (2011). Questions asked and answered in pilot and feasibility randomized controlled trials. *BMC Medical Research Methodology, 11,* 117. https://doi.org/10.1186/1471-2288-11-117

Sigafoos, J., Roche, L., O'Reilly, M., & Lancioni, G. (2021). Persistence of Primitive Reflexes in Developmental Disorders. *Current Developmental Disorders Reports,8* (Suppl 1). https://doi.org/10.1007/s40474-021-00232-2

Singh, A., Uijtdewilligen, L. O., Twisk, J., Van Mechelen, W., & Chinapaw, M. (2012). Physical Activity and Performance at School: A Systematic Review of the Literature including a Methodological Quality Assessment. *Archives of pediatrics & Adolescent Medicine, 166*(1), 49-55. https://doi.org/10.1001/archpediatrics.2011.716

Singh, J., Bandewar, S., & Bukusi, E. (2020). The impact of the COVID-19 pandemic response on other health research. *Bull World Health Organisation 98* 625-631. https://doi.org/10.2471/BLT.20.257485

Smith, L., Pihama, L., Cameron, Mataki, T., Morgan, H., & Te Nana, R. (2019). Thought space Wananga – A Kaupapa Maori decolonizing approach to research translation. *Genealogy, 3*(4), 74. https://doi.org/10.3390/genealogy3040074

Srinivasan, S., Amonkar, N., Kumavor, P., Morgan, K., & Bubela, D. (2023). Outcomes Associated with a Single Joystick-Operated Ride-on-Toy Navigation Training

Incorporated into a Constraint-Induced Movement Therapy Program: A Pilot Feasibility Study. *Behavioural Science, 13*(5), 413. https://doi.org/10.3390/bs13050413

Stahl, N., & King, J. (2020). Expanding Approaches for Research: Understanding and Using Trustworthiness in Qualitative Research. *Journal of Developmental Education 44*(1), 26-28.

Stats NZ. (2023). *2018 Census place summaries*. Stats NZ. https://www.stats.govt.nz/tools/2018-census-place-summaries/

Stephenson, J., Carter, M., & Wheldall, K. (2007). Still jumping on the balance beam: Continued use of perceptual motor programs in Australian schools. *Australian Journal of Education, 51*(1), 6-18. https://doi.org/10.1177/000494410705100102

Stevens, S. R., & Culpan, I. (2021). The joy of movement: The non-participant in physical education curriculum design. *Curriculum studies in Health and Physical Education*, *12*(2), 1-14. https:doi.org/10.1080/25742981.2021.1878918

Stone, L., Janssens, J., Vermulst, A., Van Der Maten, M., Engels, R., & Otten, R. (2015). The Strengths and Difficulties Questionnaire: Psychometric properties of the parent and teacher version in children aged 4–7. *BMC Psychology, 3*(4), 1-12. https://doi.org/10.1186/s40359-015-0061-8

Swingewood, A. (1984). *A Short History of Sociological Thought* (2 ed.). Red Globe Press London.

Taylor-Thompson, B., & Schoenfeld, D. (2007). Usual care as the Control Group in Clinical Trials of Nonpharmacologic Interventions. *Proceedings of the American Thoratic Society, 4*, 579-582.

Te Kete Ipurangi (TKI). (2014). *Health and physical education curriculum*. New Zealand Government. http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum/Health-and-physical-education/Achievement-objectives#collapsible1

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L., Robson, R., Thabane, M., Giangregorio, L., & Goldsmith, C. (2010). A tutorial on pilot studies: The what, why and

how. *BMC Medical Research Methodology, 10*(1), 1-10. https://doi.org/10.1186/1471-2288-10-1

Thomas, E., & Magilvy, J. (2011). Qualitative rigor or research validity in qualitative research. *Journal for Specialists in pediatric Nursing, 16*(2), 151-155. https://doi.org/10.1111/j.1744-6155.2011.00283.x

Tomporowski, P., Lambourne, K., & Okumura, M. (2011). Physical activity interventions and children's mental function: An introduction and overview. *Preventative Medicine, 52 (Suppl. 1)*, 3-9. https://doi.org/10.1016/j.ypmed.2011.01.028.

Tracy, S. (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry, 16*(10), 837-851. https://doi.org/10.1177/1077800410383121

Tran, N., Tran, M., Lopez, J., Woon, J., Nguyen, J., & Brecht, M. (2021). Impact of COVID-19 on Pediatric Clinical Research. *Journal of Pediatric Nursing, 61*, 240-244. https://doi.org./10.1016/j.pedn.2021.06.005

Trewin, D., & Pink, B. (2006). *Australian and New Zealand Standard Classification of Occupations*. https://www.abs.gov.au/statistics/classifications/anzsco-australian-and-new-zealand-standard-classification-occupations/latest-release

Van der Niet, A., Smith, J., Oosterlaan, J., Scherder, E., Hartman, E., & Visscher, C. (2016). Effects of a Cognitively Demanding Aerobic Intervention during recess on Children's Physical Fitness and Executive Functioning. *Pediatric Exercise Science, 28*(1), 64-70. https://doi.org/10.1123/pes.2015-0084

Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018). Characterising and justifying sample size sufficiency in interview-based studies: Systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology 18*(148), 1-18. https://doi.org/10.1186/s12874-018-0594-7

Veldman, S., Santos, R., Jones, R., Sousa-Sá, E., & Okely, A. (2019). Associations between gross motor skills and cognitive development in toddlers. *Early Human Development, 132*, 39-44. https://doi.org/10.1016/j.earlhumdev.2019.04.005

Vidoni, C., Lorenz, D., & Terson de Paleville, D. (2014). Incorporating a movement skill programme into a preschool daily schedule. *Early Child Development and Care, 184*(8), 1211-1222. https://doi.org/10.1080/03004430.2013.856895

Virameteekul, S., & Bhidayasiri, R. (2022). We Move or Are We Moved? Unpicking the Origins of Voluntary Movements to Better Understand Semivoluntary Movements. *Frontiers in Neurology, 13*. https://doi.org/10.3389/fneur.2022.834217

Vygotsky, L. (1926). *Educational Psychology*. St. Lucie Press.

Wahlberg, T., & Ireland, D. (2003). Can Replicating Primary Reflex Movements Improve Reading Ability? *Optometry Visual Development, 36*, 89-91.

Walker, W. (2005). The strengths and weaknesses of research designs involving quantitative measures. *Journal of Researching in Nursing, 10*(5), 1571-1582. https://doi.org/10.1177/136140960501000505

Walsh, R. (2003). The Methods of Reflexivity. *Humanist Psychology, 31*(4), 51-66. https://doi.org/10.1080/08873267.2003.9986934

Warnick, E. M., Bracken, M. B., & Stanislav, K. (2008). Screening efficiency of the Child Behavior Checklist and Strengths and Difficulties Questionnaire: A systematic review. *Child and Adolescent Mental Health, 13*(3), 140-147. https://doi.org/ 10.1111/j.1475-3588.2007.00461.x

Williams, J., & Holmes, C. (2004). Improving the early detection of children with subtle developmental problems. *Journal of Child Health Care, 8*(1), 34-46. https://doi.org/10.1177/1367493504041852

World Health Organization. (2020). *Ethics and Health*. https://www.who.int/activities/ensuring-ethical-standards-and-procedures-for-research-with-human-beings

Youth in Mind. (2016). *SDQ: Information for researchers and professionals about the Strengths & Difficulties Questionnaires.* Youth in Mind. https://www.sdqinfo.org/

Zielińska, M., & Goddard Blythe, S. (2020). School functioning of students with neuromotor immaturity. *International Journal of Pedagogy Innovation and New Technologies, 7*(2), 40-46. https://doi.org/10.5604/01.3001.0014.6864

Appendices

Appendix A

Health and Disability Ethics Committee Approval

(HDEC reference: 11628)

Health and Disability Ethics Committees
Ministry of Health
133 Molesworth Street
PO Box 5013
Wellington
6011
hdecs@health.govt.nz

Ethics reference: 2022 FULL 11628
30 March 2022
Associate Professor Kelly Jones
90 Akoranga Drive
Northcote
Auckland
1142
New Zealand

Tēnā koe Associate Professor Jones

APPROVAL OF APPLICATION

Study title: Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

I am pleased to advise that your application was approved by the Southern Health and Disability Ethics Committee (the Committee) with non-standard conditions. This decision was made through the FULL pathway.

Summary of outstanding ethical issues

The main ethical issues considered by the Committee which require addressing by the Researcher are as follows.

1. The Committee queried why the video is being saved for 10 years if it is meant for quality checking. The Committee suggested the Researchers delete the videos once it has been used for that purpose.
2. The Committee noted that the Child information has a lot of text for a 4-year-old. Please simplify further.
3. Please check all documentation for typos.

Conditions of HDEC approval HDEC approval for this study is subject to the following conditions being met prior to the commencement of the study in New Zealand. It is your responsibility, and that of the study's sponsor, to ensure that these conditions are met. No further review by the Southern Health and Disability Ethics Committee is required.

Standard conditions:

- Before the study commences at any locality in New Zealand, all relevant regulatory approvals must be obtained.
- Before the study commences at each given locality in New Zealand, it must be authorised by that locality in Ethics RM. Locality authorisation confirms that the locality is

suitable for the safe and effective conduct of the study, and that local research governance issues have been addressed.

Non-standard conditions:

- please address all outstanding ethical issues raised by the Committee.

Non-standard conditions must be completed before commencing your study; however, they do not need to be submitted to or reviewed by HDECs.

If you would like an acknowledgement of completion of your non-standard conditions you may submit a post approval form amendment through the Ethics Review Manager. Please clearly identify in the amendment form that the changes relate to non-standard conditions and ensure that supporting documents (if requested) are tracked/highlighted with changes.

For information on non-standard conditions please see paragraphs 125 and 126 of the Standard Operating Procedures for Health and Disability Ethics Committees (SOPs).

After HDEC review

Please refer to the SOPs for HDEC requirements relating to amendments and other post-approval processes.

Your next progress report is due by 30 March 2023

Participant access to compensation

The Southern Health and Disability Ethics Committee is satisfied that your study is not a clinical trial that is to be conducted principally for the benefit of the manufacturer or distributor of the medicine or item being trialled. Participants injured as a result of treatment received as part of your study may therefore be eligible for publicly funded compensation through the Accident Compensation Corporation.

Further information and assistance

Please contact the HDECs Secretariat at hdecs@health.govt.nz or visit our website at www.ethics.health.govt.nz for more information, as well as our General FAQ and Ethics RM user manual.

Nāku noa, nā

Mr Anthony Fallon

Chair

Southern Health and Disability Ethics Committee

Encl: Appendix A: documents submitted

Appendix B: statement of compliance and list of members

Appendix B

Permission from Sally Goddard Blythe for use of Figure 1

Image

From Leanne Seniloli <leanne@withoutlimitslearning.com>
To Sally Blythe <Sally.blythe@inpp.org.uk>
Date 2023-11-30 21:22

Good morning Sally,
I hope you are well.

I am writing to ask for your permission to reproduce the attached image, found in your 2005 version of Reflexes, Learning and Behavior, in my thesis.
As my thesis is on the feasibility and acceptability of a reflex remediation programme in preschools this will help to explain the developmental process of reflex integration.
I have extensively referenced your work, and will do so also, for this image if permission is granted.

Thank you for your consideration.
Sincerely
Leanne Seniloli

RE: Image

From Sally Blythe <sally.blythe@inpp.org.uk>
To 'Leanne Seniloli' <leanne@withoutlimitslearning.com>
Date 2023-12-01 08:32

Dear Leanne

How nice to hear from you.

Yes, provided the reference source is provided you can use the image.

Please do share your results with us when they are complete and you are able to do so.

In the meantime, slightly early wishes for a very Happy Christmas,

Sally

INPP Ltd
sally.blythe@inpp.org.uk
07355 048 846
For correspondence address contact mail@inpp.org.uk
www.inpp.org.uk

RE: Image

From Leanne Seniloli <leanne@withoutlimitslearning.com>
To Sally Blythe <sally.blythe@inpp.org.uk>
Date 2023-12-01 08:49

Dear Sally,

Thank you for your gracious permission.

It is my pleasure to share the results when they are ready. I am honoured to be apart of this research community.

Many thanks also, for your tireless work in this area over decades, that has paved the way for new researchers and practitioners like me.

Merry Christmas,
Leanne

Appendix C

Early Childhood Centre – Consent Form

Permission for researchers to access early childhood centre staff / children.

Project title: **Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study**.

Project Supervisor: ***Dr Kelly Jones***

Researcher: ***Leanne Seniloli***

Please read the attached service provider information sheet about the study. This will tell you about why we are doing the study and what will be involved. I have read and understood the information provided about this research project in the Information Sheet dated 15 November 2021.

- I have read and understood the information provided about this research project in the Information Sheet.
- I give permission for the researcher to undertake research within this early childhood centre
- I give permission for the researcher to access the staff / students / employees of this centre
- I commit to a minimum two of our teachers being involved in the delivery of the Moves4LilMinds programme and the general exercise programme at our centre over a minimum period of 12-weeks

On behalf of the early childhood centre, I am authorised to agree with the statements above and agree to take part.

Yes **(Please circle)**

Manager's / Owner's signature: …...................................………..………………………………..

Manager's / Owner's Name: ....………………..……………………………………….

Manager's/Owner's Early Childhood Centre :

…………………………………………………………………………….………………………..

Date: ………………………………………………………………….

Approved by the Southern Health and Disability Ethics Committee on 30 March 2022 Reference: 2022 FULL 11628

Note: The head of the organisation should retain a copy of this form.

Appendix D

Parent Consent Form

Parent/Guardian Consent Form

Study title:	Accessibility and Feasibility of Moves4LilMinds Movement Programme	
Lead investigator:	Dr. Kelly Jones	Contact Phone: 021 246 0587
Locality:	Auckland	
Ethics committee:	Southern Health and Disability Ethics Committee 2022 FULL 11628	

Please tick to indicate you consent to the following		
I have read, or have had read to me, and I understand the Parent/Guardian Information Sheet.		
I have been given sufficient time to consider whether or not to participate in this study.		
I have had the opportunity to use a legal representative, whānau/ family support or a friend to help me ask questions and understand the study.		
I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.		
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without this affecting my child and their attendance at centre.		
I consent to the research staff collecting and processing my personal information, including information about my child.	Yes ☐	
I agree to an approved auditor appointed by the New Zealand Health and Disability Ethic Committees, or any relevant regulatory authority or their approved representative reviewing my information for the sole purpose of checking the accuracy of the information recorded for the study.		
I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.		
I understand that I can request a copy of my individual survey responses.		
I understand my responsibilities as a study participant.		
If I decide to withdraw from the study, I agree that the information collected about me up to the point when I withdraw will continue to be processed.		
I wish to receive a summary of the findings from the study.	Yes ☐	No ☐

Declaration by participant:

I hereby consent to take part in this study.

Participant’s name:

Signature: Date:

Declaration by member of research team:

I have given a verbal explanation of the research project to the participant and have answered the participant’s questions about it.

I believe that the participant understands the study and has given informed consent to participate.

Researcher’s name:

Signature: Date:

Appendix E

Child Assent Form

Assent Form (for children aged 4 years old)

Study title (lay):	Moves4LilMinds in New Zealand
Lead investigator:	Dr. Kelly Jones Contact phone number: 021 246 0587
Locality:	Auckland
Ethics committee:	Southern Health and Disability Ethics Committee 2022 FULL 11628

Child's Name: ____

(Full Name in BLOCK CAPITALS)

Year of Birth: ____________________

Please colour the word you agree with:

Has someone read this form to you?

YES NO

Has someone told you about what will happen if you join in?

YES NO

Have you asked all your questions?

YES NO

Would you like to join in?

YES NO

If any answers are **"no"** or you **don't** want to take part, **don't** colour in 'yes'.

Statement of Person Obtaining Informed Assent

I, the undersigned, have fully explained the details of this research study to the participant named above.

____

Name of Person Conducting Assent Discussion (Print)

____

Signature of Person Conducting Assent Discussion Date

Appendix F

Study Information Poster

Moves4LilMinds Research Project

AUT

PARTICIPANTS NEEDED

We are currently recruiting:

- Parents of children aged 4 years old who regularly attend an early childhood service.
- Your child will be participating in a 12-week movement programme for children.
- You will be involved in giving feedback on your child's progress and the movement programme.
- We would like to learn what you think about the Moves4LilMinds programme.
- The study will tell us if programmes like this are helpful and if other studies can be done.
- Each participating family will be given a $20 food/fuel voucher in appreciation of their time.

To find out if you are eligible to take part contact Leanne Seniloli
Email: fvs8746@aut.ac.nz
Text or Phone: 0210584202

HDEC Reference #:
2022 FULL 11628

Appendix G

M4LM Quality Control Form

Reviewer: ___________

Date: _____________

The seven-point scale (i.e. a 0-6 Likert scale) extends from (0) where the teacher did not adhere to that aspect of programme (non-adherence) to (6) where there is adherence and very high skill. Thus, the scale assesses both adherence to therapy method and skill of the teacher. To aid with the rating of items of the scale, an outline of the key features of each item is provided at the top of each section. The descriptive features on the right are designed to guide your decision.

Competence level		Examples
Incompetent	0	absence of feature, or highly inappropriate performance
Novice	1	Inappropriate performance, with major problems evident
Advanced beginner	2	evidence of competence, but numerous problems and lack of cor
Competent	3	competent, but some problems and/or inconsistencies
Proficient	4	good features, but minor problems and/or inconsistencies
Expert	5	very good features, minimal problems and/or inconsistencies
	6	excellent performance, or very good even in the face of child difficulties

Please note that the top marks (i.e. near the 'expert' end of the continuum) are reserved for those teachers demonstrating highly effective skills, particularly in the face of difficulties (i.e. highly aggressive or avoidant children; high levels of emotional discharge from the children; and various situational factors).

The 'Key Features' describe the important features that need to be considered when scoring each item. When rating the item, you must first identify whether some of the features are present. You must then consider whether the teacher should be regarded as competent with the features. If the teacher includes most of the key features and uses them appropriately (i.e. misses few relevant opportunities to use them), the teacher should be rated very highly.

ITEM 1 - FEEDBACK

Key features: The children's and teacher's understanding of how to do the movement should be supported through the use of feedback from the teacher to the children. The use of appropriate feedback helps the children understand what they are doing correctly and what they need to change. Three features need to be considered when scoring this item:

- presence and frequency, or absence, of feedback. Feedback should be given/elicited throughout the movements.
- appropriateness of the contents of the feedback;
- manner of its delivery and elicitation (NB: is the feedback encouraging and positive)

Competence level (circle one)	Examples
0	Absence of feedback or highly inappropriate feedback.
1	Minimal appropriate feedback.
2	Appropriate feedback, but not given frequently enough by teacher.
3	Appropriate feedback given frequently, although some difficulties evident in terms of content or method of delivery.
4	Appropriate feedback given frequently, facilitating gains. Minor problems evident (e.g. Inconsistent).
5	Highly appropriate feedback given, facilitating shared understanding and enabling significant gains. Minimal
6	Excellent use of feedback, or highly effective feedback given regularly in the face of difficulties.

Comments from reviewer:

ITEM 2 – ADHERENCE TO PROGRAMME

Key features: Teacher skilfully adheres to the video programme and completes the three exercises in order as instructed. The teacher helps children work through the programme in a structured way, with some flexibility to tailor the programme to centre's needs. Three features need to be considered:

- the extent to which session content aligns with the prescribed content for the relevant programme;
- the skill of the teacher in keeping sessions closely aligned to the video programme;
- the suitability of the approach to programme adherence for the needs of the group (i.e. neither too dismissive of other content nor too responsive).

Competence Level (circle one)	**Examples**
0	No evidence that session content aligns with the prescribed content for the programme.
1	Teacher applies either insufficient or inappropriate methods, and/or with limited skill or flexibility.
2	Evidence of competent teacher. Some evidence that session content aligns with the prescribed content but lacks consistency.
3	Competent teacher. Evidence of session content aligning to prescribed content but some problems.
4	Teacher is skilled in aligning session and content to prescribed content, minimal problems and/or inconsistencies.
5	Teacher systematically applies an appropriate range of methods in a creative, resourceful and effective manner. Minimal problems.
6	Excellent performance. Skilled alignment of session content with the prescribed content, using a suitable approach even in the face of difficulties.

Comments from reviewer:

Appendix H

Teacher Semi-Structured Interview Questions

Follow Up Semi Structured Interview for Teachers

Registration number: | | | | | | | | |

YOB: | | | | |

Each new assessment must be reported on a separate form

OFFICE COMPLETION ONLY

Mode of Delivery	In-Person	Online	Phone/remote
Date entered into REDCap database (dd/mm/yy)		Researcher signature	
Date checked (dd/mm/yy)		Researcher signature	

Teacher Semi-Structured Interview Questions

Research Title: Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

The purpose of this interview is to find out about your experiences of the Moves4LilMinds programme over a 10-week period. We would like to hear about your experiences/thoughts and any suggestions about the programme that would be important to consider for using the programme in the future.

1. “What did you find most helpful about the programme?”

2. “What did you find least helpful about the programme?”

3. “What suggestions do you have for improving the programme?”

4. “Are there any benefits you have seen?”

5. “Are there any barriers you have come across to implementing the programme?”

6. “How did you deliver the Moves4LilMinds programme? (When, where how)

7. “How often did you implement the programme? i.e., the number of sessions per
8. week”

9. “What types of benefits do you feel the programme may offer participating children?”

10. “Is there anything else you would like to share with us about your experiences of the programme?”

11. “Is this programme culturally appropriate for you and your tamariki whānau?”

Appendix I

Parent Semi-Structured Interview Questions

Follow Up Semi-Structured Interview for Parents/Guardians

Registration number: | | | | | | | |

YOB: | | | | |

Each new assessment must be reported on a separate Form

OFFICE COMPLETION ONLY

Mode of Delivery	In-Person	Online	Phone/Remote
Date entered into REDCap database (dd/mm/yy)		Researcher signature	
Date checked (dd/mm/yy)		Researcher signature	

Parent/ Guardian Semi-Structured Interview Questions

Research Title: Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

The purpose of this interview is to find out about your experiences of your child taking part in the Moves4LilMinds programme over a 12-week period. We would like to hear about your experiences/thoughts and any suggestions about the programme that would be important to consider for using the programme in the future.

1. "What did you find most helpful about the programme?"
2. "What did you find least helpful about the programme?"
3. "What suggestions do you have for improving the programme?"
4. "Are there any benefits you have seen?"
5. "Is there anything else you would like to share with us about your experiences of the programme?"
6. "Is this programme culturally appropriate for you and your whānau?"

Appendix J

Ministry of Health Cultural Competence Certification

CERTIFICATE of ACHIEVEMENT

This is to certify that

Leanne Seniloli

has completed the course

Foundations in Cultural Competency (2016)

June 13, 2022

LearnOnline

MINISTRY OF HEALTH

Appendix K

Māori Consultation

Consultation with Mary Moeke regarding the research:

Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

From: Mary moeke
Sent: Wednesday, 14 July 2021 12:21 pm
To: Leanne Seniloli <leanne.seniloli@manukau.ac.nz>
Subject: Re: Notes from discussion

Tēnā koe a Leanne,

Ngā mihi atu ki a koe - thank you for seeking my help and support with your research project. As you are aware I am currently in my 5th year of completing a Doctoral thesis through Te Whare Wānanga o Awanuiārangi - Whakatāne. My research topic is Mātau Ahumoni: A prosperity algorithm for success: Igniting the hearts and minds of Mokopuna Māori: No more growing up poor in Aotearoa New Zealand.

This means that I have a signed ethics approval letter which has allowed me the honour of learning and engaging with many research participants who identify as Māori. In saying this, the mātauranga I was able to share with you comes from the process and application of what I had used in practice that has worked well for me. Therefore, I do encourage you to seek additional support where needed.

In the meantime, I have read the content of the attachment here and do agree that it is an outline of what we have discussed but would like to add in 'triggers'. From a kaupapa Māori and indigenous research lens it is important that you, the researcher have a backup plan and prepare for 'triggers' that may arise throughout any part of the consultation process.

Along with other kaupapa, Māori research academics, I would strongly say that it would benefit you to have a list of contact organisations, services, people, and direct phone numbers to offer the research participant he/she is of Māori or indigenous descent just in case some 'urgent or unforeseen' intervention is needed. And that you have someone who is of Māori descent present with you in the room if it is asked for. In this case, feel free to count me. I am happy to come out to the centre for this purpose upon request. It could also be a friend or someone that you know that could be present in the room during the 'contact'....

Aside from this, I believe your notes to have summarised well what we have discussed and talked about in terms of tikanga practices involving Māori as research participants from a mainstream early childhood lens.

If you have any other questions or would like further clarification, please contact me on XXX.

Mere Moeke-Te Purei | Kaiārahi Indigenised Kaupapa Māori Lecturer - MIT Otara Campus

NR309, North Campus, Gate 14, Alexander Crescent, MIT Otara Campus, Private Bag 94006 | Manukau, Auckland 2241

p: +64 9 976 0555 | e: mary.moeke@manukau.ac.nz | m: 021 260335 | w: www.manukau.ac.nz

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From: Leanne Seniloli <leanne.seniloli@manukau.ac.nz>
Sent: Wednesday, 14 July 2021 11:13 AM
To: Mary moeke Moeke <mary.moeke@manukau.ac.nz>
Subject: Notes from discussion

Tena koe Mary,

Attached are the notes from our korero today. Thanks so much for your time and wisdom, and helping me to define culturally appropriate and respectful practices. I appreciate it.

Please can you read through and confirm by email that this is what we discussed. Feel free to add anything I have missed also.

Discussion with Mere Moeke 14 July 2021

I briefly outlined my research project for Mary and ask for her consultation and advice regarding engaging Mãori children and whanau. This was her feedback:

- It is important that I know the Iwi, Whanau and Hapu of the families. Do research on the children in the centre and where they are from so that the whanau feel comfortable. For example some iwi are more formal and their tikanga is particular to their Iwi. This will assist in building relationships when I know who the participant is.
- Leave time in the schedule for relationship building. Organise a few hui's so that whanau can get to know me and the research. Do not rush this process.
- Have documents to show the whanau. More than information sheets with words. To support the understanding of the research use diagrams and pictures of the work. More pictures than words.
- I must not assume participants are fluent in te reo Mãori and tikanga. Use English first especially if the family and child are in mainstream early childhood centres.
- In regard to a koha it is best to give a gift rather than a voucher. Especially a gift where the mauri is attached, reminding them of the time and reasons for the gift. Try to make this relate to the research, a taonga with meaning and purpose.
- Meet the whanau in the centre rather than at their home as that is a personal space.
- Invite the whanau into the centre to observe when I am undertaking the assessments.
- Make sure I inform whanau that video and/or photos will be taken. Have a clear justification and aroha to reassure whanau that what I need to do is good for the family. Be confident and sure of my processes and they will trust my authenticity.
- When appropriate begin with karakia with parent and child, create a positive space and good aura.
- Give whanau an option and choice before beginning "Is there anything you would like me to do before we start?" Examples may be a different room, time for them to share, water, etc
- Along with personal information also ask about medical history before I start to gain a full picture of the child.

Ngā Mihi Nui

Leanne Seniloli

Senior Lecturer/Neuro Developmental EducatorSchool of Arts and Education | Manukau Institute of Technology
p: **09 9760683** | e: leanne.seniloli@manukau.ac.nz |

Appendix L

Pacifica Consultation

Consultation with Lila Tekene regarding the research:

Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

From: Leanne Seniloli <leanne.seniloli@manukau.ac.nz>
Sent: 26 August 2021 20:09
To: Lila Tekene <Lila.Tekene@manukau.ac.nz>
Subject: Re: Today's discussion

Thank you so much for your quick and responsive feedback, take care.

Ngā Mihi Nui

Leanne Seniloli

From: Lila Tekene <Lila.Tekene@manukau.ac.nz>
Sent: 26 August 2021 19:42
To: Leanne Seniloli <leanne.seniloli@manukau.ac.nz>
Subject: Re: Today's discussion

Talofa Leanne:
Thank you for consulting with me about your research. What you have written down is exactly what I shared with you. However, the word Saa is not spelled correctly. Tapu in Maori but Sa in Samoa.

Otherwise, overall talanoa is well documented.

Good luck on your research!

Take care and stay safe,
Lila

From: Leanne Seniloli <leanne.seniloli@manukau.ac.nz>
Sent: Thursday, August 26, 2021 5:26 PM
To: Lila Tekene <Lila.Tekene@manukau.ac.nz>
Subject: Today's discussion

Thank you, Lila, for your time today to help inform my future research. Here is a summary of the discussion we had. Please add anything I have left out, or change if it is incorrect, or confirm that this is accurate of our discussion. Once again thank you for your input.

Discussion with Lila Tekene regarding the research:

Determining the feasibility and acceptability of the Moves4LilMinds movement programme in the New Zealand context: a randomised pilot study.

- Pacifika people embrace concept of reciprocity, when doing research with pacific people it is important to establish give and take. Be generous and giving in my interactions, words and gifts.

- Establishing relationship is of the highest importance with Pacific people. To do this, when I go out and visit them it is best if I am giving. A simple act of giving juice and biscuits if I meet with them, or offering food at a fono is showing respect and hospitality. Pacific people want to see that the relationship goes both ways. The act of giving is a way to build the relationships.

- Relationships should also begin with the centre. I need to meet with the manger and staff of the centre frequently to explain the research and establish a strong relationship. From here the centre will reach out to parents and use their relationship as an avenue to introduce me and my research. 1 – 2 faces to face meetings should be held to fully explain the research.

- A firm warning that without relationships with the centres and parents it will be hard to get answers and consent. However, through relationship when I ask questions the responses will be immediate.

- Lila is happy to introduce me to her networks and bi-lingual if needed

- After relationships are established, then ask for permission to touch the children physically. The Samoan perspectives of tapu or Saa mean that it is forbidden however it is not as forced in the Samoan context as the Māori. It is important to get consent. I need to explain exactly what I will be doing and invite the parent to be present if they want.

- The best way to meet is face to face – technology can be barrier.

- Clearly explain benefits of the research to the centre, families and children. Show that their voice is heard and important in this process.

- Young NZ born parents understand the importance of brain development and are usually likely to want to participate and inform research.

- No verbal translation is needed if it is held in a general mixed ethnicity centre. This would be different in a full immersion centre.

Fa'afetai tele lava, Ngā Mihi Nui

Leanne Seniloli

Senior Lecturer/Neuro Developmental Educator

School of Arts and Education | Otara North Campus
Manukau Institute of Technology
p: **09 9760683** | e: leanne.seniloli@manukau.ac.nz |

Appendix M

Permission from Carol Bugge for use of Figure 6

A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse

Leanne Seniloli <leanne.seniloli@autuni.ac.nz>
Tue 23/01/2024 3:44 PM
To: carol.bugge@stir.ac.uk <carol.bugge@stir.ac.uk>
Cc: Kelly Jones <kelly.jones@aut.ac.nz>

Dear Carol,

My name is Leanne and I am a neurodevelopmental therapist, lecturer in early childhood education and student at Auckland University of Technology in New Zealand. My study is called 'Determining the Feasibility and Acceptability of the Moves4LilMinds Programme in the New Zealand Context: A Randomised Pilot Study'. I am due to submit my thesis this week for examination for a qualification in Master of Philosophy.

I have been referencing your above article published in 2013 and your ADePT model, as way of identifying my feasibility trial problems and solutions. I would like to ask permission to please use your below image in my thesis (clearly referenced with permission). I believe this would not only strengthen my work but would also continue to exemplify this model as a standardised process for researchers.

I have included in this email a link to my profiles if you are needing more information on me, and also have CC'd my supervisor - Associate Professor Kelly Jones in case you are wanting more verification about this study.

I thank you for your consideration of this request and hope to hear from you soon,

Kind regards

Leanne Seniloli
www.withoutlimitslearning.com
https://www.facebook.com/WithoutLimitsLearning
https://www.linkedin.com/in/leanne-seniloli/

Image I would like to reproduce with permission and referencing.

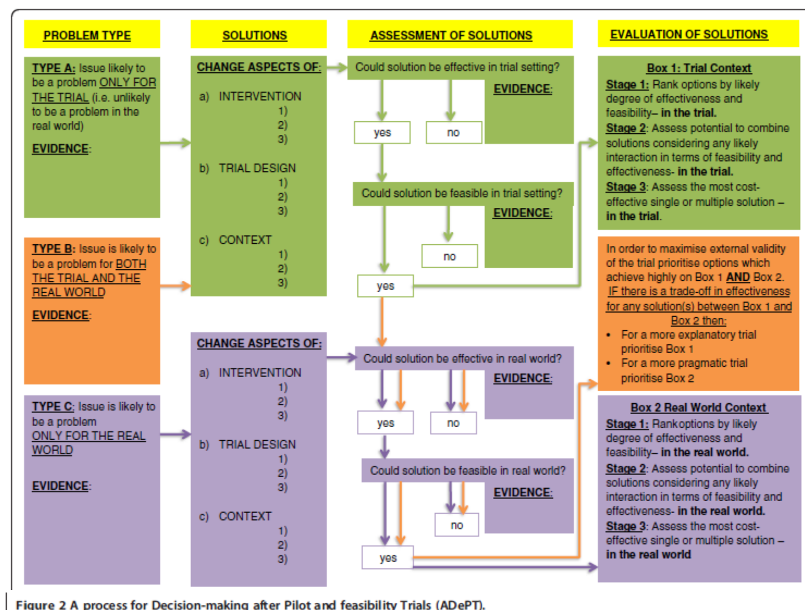

Figure 2 A process for Decision-making after Pilot and feasibility Trials (ADePT).

RE: A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse

Bugge, Carol <Carol.Bugge@gcu.ac.uk>
Wed 24/01/2024 8:20 AM
To: Leanne Seniloli <leanne.seniloli@autuni.ac.nz>
Cc: Kelly Jones <kelly.jones@aut.ac.nz>

Hi Leanne

Thanks for you message and your interest in our work.

I confirm that I am personally happy for you to reproduce this image within your thesis. However, I am not sure if the journal requires to give any permissions (it may not as an open access journal). I would simply ask you to check with the journal and assuming that they have no problem then I am happy for you to reproduce.

Very best wishes with your thesis.

Carol

Professor Carol Bugge
Professor of Nursing
Glasgow Caledonian University
Carol.Bugge@gcu.ac.uk
@CarolBugge
0141 331 8796

I am sending this email now because it is convenient to me. Please only respond to this message at a time that is convenient for you. Please do not feel obliged to respond to my emails outside your working hours.

I will endeavour to reply to all emails within 2 working days unless my out of office says otherwise

Research Centre for Health (ReaCH)
Email: reach@gcu.ac.uk | Website: www.gcu.ac.uk/reach | Twitter: @GCUReaCH

Re: A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse

Leanne Seniloli <leanne.seniloli@autuni.ac.nz>
Wed 24/01/2024 9:23 AM
To: Bugge, Carol <Carol.Bugge@gcu.ac.uk>
Cc: Kelly Jones <kelly.jones@aut.ac.nz>

Hello Carol,
Thank you for your quick response.
I have sourced this link from the journal, and as your article is open access then permission is granted as long as the figure is correctly referenced.
You can see more here:
https://support.biomedcentral.com/en/support/solutions/articles/6000217050-use-of-an-open-access-figure-or-table

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>
> support.biomedcentral.com

Many thanks for your support,
Leanne

Re: A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse

Kelly Jones <kelly.jones@aut.ac.nz>
Wed 24/01/2024 9:31 AM
To: Leanne Seniloli <leanne.seniloli@autuni.ac.nz>; Bugge, Carol <Carol.Bugge@gcu.ac.uk>

Well done Leanne and many thanks for your support, Carol.

Much appreciated,

Ngaa mihi,

Kelly

Kelly Jones
Associate Professor / Ahorangi Tuarua
National Institute for Stroke and Applied Neurosciences
School of Clinical Sciences
Auckland University of Technology
Pronouns: She / Her

Phone/Waea 07 838 4257 Mobile/Waea puukoro 021 246 0587 Twitter @kellyjonesNZ

RE: A process for Decision-making after Pilot and feasibility Trials (ADePT): development following a feasibility study of a complex intervention for pelvic organ prolapse

Bugge, Carol <Carol.Bugge@gcu.ac.uk>
Wed 24/01/2024 9:54 PM
To: Kelly Jones <kelly.jones@aut.ac.nz>; Leanne Seniloli <leanne.seniloli@autuni.ac.nz>

Great – all sorted.
Would be great to hear about how you have used the model, maybe you could let me know when you publish.
Best wishes
Carol