# Investigating a Nonlinear Pedagogy Approach to Primary School Physical Education

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# Abstract

The development of children's movement skill competence (MSC) has often been limited by the use of traditional teaching approaches to teaching that prescribe predetermined paths for learning. For example, linear pedagogical approaches in physical education (PE) settings have been characterised by teachers prescribing ideal movement models for children to aspire to replicate in highly structured and decontextualised environments. In an attempt to better understand and support the development of children's MSCs, recent research has adopted nonlinear pedagogical (NP) approaches that capture the inextricable relationship between the individual child and the movement environment. At present, research pertaining specifically to the impact of NP approaches upon children in primary school settings is limited.

Focused on the development of adopting an NP approach to PE in a primary school setting, the research reported in this thesis was underpinned by a pragmatic philosophical position. Through a mixed methods research approach, this project sought to capture change in children's MSC and better understand the experiences of adopting an NP approach to PE in primary school setting through the voices of the principal, teachers, and children.

Study one investigated the impact of an NP approach to PE upon children's MSCs after a nine-week intervention and a 13-week follow-up. The results showed a significant improvement in children's MSC following the intervention, which contributes new evidence to the impact of NP approaches to PE in primary school settings. Moreover, a significant between-group difference in MSC was reported at the 13-week retention test timepoint, in favour of an NP approach to PE compared with a linear pedagogical approach.

Study two sought to capture the experiences of a principal, teachers, and children of a school adopting an NP approach to PE. These perspectives revealed multiple interlinked themes being identified for the principal (i.e., need for change, empowering teachers and children, influences of teacher on children's experiences of PE), teachers (i.e., seeing children as individual learners, empowering children, teaching PE the way we were taught), and children (i.e., achievement, ownership, the role of the teacher). Notably, the findings of study two contributed to developing a better understanding of the findings of study one, and ultimately a greater understanding of the research question of this thesis.

This thesis concludes with the sharing of insights from me as a movement scientist embedded in situ in a primary school setting for four years and the real-world practical applications of an NP approach to PE as planned and practiced by teachers at the study school.

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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.

**Daniel M. Cooke** **08.02.2022**

Signature Date

## Co-authored Works

This thesis contains co-authored articles submitted to peer review journals:

Chapter Five: Cooke, D. M., Harrison, C., Millar, S. K., and Walters, S. The impact of a nonlinear pedagogical approach to primary school physical education upon children's movement skill competence. [*Article submitted to the Journal of Teaching in Physical Education and accepted subject to minor revisions.*]

Daniel Cooke 80%

Craig Harrison 10%

Sarah Kate Millar 7.5%

Simon Walters 2.5%

Chapter Six: Cooke, D. M., Harrison, C., Millar, S. K., and Walters, S. A nonlinear pedagogical approach to primary school physical education: A case study. [*Article submitted to the Journal of Teaching in Physical Education and accepted subject to minor revisions.*]

Daniel Cooke 80%

Craig Harrison 10%

Sarah Kate Millar 5%

Simon Walters 5%

# Acknowledgements

Firstly, I would like to thank my family and friends for supporting me on another journey, this time a PhD project in New Zealand from imagination to end product.

Next, to my supervisory team, I'm not easy to manage, but you did it, congratulations! Seriously, thank you for helping me grow personally and professionally.

To the participating school, children, teachers, families, leadership team, Board of Trustees, thank you! I arrived at the school to positively impact movement experiences, and I hope I achieved this; I leave a better person thanks to the daily interactions with all of you.

Lastly, to anyone who reads this thesis, let's take action now and help children to fall in love with movement. Our collective action is essential for our young people now and communities of the future. Let's continue to "plant trees under whose shade we will never sit."

# Ethics Approval

This research was approved by Auckland University of Technology Ethics Committee, as follows:

Study one (19/234): Accepted 08/10/2019 (Appendix A)

Study two (19/399): Accepted 25/11/2019 (Appendix J)

# Chapter 1: Scene Setting

## Personal Background

I was born and raised in England. I grew up in Buckland Monachorum, a countryside village with a population of 1,000 people, approximately 10-miles from the city of Plymouth in the South-West of England. Buckland Monachorum is best known for being a historic village located in Dartmoor National Park, and near to Buckland Abbey, the home of Sir Francis Drake. Like the majority of local people, I have a white British ethnic background.

With limited access to community entertainment facilities and public transportation, my childhood was mostly spent exploring the village and its surroundings with other children. Our explorations involved swimming and cliff jumping at the local river, riding mountain bikes, climbing trees, rope swinging, playing street games (curby, hide and seek, water fights), skateboarding, and scootering. Groups of mixed age children would gather often to play unstructured versions of football, basketball, rugby, and cricket. Like many other English children, my passion and dream was to play football, so most of the time we played football. This passion also involved travelling to a nearby village to play for a community team, Horrabridge Rangers, from the age of five.

I was deeply affected by a love of movement throughout my childhood. Living a 40-minute drive to Plymouth meant we had limited access to sporting facilities, equipment, and coaches. A gripe at the time, I now reflect on the remoteness, natural wilderness, and lack of imposed structure as a potent combination of conditions supportive of learning through exploration, discovery, and adaptation, especially for a deeply curious and hyperactive kid like me.

My early school years (5-11) were spent alongside 150 other children at Buckland Monachorum Primary. Just a 5-minute walk from my door, the school was

rated as ‘outstanding’ by Ofsted (UK Government office for standards in education, children’s services, and skills). It consisted of almost all pupils of White British heritage and served a high socio-economic community. When I reflect on my movement experiences in school it makes me smile. Physical education provided me an opportunity to stand out. I was a skilled, successfull performer and received praise from my parents, teachers and peers. Despite my fond memories of PE, I know my experiences were not shared by all the children in my class. For example, during games of rounders, while I shined, other kids moved with inefficiencies, struggled to throw, dropped catches and missed strikes. Such experiences may have negatively impacted their participation in PE at the time and PA later in life. Years later, I look back on my early movement experiences as critical moments in my life. Without them, I don’t think I would have ever forged the positive relationship I now have with movement.

My positive movement-related experiences during my early school years undoubtedly laid a foundation for me to continue to play a variety of sports competitively throughout my later school years (12-18) and into early adulthood. My desire to get better at sports drove my exploration of training methods to improvement performance, ultimately leading me to undertake a sports coaching degree. It was at this time I began to explore coaching opportunities such as undertaking my English Football Association Level 2 qualification and going into schools as part of the university Futsal club to coach primary and secondary school children. These experiences were formative to nurturing my love for movement that began to shift from a playing role to also a coaching role.

My curiosity and desire to support more children to thrive through movement led me on a coaching journey my entire adult life, mostly supporting youth sporting populations. This PhD opportunity within a primary school PE setting excited me as I could support a broader range of children to fall in love with movement. It is without

doubt that my personal experiences are inextricably linked with this PhD research project. Fundamentally, my aim is to help all children develop movement skill competence (MSC) and the New Zealand primary school context provided a unique opportunity for me to explore this.

## Origins of the research project in context

This section provides insight into early conversations I had with the school principal, which help contextualise the need for, and the origins of this PhD thesis and how it evolved.

This PhD project took place between 2018 and 2022 at an Auckland primary school in New Zealand. The school is situated within a high socio-economic community and accommodates 800-850 children from years one to six with 80-100 staff members. The school has a motto to support all children on their journey to "be the best you can be." In his interview (Chapter 6), the school principal explains that "taking a child in and giving them experiences through their six years that will enable them to find out who they are and what they love doing" is the mission of the school.

In a step toward bringing the motto and mission to life at the school, the staff had a shared school vision "Hono (Connect), Whakatara (Challenge), Whakamana (Empower)." Firstly, to *connect* with each other via the forming of meaningful relationships, secondly to *challenge* the teachers and children in a variety of contexts to improve themselves and others, and lastly to *empower* children and teachers to be the best they can be in any endeavor they wish to pursue. The school principal explained "it makes sense that if we can connect children to something that they love doing then they are more likely to learn." Children at the school have choice over "what they're engaging in", "what it looks like," and "when it happens", this is important for children "taking responsibility." Simply, the principal summarised, the "children are in control."

Actualising the school mission and vision was a job for all stakeholders. Specifically pertaining to physical education (PE), the principal described the teachers as "a staff of mixed people who have played sport, dabble and enjoy exercise, dabble and don't enjoy exercise, and don't enjoy exercise so don't do it." The principal believed such diverse experiences were "reflected in PE that was being provided for children." Some teachers love going out for PE and sport with their children every day, whilst others do not take their class out at all. A lack of PE provision for many children meant the school was failing at living their mission. The principal also described limitations in PE practices:

"…teachers that love going out for PE and sport, but they're living it through their experiences growing up." For example, "highly sport oriented," "highly teacher directed," "based on what's been passed on to them," "they do the things they know well, sports, because they feel comfortable doing them." In the eyes of the principal, PE provision was a direct result of the knowledge and confidence of his staff. Current PE teaching practices at the school failed to give children choice – a key pillar of the vision - reducing opportunities for children to take responsibility for their actions and be in control of their PE experiences. To better align PE provision with the school vision, change was needed. When asked "did you see a need to change something?" the principal responded:

"If you'd asked me ten years ago, the need I would have seen would be we need to upskill people to know the things they need to teach children PE. How to do the basics of throwing, catching, and those sorts of things."

The principal went on to say:

"What I've learned over time is that approach wasn't working. You can run those lessons for teachers, model them, get beside them. But, at the end of the day it's not theirs, they don't own it, they're not empowered by it, so they're less likely to

continue it once you're out of the scene." This reflection changed the way the principal wanted to improve PE:

"[It has] driven us towards a philosophy where we expose teachers to professional learning, where they can see it [PE] happening, be part of planning, they can take responsibility for it [PE], and then they can be part of creating and designing a [PE] programme in which can be theirs and their children's," "the children are a big part of it, so there's a big part of empower."

The principal's desire for better PE practices for all children at the school was clear. He wanted sustainable change and believed the best way to achieve it was to empower his teachers.

In New Zealand, some schools receive a government subsidy for sport and physical activities. Often, the money is used to bring in external provision. However, while children at the study primary school enjoyed their experiences, teachers rarely attended classes, instead opting to rest or prepare for other areas of the curriculum. The principal disapproved of this approach as staff were not developing their PE teaching skills. A search for alternative options led to allocation of a PhD scholarship through Auckland University of Technology and the recruitment of a movement skill specialist to join staff. It should be noted that the school's explicit interest in research outcomes was limited, and this was not the primary reason for investing in a research position at the school. Instead, the funding of a PhD scholarship as opposed to an additional member of staff was decided as the principal had a close familial connection with the sport science department of the university and the financial cost of a PhD student was significantly cheaper than employing a full-time member of staff.

The school's need for change coalesced with my desire to help children develop their movement skill competence. As a result, I started my PhD at the school with a goal to positively impact the quality of PE provision for all children within a four-year study

period. At the beginning of the project, the principal, my primary PhD supervisor (Dr Craig Harrison), and I met to establish the objectives of the study. It was essential that any intervention was sustainable and outlasted the time I spent at the school.

My role at the school was to support at least one whole year group (i.e., Year 2) per year to deliver a minimum of three PE lessons per week, with the aim to support all children to develop their MSCs. This 4-year process began with years 1 and 2 at the school. I adopted an approach whereby the lessons were heavily dependent upon me initially and then over time transitioned the ownership to the teacher. For example, at the beginning I was responsible for planning the PE lessons, organising and setting up the equipment, and delivering the lessons, then I would lead the reflective discussions with the children following the sessions. Throughout the school year, the responsibility of planning, delivering, and reviewing PE lessons was transitioned to the teachers and I would be present at all PE lessons and available throughout the school week to support the planning and reflection practices. It is at this stage of the process where the research studies in this thesis were conducted. This thesis depicts the journey and findings that followed.

## Reflexivity and Positioning

It is important in qualitative research that researchers acknowledge their role in the research as being part of the research process, and that process can be influenced by the researcher's lived experiences, worldviews, and sociocultural predispositions (Creswell, 2014). The aim of this section is to engage in a reflexive process and disclose my background and position within the research.

I am a white male of British descent, and a migrant to New Zealand. I am from a different background (European) to the majority of participants of this study. Nonetheless, I have previous experience of living and working within other cultures

having resided in the USA for 3-years prior to moving to New Zealand. Additionally, I have had the fortunate opportunity to travel and visit many different cultures in Europe, America, South America, and now Oceania. My lived experiences in multiple cultures have altered my worldview, opened my eyes to other ways of being, and enhanced my ability to relate with people from different sociocultural backgrounds.

For more than one year prior to the commencement of this research I was a member of staff at the primary school. This unique position afforded me the opportunity to develop relationships with the principal, teachers, and children participating in this research. Specifically, I had been working with: 1) the principal to align PE practices with the school vision, 2) the teachers in a group and individual basis with their classes for three 10-week school terms, and 3) the children as part of their PE lessons over three 10-week school terms and their other extracurricular movement activities. The shared experiences, formal discussion, and informal conversations with the participants fundamentally influenced the design and implementation of this research.

Given my working role within the school, relationships with the participants, appreciation for my role in collecting and interpreting data, I was uniquely positioned to conduct this research project.

# Chapter 2: Thesis Introduction

## Thesis Context

The primary school that provides the site for the research is in an area of high socio-economic status within Auckland, New Zealand. The school had a clear vision for all staff and children of the school: connect, challenge, and empower. This means, firstly, to connect with each other via the forming of meaningful relationships; secondly. to challenge the teachers and children in a variety of contexts to try new things, self-improve and support the development of others; and, lastly, to empower children and teachers to be the best they can be in any endeavour they wish to pursue.

When evaluating the school's position in achieving the school vision, the principal and the leadership team believed the school was underserving children in movement contexts, e.g., physical education (PE), sports, and physical activity. This realisation came to the principal and the leadership team's attention as they believed they had noticed a decline in children's movement skill competence (MSC) over the past 20 years in New Zealand (NZ) primary school settings. In agreement, international scientific literature has also indicated a decline in MSC of school children (Lopes et al., 2020). The principal and the leadership team decided that they could take action to develop children's movement skills by improving provision of PE for all children at the school; however, they would require support in best achieving this outcome. As a result, a research position was created (this PhD) providing an opportunity to work on-site at the school for the four-year duration of this project. While the school leadership team was interested in developing all children's MSC, the specifics of the research question were left open. Thus, this thesis seeks to better understand MSC development in primary school settings; with the intention of applying this knowledge to support real-world change.

## Movement Skill Competence

Competency in the performance of fundamental movement skills (FMS) are an essential component of the development of a physically literate individual (Ford et al., 2011; Lubans et al., 2012). FMS have been consistently associated with positive health trajectories, enhanced health-related fitness, perceived competence, and weight status (Robinson et al., 2015; Robinson et al., 2017). FMS are an organised series of basic movements essential to successfully participating in sports and physical activities (NSW, 2000). FMS are often classified as locomotion (e.g., running and jumping), object control (e.g., kicking and catching), and postural control (e.g., balance) oriented (NSW, 2000).

Children's FMS proficiencies have been reported as declining in numerous countries. The 13-year trend from 1997–2010 showed little to no improvement in movement competency levels in child populations (Hardy et al., 2013). Given the importance of MSC for health and wellbeing during childhood and the associations with physical activity engagement during adolescence and adulthood, it is not surprising that an abundance of scientific literature exists in this area (Logan et al., 2012; Morgan et al., 2013). A systematic review and meta-analysis concluded that training children in FMS can both increase the intensity of physical activity participation and reduce sedentary behaviours (Engel et al., 2018). This is important as interventions during childhood may have a significant and positive impact upon an individual's lifelong physical literacy journey and health. Thus, FMS development is an essential component of developing physically literate individuals and sustaining participation in physical activity (Cairney et al., 2019).

## Pedagogical Approaches

Despite the positive implications of current movement skill intervention research, movement skill literature has challenged whether the intervention programmes utilise developmentally and instructionally appropriate implementation methods for child populations (Atencio et al., 2014; Gagen & Getchell, 2006). Traditional pedagogical approaches to PE typically centre around a linear instruction-led approach emphasising expert proficiency of specific fundamental movements in repetitive 'drills' and competitive games (Light, 2008). Linear pedagogical approaches are derived from information processing (Schmidt et al., 2018) and stage theories of learning (Fitts & Posner, 1967) (see Chapter 3 for more information). Such traditional pedagogical approaches approach can adversely affect less competent and confident individuals (Moy et al., 2015). Specifically, a traditional pedagogical environment has been correlated with reduced levels of intrinsic motivation associated with heightened boredom, humiliation, marginalisation, passive participation and disengagement (Bunker & Thorpe, 1982; Ennis, 1999; Mitchell et al., 2006; Ntoumanis et al., 2004; Smith & Parr, 2006). In contrast, a robust relationship has been purported between intrinsic motivation and higher levels of active engagements (Ntoumanis, 2001), student learning (Tjeerdsma-Blankenship, 2008), concentration and effort (Standage et al., 2003), sustained participation in physical activity (Ntoumanis et al., 2004), and positive cognitive, psychomotor and social experiences (Vallerand, 2001). Hence, providing motivationally supportive learning environments is essential to continued engagement, participation and, ultimately, to the sustained learning of movement skills. Thus, there needs to be a clear understanding of how the pedagogical approach utilised can enhance movement skill competency and satisfy learners' intrinsic motivation.

Contemporary evidence from an ecological perspective has challenged the assumptions of a traditional linear pedagogy (LP) approach to PE (Chow, 2013).

Ecological dynamics is a theoretical framework that is comprised of dynamical systems theory and ecological psychology that subsequently form the principles of nonlinear pedagogy (NP). An NP approach caters to the inherent nonlinearity of human learning (i.e., over unique timescales) as performance changes are non-proportional to the amount of inputs (i.e., spatial constraints, information, feedback) received in the learning environment (Seifert et al., 2017). Contemporary theoretical and practical advances in PE have advocated for the implementation of an NP (Chow et al., 2016; Lee et al., 2017; Renshaw et al., 2010; Roberts et al., 2018). Specifically, Lee et al. (2014) claimed teaching approaches grounded in the principles of NP were effective at enhancing sports skills of primary school children. Principles of NP pertaining to assessment, lesson design, instruction delivery, and provision of feedback support teaching practices that accommodate the nonlinearity of movement skill learning (Chow, 2013). The principles of NP are: (1) representativeness, (2) constraints manipulation, (3) attentional focus, (4) task simplification, and (5) exploratory learning (see Chapter 3 for more detail).

With a better understanding of NP, teachers have a theoretically informed approach to the design and implementation of PE lessons (Renshaw & Chow, 2018) for developing MSC and providing contexts in which children are motivated to learn (Chow, 2013; Lee et al., 2017). Nonetheless, articles discussing NP approaches to PE have commented on the lack of collaboration between pedagogues and movement scientists, with a specific need for an in-situ representative scientific investigation (Renshaw et al., 2010; Roberts et al., 2018). Specifically pertaining to the context of this project, applied research investigating the impact of NPs in primary school PE settings is limited.

## Research Aims

The overarching aim of the research reported in this thesis is to gain a better understanding of developing children's MSC in primary school settings. The subsequent aims are:

1. To measure change in children's MSC following participation in PE lessons that adopt a NP approach.
2. To capture and share the experiences of the principal and teachers adopting a NP approach to PE.
3. To capture and share the experiences of primary school aged children participating in PE lessons that adopt a NP approach.
4. To improve the practical application of NP approaches to primary school PE.

Ultimately, a more thorough understanding would enable the development of more evidence-backed recommendations to support real-world change.

## Structure of the Thesis

The structure of the thesis is in Figure 1, below.

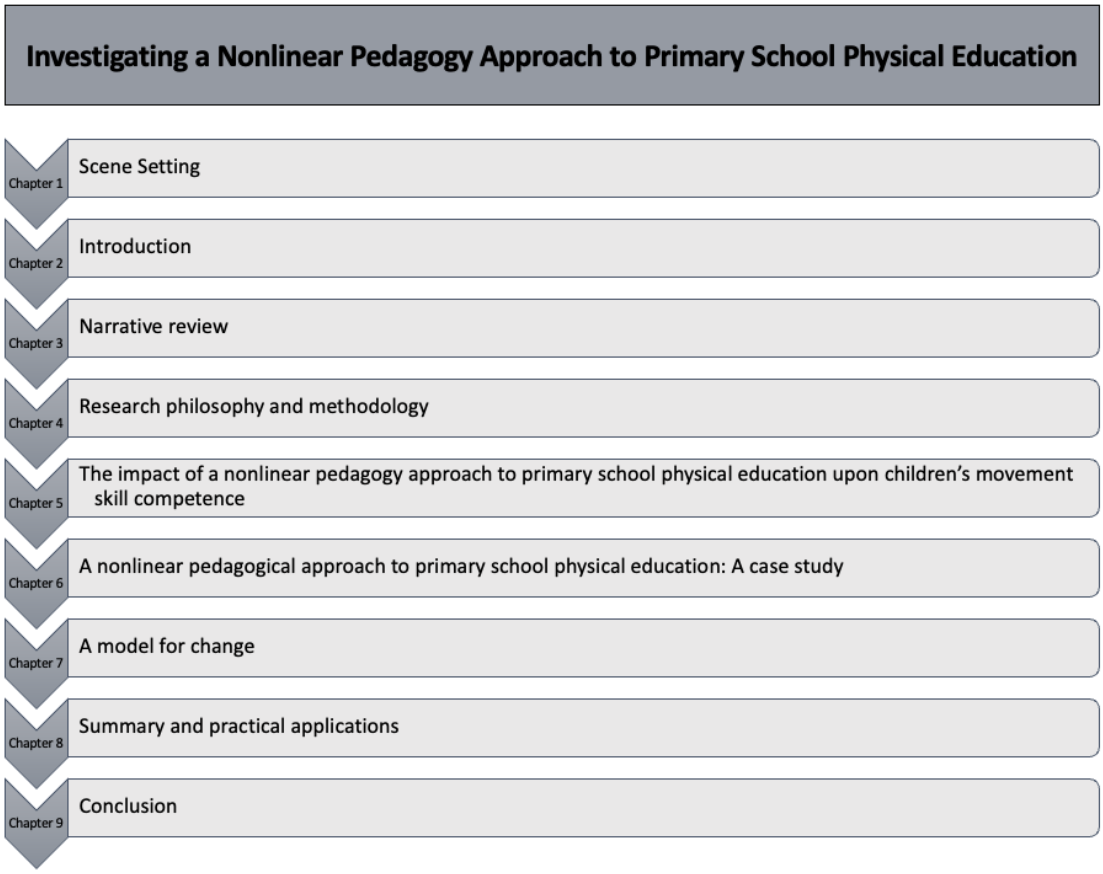



*Figure 1: Thesis structure schematic*

Chapter 1 aimed to set the scene where this thesis took place. Chapter 2 positions the research within scientific literature pertaining to movement skill learning in primary school settings.

Chapter 3 provides a detailed narrative review of children's MSC, ecological dynamics, nonlinear systems and nonlinear pedagogies.

In Chapter 4, the research paradigm and mixed methodology underpinning the research are explained. The rationale for the use of mixed methods research (MMR) in this project is also detailed.

Chapter 5 presents the first empirical study of the thesis. This chapter explains the quantitative data collection methods, statistical procedures used to analyse the dataset, and provides a discussion of the key findings within the context of broader literature. The results in this chapter identify the impact of an NP approach to PE upon

children's MSCs across a 10-week school term and the retention of the MSC development 13 weeks after the study.

Chapter 6 presents the qualitative research methods for study two. The voices of the principal, classroom teachers, and school children provide a deeper understanding of effectively adopting an NP approach to primary school PE and the impact upon children's experiences of PE.

Chapter 7 provides a summary of the key findings of the thesis and the benefits of adopting an MMR approach. The findings of the PhD are discussed in relation to the context of the primary school and the key stakeholders.

Chapter 8 shares the insights from my perspective as a PhD student working in situ at a primary school over a four-year period and real-world practical applications. Explicitly, this chapter discusses five identified principles of sustainable improvement to primary school PE practices: the need for a leader who seeks change, role modelling, the onsite specialist, managing entrenched behaviours, and allowing time for change. The practical applications provided are devised from real-world examples that were used and adopted by the teachers at the primary school where the PhD project took place.

Lastly, the conclusion to this thesis is presented in Chapter 9. The outcomes of this thesis are presented, limitations and strengths of the PhD are addressed, and my recommendations for future research directions are presented.

# Chapter 3: Narrative Review

## Chapter Introduction

The purpose of this chapter is to review related previous scientific literature that informed the context of this research pertaining to MSC and NP. This chapter is structured to provide an overview of the importance of MSC for child populations and the physiological factors that impact MSCs. Next, ecological dynamics theory will be addressed, leading to a review of NP and the characteristics of nonlinear systems. Lastly, the impact of adopting NP approaches upon motivation will be reviewed. Chapter 3 will be followed by a chapter explaining the research philosophy and methodology adopted throughout the research.

## Movement Skill Competence

In recent years physical literacy (PL) interventions have been promoted by numerous organisations and research groups {Delaney, 2008 #380;Keegan, 2013 #381;Mandigo, 2009 #383;Roberts, 2018 #199;Rudd, 2020 #396}. Definitions adopted for PL differ around the world, influencing measurements of PL, interpretation of findings, and preventing the aggregation of research findings. Consequently, in practice PL is often operationalized differently in different settings by practitioners. Nonetheless, a systematic review by Edwards et al. (2017) reported that most research adopts the definition of PL given by {Whitehead, 2010 #385@@author-year} "the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life" (p.11). Specifically, 70% of the research reviewed by Edwards et al., adopted Whitehead's definition, suggesting alignment within the majority of research conducted. In the context of this thesis the physical component is primarily addressed, however it is important to note that "physical" is only one component of PL. This research is adopting a pragmatic

approach to PL through an examination of the physical concept, however, acknowledges that PL represents other components including psychological, social, spiritual, and cognitive.

Dating back to the 1800s and more recently formalised by Whitehead (2010), the concept of physical literacy has the aim of increasing engagement with physical activity (Rudd, 2021). This objective is founded upon a strong connection between an individual's level of physical literacy and their participation in physical activity (Giblin et al., 2014). This relationship is essential to consider, as regular physical activity is very strongly associated with enhanced levels of health and wellbeing throughout the lifespan. Specifically, meaningful increases in psychological wellbeing, cardiorespiratory fitness and the reduction of numerous health risk factors have been established within the literature (Biddle & Asare, 2011; Hallal et al., 2006). Therefore, it seems fair to suggest that the development of physical literacy plays an important role in the long-term health and wellbeing of populations across the world.

Physical activity participation throughout life is strongly related to an individual's physical activity experiences during their formative years. Current literature indicates a robust relationship between physical activity participation during childhood (5–11 years) and participation levels through adolescence (12–18 years) (Yli-Piipari et al., 2012) and adulthood (18+ years) (Dumith et al., 2011). Due to the relationship between physical activity and physical literacy competencies, the development of physical literacy during childhood may be essential for the enhancement of lifelong health and wellbeing.

MSC is an essential component of the development of a physically literate individual (Ford et al., 2011; Lubans et al., 2012). MSC is a global term to reflect various terminologies used in previous literature (i.e., fundamental movement skill, foundational movement skills, general motor coordination) to describe goal-directed

movements (e.g., running, throwing, jumping) (Robinson et al., 2015). Fundamental movement skills (FMS) are defined as "a series of basic movements that involve the combination of movement patterns of two or more body segments", and are classified as locomotion (e.g., running and jumping), object control (e.g., kicking and catching), and postural control (e.g., balance) oriented (NSW, 2000). FMS assessments have supported a better understanding of children's MSC through large-scale subject comparisons across socio-economic groupings, countries, sex, and long time periods. However there is an existing debate about the effectiveness of current FMS assessments and measurements tools are evolving and improving (Ng & Button, 2018). Well-established motor development models have highlighted childhood as a crucial period for the development of movement skill competencies (Clark & Metcalfe, 2002).

Children's FMS proficiencies are at an all-time low in numerous developed countries. A 13-year trend from 1997–2010 showed little to no improvement of movement competency levels in child populations (Hardy et al., 2013). Further, competency in FMS was reported as low among school-aged children following each annual survey (Hardy et al., 2013). Current trends indicate that many children entering adolescence and adulthood without the basic movement skills that support the development of advanced movement skills frequently performed in recreational activity and competitive sport environments (Barnett et al., 2016). Due to the relationship between FMS and numerous health markers, this stagnation in movement skill development may have health consequences.

FMS proficiency has been consistently associated with positive health trajectories, enhanced health-related fitness, perceived competence, and weight status (Robinson et al., 2015; Robinson et al., 2017). Recently, a systematic review and meta-analysis concluded that training children in FMS can both increase the intensity of physical activity participation and reduce sedentary behaviours (Engel et al., 2018).

Children who possess high performance levels of FMS show little to no decline in levels of physical activity through adolescence and adulthood (Lopes et al., 2018). This is important as interventions during childhood may have a significant and positive impact upon an individual's lifelong physical literacy journey and health.

Given the importance of MSC for health and wellbeing during childhood and the associations with physical activity engagement during adolescence and adulthood, it is unsurprising that much literature exists in this area (Logan et al., 2012; Morgan et al., 2013). A meta-analysis (n = 11) conducted by Logan et al. (2012) reported a significant and small to medium positive effect of movement skill interventions on the improvement of FMS in children ($d = 0.39$, $p < 0.001$) compared to control groups (i.e., free-play). These findings are noteworthy for two key reasons: 1) they demonstrate that movement competencies in children are not truly phylogenetic; and 2) current interventions have successfully developed the movement competency base that supports the development of the more advanced movements that competitive sporting arenas demand. Such findings support the notion there is a need for deliberate and purposeful development of movement skills in child populations.

## Physiological Factors Related to Movement Skill Competence

### *Neuromuscular Performance*

Neuromuscular performance is the ability of the neuromuscular system to display movement control by effectively organising muscular, neural, and physiological systems (Faude et al., 2017). Deficits in neuromuscular performance can result in a lack of movement control during dynamic movements, displayed as low levels of movement competency and often resulting in an increased risk of injury (Hewett et al., 2005; Serpell et al., 2012).

Due to the adaptable nature of the neuromuscular system, movement skill performance can be enhanced. In support of this, a systematic review by Faude et al. (2017) reported that movement control is modifiable via neuromuscular adaptation in response to appropriate training interventions. Specifically, neuromuscular domain parameters such as balance, postural stability, strength, and power qualities were enhanced following training interventions in youth populations. Individual adaptations are often small; however, when appropriate training is conducted, the enhancement of individual neuromuscular deficits can act synergistically to significantly enhance athletic performance and reduce the likelihood of injury occurrence (Mandelbaum et al., 2005; Myer et al., 2011; Stracciolini et al., 2017). For example, the combination of strength, balance, and power enhancements has been consistently shown to improve neuromuscular joint control, subsequently reducing forces and moments upon skeletal, muscular and ligament structures during movements involving high biomechanical loads such as jump-landing, rapid deceleration and cutting manoeuvres (Mandelbaum et al., 2005). Ultimately, this increased capacity to cope with the forces present during movement tasks common in sport and recreational activities increases an individual's level of movement skill performance and resiliency to injury.

It has been proposed that the nervous system is in a heightened state of adaptability during youth compared with adulthood (Mundkur, 2005). Recent neuroimaging data has suggested reduced motor cortical inhibition in child subjects promotes neural plasticity (Walther et al., 2009). Specifically, Walther et al. (2009) concluded that a reduced GABAergic (generate inhibitory neurotransmitter in CNS – limits nerve transmission, inhibiting nervous activity) inhibition can be found in children due to the immaturity of inhibitory intracortical pathways, and that this likely facilitates neuronal plasticity and motor learning in children (Walther et al., 2009). Thus, from a neuromuscular performance standpoint, the heightened state of neural

plasticity during childhood provides an opportune stage of development at which to implement injury prevention strategies.

### *Rate of Force Acceptance*

Neuromuscular performance is commonly considered as an individual's capacity to rapidly produce force. However, it also important to consider that musculotendinous injury is commonly associated with an inability to rapidly tolerate forces present during dynamic movements frequently performed during sport-related activity (Hawkins & Fuller, 1999; Lloyd, 2001). The ability to accept and overcome high initial ground contact forces rapidly is measured in terms of the rate of force acceptance (RFA) and is dependent upon specific muscle actions and neural factors (Jeronimo & Pelot, 2016). Human musculature manipulates forces via three types of action: 1) eccentrically (muscle lengthening under tension), isometrically (no change in muscle length under tension), and concentrically (muscle shortening under tension) (Padulo et al., 2013). Athletic performance (e.g., sprinting, jumping, throwing) is commonly associated with applying concentric muscle actions, whereas displays of low movement control and injury have been strongly correlated with eccentric muscle actions during moments of absorbing forces (e.g., jump-landing, rapid deceleration, and cutting manoeuvres) (Ibikunle et al., 2014). Therefore, when seeking to develop an individual's movement competency, the importance of the ability of an individual to manage large gravitational forces present during the performance of dynamic movements must not be overlooked.

Sporting environments require a capacity to repeatedly cope with and express large forces. This force frequently has to be expressed in under 250ms (Kodayu et al., 2018). Producing force in such short periods of time to overcome the ground contact forces is highly dependent upon rate of force development (RFD, a measure of the rate of increase in force following muscle action onset) (Maffiuletti et al., 2016), and

electromechanical delay (EMD, the time lag between muscle activation and force production) (Norman & Komi, 1979). There is minimal evidence of muscular hypertrophy in child populations, so it generally accepted that enhanced force production capacities are related to neural adaptations (Faigenbaum et al., 2009). Neural adaptations in child populations include enhanced motor unit recruitment, synchronisation, and rate coding (Dotan et al., 2012) and are essential for enhanced movement efficiency (Cannon et al., 2007). Legerlotz et al. (2016) demonstrated there is a capacity for children as young as 7–12 years of age to enhance the performance of neural factors that increase an individual's ability to tolerate initial ground contact forces. Therefore, it is necessary to provide an opportunity during childhood to train neuromuscular qualities that can aid in overcoming the large initial ground contact forces associated with sport and recreational activity environments.

### *Postural Stability*

Postural stability is the ability to maintain, achieve or restore a specific state of balance (Horak, 2006), and is a movement performance factor consistently associated with enhanced movement skill performance. Postural stability is essential in achieving efficient motor control that enables static stable positions and dynamic stable positions as the body moves through space (Rudd et al., 2015). A lack of postural stability during dynamic movements (i.e., changing direction, jump-landing and rapidly decelerating) is commonly associated with non-contact injury to the lower extremity (Grimmer, 2003; Jones et al., 2000). Nonetheless, a scientific literature review reported training interventions that enhance postural stability performance successfully reduced sport and recreational activity related injuries (Lauersen et al., 2014). Thus, postural stability is considered an important movement performance quality to consider when implementing strategies to reduce injury risk.

Postural stability adaptations are theorised to be a result of enhanced proprioception, a complex neuromuscular process associated with the sense of the movement and position of the body (Lauersen et al., 2014). It is well established that improving postural stability significantly improves displays of movement skill via the positive alteration of lower extremity biomechanics (DiStefano et al., 2010; McGuine & Keene, 2006; Olsen et al., 2005) – specifically, the stimulation of receptors to detect changes in tension and length of muscle, the rate of these changes, and changes in the position of body segments (Harris & Dudley, 2000). Subsequently, this information is transmitted by afferent neural pathways to stimulate the timely activation of corresponding motor units, ultimately resulting in the maintenance of balance (Laskowski et al., 1997). Adaptations in the sensory and motor systems that regulate postural stability performance are most sensitive to change during childhood (Drabik, 1996). Therefore, it is important that postural stability qualities are purposefully developed during childhood.

In conclusion, it seems clear that to enhance movement competency there is a need to develop essential underpinning physiological qualities. Current literature has consistently demonstrated positive physiological adaptations following well executed interventions across multiple factors related to movement competency. Notably, adaptations have been demonstrated in youth populations, a period of development that is pertinent for development of movement competency qualities. However, research continues to report long-term trends of declining levels of movement competency in children (Fraser et al., 2019). This is significant as, although literature is demonstrating enhanced MSC following interventions, the sustainability and broad impact of such improvements are somewhat limited. Thus, for the sustainable development of physically literate populations, we must seek to better understand the implementation of interventions that facilitate the development of independent, self-sufficient, and

innovative learners who engage in habitual physically active behaviours that develop movement competency throughout life.

## Linear Pedagogy

Information processing theory has been a dominant theory of movement skill learning (Schmidt et al., 2018). It considers the human being as a processor of information like a computer. Information (e.g., auditory, visual, proprioceptive) enters the human as input and is then encoded and stored. Next, various processing stages occur that encode the information so an prescription for movement can be selected, and the eventual output is skilled movement. Information processing theory postulates a top-down approach to movement skill learning with a mental representation located in the brain which is built or strengthened following a learning process, so that a plan of movement action can occur prior to the occurrence of a movement action (Schmidt et al., 2018). The building or strengthening of the mental representations in the brain is seen as a gradual linear process nurtured by repetition of a skill. The skill is then developed linearly in a step by step fashion through three stages of learning (Fitts & Posner, 1967). Firstly, cognitive stage, where a learner practices a component of a skill with most parts of the movement controlled in a conscious manner. Next, associative stage, where movement is more refined and fluid with requiring less conscious control. Finally, autonomous stage, where automaticity of a skill is achieved with consistent and effective movement (Fitts & Posner, 1967; Weaver, 2015). In movement skill learning contexts, information processing theory is often implemented through a linear pedagogy (LP). Chow et al. (2015) posited that LPs are characterised by four main teaching principles: 1) there is a correct optimal movement pattern for each motor skill, 2) motor skills are broken down into key components of a skill for learning, 3) motor skill variability is noise in the system that must be reduced when seeking to master a skill, and 4) internal focus of

attention is needed when learning a motor skill. Traditionally, this has resulted in repetitive and prescriptive practices that technical demonstrations of ideal movement models by teachers for learners to aspire to achieve (Williams & Hodges, 2005). An underlying assumption of LP is the existence of an ideal movement model for any given task, and the role of the teacher is to support learners to replicate that movement model (Williams & Hodges, 2005). However, evidence from contemporary ecological models has challenged the traditional assumptions of movement skill learning.

## Ecological Dynamics

As guidelines that conceptualise a more broadly defined physically active individual need to be implemented into practice, a better understanding of pedagogical approaches that can support this realization is important. (Thorburn et al., 2011). The development of MSC will aid children in the individual development of their engagement with physical activity for life. Teachers need to support children in the development of an increased ability to organise the body and its components in an unpredictable environment to efficiently display MSC. Thus, a theoretical understanding of human learning could support the teacher in the designing and implementation of learning environments that could heighten the acquisition of movement skill and its transfer to physical activity settings.

The theoretical constructs of ecological dynamics provide a basis for the development of a pedagogical approach that could support the long-term enhancement of movement skill. Ecological dynamics is founded upon the study of organism–environment systems: information-based behavioural transactions between individual organisms (i.e., children), and between these organisms and relevant variables (i.e., objects, surfaces, area size) within the performance environment (e.g., sport and recreational activity). Specifically, ecological dynamics views the organism–

environment interaction as a level of explanation of how individuals coordinate movement during goal-directed behaviours (Kugler et al., 1980). The continual interactions between key system parts and the changes across varying timescales result in complex and dynamical systems forming between the organism and the environment (Araújo et al., 2017). To better understand the complexities of performer and environment interactions, ecological dynamics combines ecological psychology and dynamical systems theory.

## Ecological Psychology

Ecological psychology highlights how proficient movement performance emerges via heightened levels of coupling between perception and action systems established during interactions between the individual organism (i.e., the child) and the performance environment (e.g., sport, recreational activity) (Chow & Atencio, 2012). For example, prior research has illustrated how key physical motor qualities such as postural control can be significantly impacted by the availability of information to the performer (Stoffregen et al., 1999). Notably, when given prior notification of perturbation, learners showed superior postural control performance (Stoffregen et al., 1999). This may suggest that the presence and receipt of information relevant to performance can impact the display of MSC. Therefore, learning environments for developing movement skill must account for the inseparable link between the perception and action subsystems of human movement.

Human perception plays a fundamental role in guiding movement behaviour during the movement skill acquisition process (Gibson, 1979). The initial perception of information in the performance environment can constrain the human motor system (i.e., the neuromuscular system), and then guide the performance of an action (i.e., movement). However, this is not a unidirectional process. Without perception, actions

cannot be functional (e.g., have specific purpose), and without action, perception cannot be functional (Gibson, 1979). So, as a consequence of actions (i.e., movement), learners are exposed to different information via changes to systems such as their optic array, which subsequently impacts the perception of the performance environment. This was astutely put by James Gibson (1979) as follows: "We perceive in order to move but we must also move in order to perceive" (p. 223). Thus, a reciprocal relationship exists as perception influences action and action influences perception. Therefore, as movement performance is intertwined in the interaction with key information present within the environment, pedagogues need to consider the representative design of the environment they are presenting to the learners.

## Dynamical Systems

Dynamical systems theory is a systems approach that encompasses areas of physics and mathematics and their connections with biology and psychology in order to describe the behaviours of complex dynamical systems (i.e., human beings) (Araujo et al., 2014). Within this theory, emergent behaviours can be analysed with the same founding principles, irrespective of a system's structure and configuration (Araujo et al., 2014). For example, the coordination of a child's movement in a recreational environment can be understood by analysing system changes over space and time. This theoretical construct is essential to understanding how the constant coupling (coadaptation) between a learner and the learning environment can be modelled, theoretically positioned, and critically analysed (Araujo et al., 2014). Accordingly, a movement skill should not be considered without regard for the movement task and environmental context it is being performed within.

Dynamical systems theory provides a theoretical framework which emphasises that movement skill emerges from child–environment interactions. All dynamical

systems have common characteristics: 1) they are comprised of several interacting parts (i.e., nervous system, musculoskeletal structures, teacher–learner interactions), 2) they model nonlinear behaviour (small changes in input do not necessarily equal small changes in output), 3) they involve self-organisation (learners organise their own movement behaviour in response to environment focal points), and 4) behaviours are emergent (dependent upon organism–environment interactions). This theory supports the notion that the learning process is unique to each individual and formed from the self-organising of body parts to perform a desired movement outcome. By positioning humans as dynamical systems we can exploit these characteristics to facilitate movement skill acquisition.

## Characteristics of Nonlinear Learning Systems

In ecological dynamics, the learning process is viewed as changes to a learner's intrinsic dynamics. In other words, learning occurs as a transformation to the inherent characteristics of an individual's movement skillset occurs. Learning (i.e., true changes in a learner's intrinsic dynamics) happens when conflict occurs between the current coordination behaviours of the individual and a new coordination state (Schoner & Kelso, 1988). From a nonlinear perspective, the acquisition of movement skill in humans is a lifelong process which is founded upon individual variance and accumulated learner–environment interactions (Renshaw et al., 2010). Recently, pedagogical literature has demonstrated that variability is an inherent feature of human learning (Chow & Atencio, 2012; Chow et al., 2014). A prime example is how learning can occur in unique ways over irregular time courses with the same performance outcome (Doll, 2008). In support of this notion, Doll (2008) proposed that learning does not occur in a linear manner through direct knowledge transfer from teacher to learner, but in a nonlinear manner where an individual is able to solve problems in a self-

exploratory manner. Subsequently, the idea of movement skill being developed in unpredictable, multifactorial, and nonlinear ways was conceived (Jess et al., 2011). Therefore, practitioners aiming to enhance the MSCs of children should consider a pedagogical approach that accounts for the inherent nonlinearity of human learning. There are three key characteristics of nonlinear learning systems:

***Non-proportionality***

Humans learn in a nonlinear manner (i.e., over unique timescales) as performance changes are non-proportional to the amount of inputs (i.e., spatial constraints, information, feedback) received in the learning environment (Seifert et al., 2017). A direct relationship between the amount of inputs a learner receives and the acquisition of a movement skill does not exist (Chow et al., 2014). A small change in the learning environment (i.e., a change of movement task) could result in a small or large change in movement performance behaviour. Consequently, the inputs that teachers provide in the learning context may lead to unexpected and non-proportional changes in performance outcomes (Chow et al., 2015).

***Variability***

Individual variance in movement coordination can exist within individual performers without impacting performance outcomes (Lee et al., 2014). The variance in human movement solutions is founded upon the principle of multi-stability. Specifically, one input received within the learning environment may impact displays of movement performance behaviours in numerous ways. Moreover, when specific constraints are manipulated within the learning environment, a learner can be guided towards several different movement outcomes. For example, if a teacher throws a ball in the air for a child to catch, the receiving child can respond in multiple ways (catch with two hands,

let it bounce before catching, trap the ball between their hands and body) and is not restricted to one movement solution (e.g., catch with two hands).

### *Multi-stability*

Nonlinear systems display variability during the process of learning. Variability has long been thought of as undesirable in movement skill literature and is commonly referred to as noise (Chow et al., 2015). A common sporting example is inconsistency in technique across movement performance would be considered undesirable. However, in dynamical systems noise can have a functional role by exposing a system to opportunities to move across multiple states of coordination (Lee et al., 2014). These opportunities ultimately increase a learner's capacity for adaptability in displays of movement performance resulting from learners exploring a variety of movement solutions (Davids et al., 2005).

### *Summary of Characteristics of Nonlinear Learning Systems*

These characteristics (i.e., non-proportionality, variability, and multi-stability) of nonlinear learning provide a foundation for better understanding the nonlinearity that is inherent to complex system behaviour, for example human learning . This is in opposition to traditional linear pedagogical practices that are prevalent within PE settings. Traditional pedagogical approaches to PE are characterised by 1) conventional, highly structured teaching sequences which start with the introduction of a technical skill in isolation from the performance environment, 2) learners' repetitive attempts to reproduce model movement templates prescribed by the teacher, 3) regular provision of corrective verbal feedback from the teacher, and 4) a concluding game-like activity where learners attempt to apply the technical skill learned in the PE lesson (Hopper et al., 2009; Martens, 2004). Such practices have been commonly associated with the power law of practice which assumes a linear, predictable progression of skill with an

amount of practice (Newell & Rosenbloom, 1981). Such pedagogical approaches have been criticised from a skill acquisition perspective due to the decontextualisation and deconstruction of movement tasks, two factors that directly contradict the nonlinear characteristics of human learning. Thus, a teaching framework that could support the adherence to the nonlinear characteristics of learning could prove highly beneficial within movement skill learning contexts.

## Nonlinear Pedagogy

From an ecological perspective, a teaching approach that accommodates the needs of a nonlinear learner is required. The inherent nonlinearity of human learning is a complex topic and has proven difficult for practitioners to comprehend and intentionally apply in learning settings. A framework that supports the purposeful facilitation of learner–environment interactions in a movement skill practice setting could be beneficial for the development of robust and adaptable movement skillsets. A teaching approach that caters to the inherent nonlinearity of human learning is an NP approach to teaching movement skill. Contemporary theoretical and practical advances in PE have advocated for the implementation of an NP (Chow et al., 2016; Lee et al., 2017; Renshaw et al., 2010; Roberts et al., 2018). Lee et al. (2014) advocated for teaching approaches grounded in the principles of NP as being effective at enhancing the sports skills of primary school children. Principles of NP pertaining to assessment, lesson design, instruction delivery, and the provision of feedback support teaching practices that accommodate the nonlinearity of movement skill learning (Chow, 2013). The principles of NP are: (1) representativeness, (2) constraints manipulation, (3) attentional focus, (4) task simplification, and (5) exploratory learning.

### *Representativeness*

Representativeness is derived from the original concept of representative design from Brunswik (1956), subsequently adapted to representative learning design by Pinder et al. (2011). NPs provide a framework for learning to occur to in settings representative of the performance environment (Chow, 2013). From an ecological perspective, the individual learner is inextricably linked to the environment, so true skill acquisition occurs as a consequence of these interactions. For MSCs to be developed, learners need to be placed in realistic learning settings so they can attune to information that is relevant to their performance setting (Fajen et al., 2009). Critically teachers must preserve information-movement couplings in practice that are required in performance settings. However, traditional primary school PE lessons have consisted of teachers presenting ideal movement model solutions to children. Subsequently, the children have time to practice replicating the movement presented by the teacher in isolated and decontextualised scenarios. For example, young children will be positioned in lines, shown how to hold and throw a ball by the teacher, then the children may be given an opportunity to replicate the movement demonstrated by the teacher. A skilled mover will be able to display their movement skills in realistic settings.

### *Constraints Manipulation*

Over recent years, a constraints-led approach (CLA) has been utilised as a framework for intentionally shaping learning environments to facilitate the acquisition of movement skills (Fitzpatrick et al., 2018; Renshaw et al., 2010; Roberts et al., 2018).

The term ‘constraints’ refers to the myriad of personal, task, or environmental factors that act as boundaries to guide the movement behaviours that emerge in learning environments (Newell, 1986). Personal constraints refer to the structural and functional aspects of the learner, environmental constraints include physical and socio-cultural

elements, and task constraints include rules and goals of the task, and equipment (Chow et al., 2014). The CLA articulates the idea that dynamic interactions between these constraints allow individual learners to self-organise perceptions and actions to develop unique efficient movement solutions (Newell, 1986; Renshaw et al., 2010). Therefore, the purposeful manipulation of constraints may be utilised to design environments for the development of MSCs.

It is most common that teachers utilising a CLA in their learning settings will modify task constraints as they are the simplest to manipulate within practice design (Tan et al., 2012). Task constraints are typically modified by informational means (i.e., task instructions), physical means (i.e., equipment, size of area), and rules of the activity (Buszard et al., 2016). Through the intentional manipulation of constraints the teacher can encourage certain movement solutions to emerge with less direct instruction. Recently, Komar et al. (2018) reported that the use of informational (i.e., analogy) and physical (i.e., metronome) constraints improved the retention of the learning of the key performance characteristics of breaststroke swimming in young adult males in comparison to a no additional information control group. This research demonstrated the positive effect that manipulating task constraints in practice settings can have upon movement skill learning. However, much of the current literature has reported the use of CLA in adolescent and adult populations. More research is required to understand the impact of a CLA upon movement skill learning in child populations.

### *Attentional Focus*

The way a learner focuses their attention during an activity has the potential to influence skill development. Focus of attention has commonly been positioned as either external where attention is directed to the outcome of action, or internal where attention is directed to the action itself (Wulf, 2007). In line with NPs is the use of an external focus

of attention to reduce the conscious and explicit control of movement. Instructions and feedback to learners can be devised to focus attention on the effects of a movement on the environment (i.e., learning task outcomes) (Wulf & Lewthwaite, 2016). For example, during a throwing a task a child may be instructed to aim for a specified target, with the outcome of hitting the target, or not, providing feedback to the learner. Previous research has noted how the benefits of employing an external focus of attention can be task and learner dependent (Peh et al., 2011). Notably, a previous study has commented that children may respond differently to external focus of attention instructions, and noted that the benefits of this approach may not appear in child populations (Michal et al., 2008). Thus, the positioning of the research reported in this thesis in a primary school setting addresses the lack of NP literature concerning child populations. Regardless, an external focus of attention is an important aspect of NPs.

### *Task Simplification*

A need for information–action couplings to remain intact during learning tasks is a key characteristic of NPs. Task simplification, as opposed to task decomposition, therefore is essential for supporting MSC development from a nonlinear perspective (Button et al., 2020; Chow, 2013). Task simplification is closely related to the previously discussed principle of constraints manipulation, as manipulating constraints can facilitate task simplification. For example, for a young child aiming to shoot basketball into a basketball hoop, the teacher may change the height of the basketball hoop being aimed at. A similar approach has been adopted with tennis skills in child populations through the manipulation of area sizes, racket sizes, and ball compressions to simplify learning tasks (Fitzpatrick et al., 2018). Importantly, task simplification increases the likelihood of a successful outcome whilst maintaining information–action coupling, this

is critical for learning, according to NPs, as per the discussion in the "Representativeness" subsection.

### *Exploratory Learning*

A characteristic of nonlinear learning systems is variability, where variance in movement coordination can exist within performers without impacting performance outcomes (Lee et al., 2014). NPs can intentionally include disturbances in the learning context to encourage variance in the learning conditions. The intention of instilling variability in practice is to encourage exploratory learning behaviours where learners can be challenged to search for novel movement solutions (Ranganathan & Newell, 2013). Thus, variability in practice is essential for supporting a learner shift from one movement solution to a new movement solution (Button et al., 2020; Davids et al., 2006), through exploring constraints in the learning environment. To encourage exploratory learner behaviours, teachers can manipulate task constraints. For example, the use of different ball sizes and textures in a throwing activity could encourage the learner to search for and explore different movement possibilities supporting a movement skill to be learnt.

## Constraints-Led Approach in Skill Acquisition

The CLA originated in the work of Newell (1986) and is one example of a NP for teachers and coaches in sport and PE. Understanding the application of a CLA to movement skill acquisition in primary school settings is important for the advancement of pedagogical practices utilised with child populations. Literature regarding the manipulation of task constraints in primary school physical education settings is extremely limited. Nonetheless, a recent investigation by Fitzpatrick et al. (2018) studied the impact of a CLA on primary school aged (7–8 years) children's tennis performance. Specifically, the results showed that physically scaling task constraints

(i.e., manipulating practice area dimensions) during an eight-week intervention altered the group's movement behaviours to better correspond with key performance characteristics of the adult game. By manipulating physical task constraints, the learning environment was shown to augment the technical and tactical development of players to better support their progress through the long-term developmental stages of tennis. Therefore, as we consider the use of pedagogical approaches to enhance MSC, it is important to note how the manipulation of physical task constraints can help design learning environments that better prepare learners for the demands of performance environments throughout their development.

Task constraints can also be manipulated via the means of information presented to the learner. Feedback presented to the learner can significantly impact the learning outcomes. Previous research has reported that the provision of feedback via cues (i.e., body-part information), task feedback (i.e., knowledge of object velocity), and task strategy (i.e., throw hard) are superior to general task information (i.e., throw the ball) in supporting children to self-organise the display of body positions associated with enhanced throwing performance (Lorson & Goodway, 2007). Specifically, Lorson and Goodway (2007) noted that, without the informational constraints, learners were not constrained during the throwing practice in ways that supported them adopting an enhanced throwing technique. Additionally, teachers should be cognisant of the impact of the methods used to present feedback on learning. Information can direct attention to internal aspects (i.e., the body) or external aspects (i.e., effects of movement on the environment) of movement (Wulf et al., 2010). A review of focus-of-attention literature reported that an external focus of attention enhances motor performance and retention of learning in comparison to an internal focus of attention (Wulf, 2013). Therefore, teachers should carefully consider what information they provide to the learner and the delivery methods they utilise.

With a better understanding of a CLA to movement skill teaching, pedagogues have a theoretically informed framework to support the delivery, implementation, and manipulation of practice settings. By catering to the inherent nonlinearity of learning, teachers can seek to purposefully develop the MSCs of children that are commonly associated with injury occurrence in sport and recreational activity-related contexts. The pedagogical framework is founded upon both an informed theory yet also aligns with the psychological needs of all learners.

## Motivation and Nonlinear Pedagogy

Despite the positive implications of current movement skill intervention research, movement skill literature has challenged whether the intervention programmes utilise developmentally and instructionally appropriate implementation methods for child populations (Atencio et al., 2014; Gagen & Getchell, 2006). Specifically, traditional linear pedagogical approaches to movement skill acquisition have been criticised for failing to satisfy learners' basic psychological needs. An instruction-led approach emphasising expert proficiency in specific fundamental movements in repetitive 'drills' and competitive games can adversely affect less competent and confident individuals. This pedagogical environment has been correlated with heightened boredom, humiliation, marginalisation, passive participation and disengagement (Bunker & Thorpe, 1982; Ennis, 1999; Mitchell et al., 2006; Ntoumanis et al., 2004; Smith & Parr, 2006). Juxtaposed with this, a robust relationship has been purported between intrinsic motivation and higher levels of active engagements (Ntoumanis, 2001), student learning (Tjeerdsma-Blankenship, 2008), concentration and effort (Standage et al., 2003), sustained participation in PA (Ntoumanis et al., 2004), and positive cognitive, psychomotor and social experiences (Vallerand, 2001). Hence, providing motivationally

supportive learning environments is essential to the continued engagement, participation, and ultimately sustained learning of movement skills.

Intrinsic motivation has been previously defined as a drive towards self-improvement by acting in ways that the individual deems important for their development (Deci & Ryan, 2000). Intrinsic motivation sits at the centre of individuals exhibiting long-term learning behaviours and, as such, is an essential concept that should be understood by movement skill pedagogues. Self-determination theory (SDT) is a theory of human motivation concerning people's innate psychological needs. The three underlying psychological needs of SDT are: 1) autonomy – the freedom for self-choice and from external control; 2) competence – the ability or perceived ability to deliver effective performance; and 3) relatedness – the need for interpersonal relations which provide connection (Legault, 2017). If a teacher can satisfy these basic psychological needs of the learner in the practice context, it is likely that the heightened motivation of the learner will support movement skill learning.

NPs can inherently satisfy the psychological needs of individual learners. An NP allows for the ownership of learning to be shared with the learner and provides increased opportunities for skill development via exploratory behaviours (Renshaw et al., 2010) in representative movement contexts (Seifert et al., 2017). The freedom for the learner to explore their own movement solutions reduces the threat to perceived competence and autonomy in comparison to traditional explicit instruction to replicate a model movement technique. Further, the learner–teacher relationship is likely strengthened as interactions are learner-centred and thus more supportive as opposed to critical and instructive (Renshaw et al., 2010). Notably, Moy et al. (2015) reported that when delivering lessons aimed at developing hurdling skills, a teaching approach founded upon principles of NP was superior to a traditional direct linear pedagogical approach in participant reported competence, relatedness, and autonomy. These findings

are of significance as they directly contradict the traditional linear teaching practices prevalent in movement skill learning settings and suggest that, when aiming to enhance the movement competencies of children, teachers should consider the use of an NP approach. Therefore, for the lifelong development of movement skills, pedagogues should consider how they can accommodate a learner's basic psychological needs.

## Summary

Considering the importance to health of developing MSCs and lifelong participation in physical activity, developing children's MSCs should be a priority. Despite research in the subject area increasing further investigation is required regarding the effect of a theoretically informed approach upon the development of MSCs within a primary school setting, further investigation is required.

Current literature investigating the effects of an NP approach to PE upon children's MSCs is limited. Further, the limited intervention research that has been conducted has focused upon the development of sport-specific skills (Fitzpatrick et al., 2018; Lee et al., 2014; Lee et al., 2017). Further investigation is therefore required to understand the implementation of the theoretical constructs of NP to enhance children's MSCs.

Also, little is known regarding teacher and learner experiences of adopting NP approaches to PE in primary school settings. This lack of knowledge means there is little understanding of the satisfaction of the psychological factors that underpin intrinsic motivation, and thus the sustainability of change in MSCs (Komar et al., 2022; Rudd et al., 2020). Therefore, research is required to understand experiences of teachers and learners in PE settings that utilise an NP approach.

# Chapter 4: Research Philosophy and Methodology

## Chapter Introduction

Chapters 2 and 3 of the thesis highlighted the need for improved primary school PE provision to develop children's MSCs. At the study school there was a need to align PE teaching practices with the wider philosophy of the school. Previous scientific literature pertaining to the use of NPs in primary school settings was limited and had highlighted a need for collaborative in-situ investigations between teachers and movement scientists (Renshaw et al., 2010; Roberts et al., 2018). In contributing to developing this area of research, the intent of this PhD research was to investigate the impact of an NP approach to PE upon children's MSC and to capture the experiences of the teachers and children of a primary school adopting an NP approach to PE. The data from the research could then be used to inform practical recommendations and guidance: 1) for the study school to improve their PE practices throughout the rest of the school class groups, and 2) for other primary schools seeking guidance on how to enhance their PE practices. To best produce knowledge that could have the intended practical impact, it was essential an appropriate research process was adopted in the thesis. Figure 2 (see next page) outlines the organisation of the research process used in this thesis, with each component of the process being addressed in depth in this chapter.

## Research Paradigm

Researchers adopt a wide variety of worldviews which influence their interpretations of the world (Chilisa & Kawulich, 2012). A researcher's worldview can broadly depend upon their value systems and beliefs about the nature of reality and knowledge (Chilisa & Kawulich, 2012). In research settings a worldview is often referred to as a paradigm and can be used as a practical tool to solve research problems (Abbott & Abbott, 2004; Denzin & Lincoln, 2017).

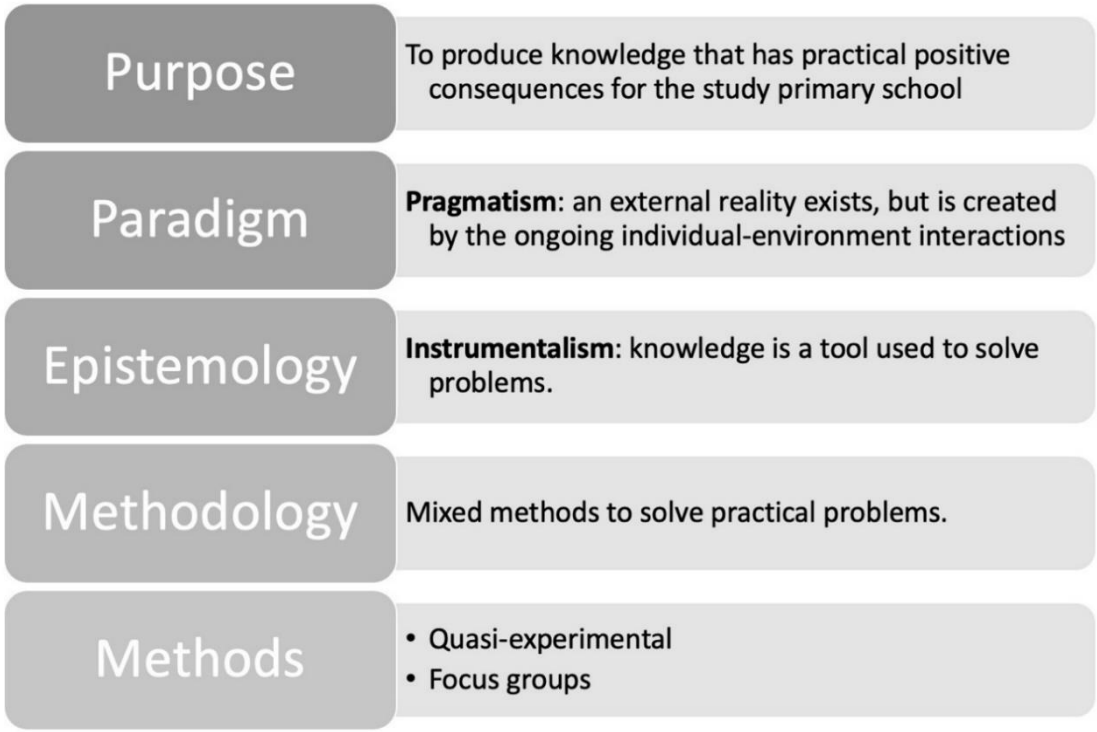



*Figure 2: Organisation of the research process used in this thesis*

There are numerous research paradigms that are utilised to position and structure research, e.g., post-positivism, constructivism, and pragmatism. Specifically, pragmatic researchers are not concerned with pursuing a single objective version of reality, instead valuing the impact of the research upon solving a real-world problem (Giacobbi et al., 2005). Due to the practical nature of the research presented in this thesis, a research paradigm that is focused upon the impact of the research on solving real-world problems was necessary, thus a pragmatic research paradigm was adopted (Maxcy, 2003).

The specific philosophical interpretations of pragmatism are dependent upon the scholar followed (Maxcy, 2003; Shalin, 1986). This thesis was influenced by the works of John Dewey (1929, 1906), due to Dewey's philosophical alignment with ecological dynamics theory (outlined in Chapter 3). Dewey rejects a dualism between mind and

body (perception–action), instead believing ongoing interactions with the environment construct an individual's experience of reality (Dewey, 1922), a belief that aligns with the ecological dynamics view of an inextricable relationship existing between an individual and the environment (Gibson, 1979). Thus, this thesis was philosophically guided by both pragmatism and ecological dynamics theory.

Ontologically, pragmatism proposes a middle ground between the worldviews of objectivism and subjectivism. An objectivist reality proposes the use of quantitative methodologies to objectively quantify reality so that generalisations can subsequently be made (Creswell, 2014). A subjectivist ontology states that a singular external reality does not exist; instead, reality is subjective and broader explanations can be generated inductively from the data (Guba & Lincoln, 1982). Accepting the notions of both objectivism and subjectivism, pragmatism suggests an external reality exists but is created by the ongoing interactions between the individual and the environment (Dewey, 1922). This thesis adopted a pragmatic worldview by seeking to understand the impact of adopting an NP approach to PE in situ at a primary school.

## Mixed Methods

Epistemology provides philosophical guidance for assumptions regarding how knowledge is gained and differentiated from opinion (Creswell, 2009). The intention for this thesis to contribute to a greater understanding of an NP approach to PE aligned with the epistemology of instrumentalism, as knowledge was viewed as a tool used to solve real-world problems. Methodologically, MMR is often philosophically guided by a pragmatic paradigm (Guba & Lincoln, 1994; Tashakkori & Teddlie, 2003). Pragmatic MMR utilises a range of research methods, techniques, and procedures when collecting data to best address the research problem (Creswell, 2014). A mixed methods approach was deemed an appropriate research tool to use to better understand the complexities of

adopting an NP approach to PE in a primary school setting. Thus, a combination of quantitative and qualitative research methods was employed to best answer the research questions. Specifically, a quantitative study (Chapter 5) addressed the lack of knowledge regarding the effects of an NP approach to PE upon children's MSC, and a qualitative study (Chapter 6) generated a greater and more nuanced understanding of adults' and children's experiences of adopting an NP approach to PE. Utilising MMR facilitated the development of a more complete dataset allowing for a greater understanding of adopting an NP approach to PE in a primary school setting.

In this thesis, an MMR approach allowed for a broader perspective of the research landscape than a single research method approach could have allowed on its own. A broader perspective was important for a greater understanding of the research and its potential practical impact on the study school. Specifically, in a quasi-experimental study reported in Chapter 5, quantitative data were collected to assess changes in children's MSCs over time in response to an NP approach to PE. Then, a case study reported in Chapter 6 adopted focus group methods to generate qualitative data to gain insight into the experiences of a principal, teachers, and children in adopting an NP approach to PE. The use of both quantitative and qualitative research methods allowed for deeper exploration and understanding of the impact of an NP approach to PE in a primary school setting. For example, the insights gained from the participants' voices through focus groups in Chapter 6 allowed for deeper insight into the quantitative MSC data generated in Chapter 5 (as discussed in Chapter 8).

Despite the potential benefits of adopting an MMR approach, previous literature has noted a possible limitation to be the requirement of additional resources to conduct the research. For example, MMR can typically require more time and a multi-disciplinary research team that possesses the skillsets in both quantitative and qualitative research methods. However, the potential impact of these limitations on this

thesis research was reduced. Time would not be a limiting factor as the PhD student was positioned full-time with the study primary school, and the PhD student's advisory team had extensive experience in quantitative, qualitative, and MMR methods. Thus, the circumstances of this PhD provided a unique opportunity to conduct MMR that can otherwise be taxing on resources.

## Research Design

Within MMR, six different typologies have been identified for classifying research design: sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested, and concurrent transformative (Plano-Clark & Creswell, 2008). To best answer the research questions posed in this thesis, a concurrent transformative research design was utilised, where quantitative and qualitative data were collected concurrently (Kroll & Neri, 2009). The aim of concurrent transformative research design is to use research to provide solutions to change communities, in this instance an NZ primary school. The conduct of the study was informed by pragmatism and ecological dynamics theoretical perspectives throughout, with the intention of creating practice-based evidence that could be used to solve problems pertaining to PE teaching practices at the study school. Specifically, in Chapter 5, quantitative data were collected to measure change in MSC following an NP approach to PE. Then, Chapter 6 employed qualitative data collection methods (focus groups) to explore the experiences of the adults and children of a primary school adopting an NP approach to PE. Specific details relating to the methods adopted in each sub-study are outlined in Chapters 5 and 6. Following independent data analysis, all data were then integrated during the interpretation phase to support real-world change in the study primary school that could then be interpreted for application in other primary schools (Chapters 7, 8, and 9).

## Children's Movement Skill Competency Assessment Tools

The main aims of assessing children's MSCs have been for diagnosis, monitoring development, and measuring intervention impact (Scheuer et al., 2019). The study presented in Chapter 5 used MSC assessments to quantify the impact of a PE pedagogical intervention. A myriad of assessment tools have been developed and are typically comprised of either product- or process-oriented test criteria established (Bonney & Smits-Engelsman, 2019; Cools et al., 2009; Lopes et al., 2020). Product-based assessments quantify movement skill performance using objective measures such as time to completion, distance, and speed (Logan et al., 2018). For example, the Canadian Agility and Movement Skill Assessment (CAMSA) (Longmuir et al., 2017) includes time scoring criteria (i.e., completion time <14-seconds) for a variety of movement skill tasks. Process based assessments measure movement skill performance by critiquing a child's movement patterns against a predetermined ideal movement criteria (Logan et al., 2018). For example, the Test of Gross Motor Development (TGMD) involves scoring children's displayed movement pattern during 12 skills against a listed performance criteria (i.e., Run: non-support leg bent approximately 90 degrees (Ulrich, 2000). After the completion of two trials, the child's scores are added together to provide a summed score for each skill. As noted by Logan et al. (2018) movement skill assessments differ in their complexity through the number of skills, performance criteria, and video analysis requirements for scoring. Assessments such as TGMD have been critical to understanding the global landscape of children's MSC across extended periods of time (Avigo et al., 2019; Bardid et al., 2016; Bolger et al., 2019; Duncan et al., 2019; Hardy et al., 2010; Mukherjee et al., 2017). Previous research has been critical in identifying associations between MSC and PA (Holfelder & Schott, 2014), MSC and a myriad of health benefits (Robinson et al., 2015; Robinson et al., 2017), and the trending decline in children's MSC (Hardy et al., 2013).

However, traditional MSC assessments conflict with contemporary movement skill learning theory. Specifically, traditional MSC assessments 1) downplay the role of the environment, and 2) in search for an ideal movement technique, neglect adaptability and individuality of skill, not allowing for self-organisation. Accordingly, the investigation of pedagogy guided by ecological dynamics (ED) theory without it being reflected in the assessment would seem futile.

A key component of the ED framework is dynamical systems theory (DST). Harnessing ideas of complexity and self-organisation, DST addresses how MSC can be viewed as emerging from the coordination tendencies of complex neurobiological systems self-organising under constraints (i.e., individual, environment, task) (Araujo et al., 2014). For this reason, from an ED perspective, MSC tools should be affordance based and allow individuals to self-organise under the constraints of an environment and task representative of children's physical activities. For example, to navigate an obstacle course as quickly as possible without knocking over equipment.

In this thesis, consideration also needed to be given to the ecological validity of all assessment tools. For assessments in the study school to be ecologically valid, it was of paramount importance that the teachers could understand and be capable of administering MSC assessments. Hence, in addition to having a robust theoretical foundation, assessment tools would need to account for three key considerations: 1) assessment complexity (e.g., required expertise to administer and analyse the assessment), 2) administration demands (e.g., testing duration, equipment requirements, data analysis) and 3) relevance to the curriculum (e.g., assessment-curriculum alignment). To my knowledge at the formation of this thesis limited scientific literature had utilised MSC assessments that were theoretically driven by ED and ecologically valid for the study school. Consequently, the decision of what assessments to use proved to be one of the most challenging factors of my thesis.

The Harre Circuit Test (HCT) and Time-To-Contact-Judgement (TTCJ) were utilised as they are affordance based (acknowledging the individual-environment-task interactions), ecologically valid for the study school setting, and had previously been used with child populations (Chiodera et al., 2008; Dallolio et al., 2016; Lucertini et al., 2013; Trecroci et al., 2015; Wann et al., 1993). Firstly, the assessments were affordance based, considering the environment as critical to MSC performance (e.g., navigate the obstacle course as quickly as possible without knocking over the equipment), accommodating the individuality of each child (e.g., children could solve the task in their own unique way). From an ecological validity perspective, the HCT and TTCJ could be conducted using minimal school equipment, setup in the school hall, completed in less than 5-minutes per child (compared to 15+ minutes per child for the TGMD), video captured using a classroom iPad, and uploaded to the online school learning portal for teachers, children, and their families to access. Nonetheless, it is acknowledged that both the HCT and TTCJ assessments are somewhat limited in their capturing of a child's MSC. For example, the assessments solely focused on assessing locomotion and neglected ball control and stability components of traditional fundamental movement skill (FMS) assessments. Better tools to measure MSC that align with ED theory are required.

The design, creation, and validation of a novel MSC assessment tool was considered for this PhD. However, following extensive discussion, piloting, and expert advice, I resigned to the fact that validating a new tool was beyond the scope of my thesis. Nonetheless, if I was to conduct this research project again, I would consider the inclusion of other MSC assessments. For example, the Divergent Movement Ability Test (DMAT) (Cleland & Gallahue, 1993) would have supported a deeper understanding of the change in children's MSCs following the PE pedagogical intervention. The DMAT encompasses all three components of traditional FMS

assessments (i.e., locomotion, object control, stability). Further, the quantification of movement creativity facilitated by the DMAT would have allowed for a more thorough investigation of how each child explored the range of their individual movement possibilities. Unfortunately, I only became aware of the DMAT after the data collection phase in this thesis.

In future research I would consider capturing video footage of children completing the HCT and TTCJ for analysis. For example, investigating children's deceleration profiles during the TTCJ assessment or the number of failed attempts and different movement strategies used in the HCT. Notably video capturing TTCJ performance was intended for this study and was successful during piloting, however, due to faulty camera equipment the footage captured during the study was unusable for analysis. Albeit beyond the scope of chapter 5, video capture has proven valuable to the school. Teachers have used classroom iPads to video their children completing the HCT as part of their PE lessons. The footage is then uploaded to the school online learning portal for teachers, children, and parents to access.

In conclusion, ED provided a guiding theory for the selection and application of the MSC assessment tools employed in this thesis. However, limitations existed for the HCT and TTCJ, that certainly limited the scope of which change in children's MSCs were captured. Thus, future research is warranted for the continued development of valid and reliable tools that can capture the development of children's movement skills in physical activity settings.

# Chapter 5: The Impact of a Nonlinear Pedagogy Approach to Primary School Physical Education upon Children's Movement Skill Competence

This chapter presents an article submitted to the Journal of Teaching in Physical Education that has been accepted subject to minor revisions.

## Prelude

The narrative review in chapter 3 indicated the importance to health of developing MSCs, particularly in child populations. Despite a myriad of research investigating MSC development of children, literature investigating the use of teaching approaches underpinned by contemporary ecological models in primary school settings is limited. Thus, the aim of this chapter was to develop a better understanding of the impact of a NP approach to primary school PE upon children's MSC. The findings of chapter 5 provide insights into adopting a NP approach to PE and the potential benefits to the development of children's MSCs.

## Introduction

Physical activity (PA) is robustly related to a myriad of health benefits throughout the lifespan (Biddle & Asare, 2011; Gunter et al., 2012; Janssen & LeBlanc, 2010; Khan & Hillman, 2014; Proudfoot et al., 2019), with childhood widely accepted as a vital stage of development to establish physically active behaviours that last for life (Telama et al., 2014; World Health Organization, 2020). For interventions to support changes in PA behaviours an understanding of the numerous influences upon child participation in PA is required (Gao & Wang, 2019). A major factor that has been associated with positive increases in PA in child populations is movement skill competence (MSC) (e.g., running, changing direction, rapid stopping, jump-landing) (Jones et al., 2020;

"<Stodden et al. 2008 - A Developmental Perspective on the Role of Motor Skill Competence in Physical Activity- An Emergent Relationship.pdf>,"). A theoretical model presented by Stodden et al. (2008) presents MSC as an underlying mechanism for the initiation, maintenance or decline of physical activity (Stodden et al., 2008). Subsequently Cairney et al. (2019) has extended the model to account for a recent increase in physical literacy research. However, recent longitudinal literature from numerous Organisation for Economic Co-Operation and Development countries reports children's MSCs were low and that they are continuing to decline (Duncan et al., 2019; Hardy et al., 2013; Tomkinson et al., 2017). Low MSC is of concern given the relation to physical activity behaviours and health related factors (Jones et al., 2020; "<Stodden et al. 2008 - A Developmental Perspective on the Role of Motor Skill Competence in Physical Activity- An Emergent Relationship.pdf>,"), thus it would seem to be fundamentally important to investigate methods of best supporting the development of children's MSC.

Curriculums, national standards, and policies around the world reference the development of MSC in primary school physical education (PE) (Dos Santos et al., 2016; Education Wales, 2008; New Zealand Ministry of Education, 2015; SHAPE America, 2015). In New Zealand primary schools, the implementation of PE is the responsibility of the classroom teacher. While this supports good relationships between teacher and child, it can dilute the quality of education provided in certain learning areas. Research suggests that teachers lack up to date understanding about movement skill learning, and as a consequence default to pedagogical approaches representative of their childhood PE experiences (Moy et al., 2013). For example, a child has traditionally been conceived as a linear system who follows a predetermined path in their learning. Traditional teaching approaches, therefore, have tended to adhere to a linear pedagogical (LP) approach (Moy et al., 2013; Vinson et al., 2016). In PE, LPs are

typically characterised by the teacher prescribing an ideal movement model that a learner aspires to achieve through repetitive practice of basic skills in highly structured, isolated, and decontextualised lessons that follow a sequential order (Wickens, 1989; 1997). Previous scientific literature has reported traditional PE teaching that aligns with an LP approach to be effective for developing children's MSCs (Dudley et al., 2011; Morgan et al., 2013; Tompsett et al., 2017; Wick et al., 2017). However, contemporary evidence from an ecological perspective has challenged the assumptions of a traditional LP approach to PE (Chow, 2013). Therefore, it is important to understand and consider alternate theoretical approaches to MSC learning.

From an ecological perspective, individuals are inextricably linked to the environment (Handford et al., 1997). Specifically, a learner's movement competencies cannot be fully understood without specific reference to the environmental context within which they emerge (Renshaw et al., 2010). Furthermore, individuals have long been viewed as complex adaptive systems that display self-organising tendencies in interaction with constraints present in the environment (Kelso & Schöner, 1988; Schoner & Kelso, 1988). Constraints are important as they form the boundaries within which learners strive to self-organise and produce functional movement solutions (Newell, 1986). Briefly, Newell (1986) first classified constraints as individual, task, and environment (see Newell, 1986, for further detail). As learners explore and discover individual movement solutions their MSC will emerge through nonlinear periods of sudden progression, regression, and no change (Kelso, 1995). The nonlinearity of MSC proposed from an ecological perspective conflicts with traditional LP approaches that prescribe ideal movement models for all learners to aspire to achieve (Chow, 2013). From an ecological perspective, a teaching approach that accommodates the needs of a nonlinear learner is required.

Contemporary theoretical and practical advances in PE have advocated for the implementation of a nonlinear pedagogy (NP) (Chow et al., 2016; Lee et al., 2017; Renshaw et al., 2010; Roberts et al., 2018). Principles of NP pertaining to assessment, lesson design, instruction delivery, and provision of feedback support teaching practices that accommodate the nonlinearity of movement skill learning (Chow, 2013). Specifically, the principles of NP are: (1) representativeness (e.g. children are tasked with moving like various animals from Charlotte's Web), (2) constraints manipulation (e.g. changing the shape, size, weight of a ball played with), (3) attentional focus (e.g. create an external focus of attention for a distance throwing challenge by moving a target further away from the child), (4) task simplification (e.g. increase the size of a target being aimed at), and (5) exploratory learning (e.g. a teacher may ask "how could you solve this movement problem in a different way?") (see Chow 2013 for an in depth discussion). Primary school PE literature has purported teaching approaches grounded in the principles of NP to be effective at enhancing sports skills of children Lee et al. (2014) and facilitating perceived competence, autonomy, and relatedness (Lee et al., 2017). The satisfaction of these basic psychological needs is paramount in providing contexts within which learners are motivated to learn (Chow, 2013). Specifically, Lee et al. (2014) found that a 4-week NP PE intervention enhanced movement skill proficiency in a tennis-based skill task whilst catering for individual learner differences through the exploration and discovery of individual functional movement solutions. Nonetheless, in general, articles discussing NP approaches to PE have commented on the lack of collaboration between pedagogues and movement scientists, with a specific need for in situ representative scientific investigation (Renshaw et al., 2010; Roberts et al., 2018). Further, NP approaches challenge traditional LP approaches to PE in that LPs may not best support MSC development, thus a comparison of NP and LP approaches impact upon children's MSCs is warranted.

When developing children's MSC, there is a need to ensure that the movement skills being learned in PE are representative of the physical activities that children regularly engage in. In the realm of children's movement science, a large body of existant literature has assessed movement skill competency using various fundamental movement skills (FMS). Briefly, a FMS is defined as "an organised series of basic movements that involve the combination of movement patterns of two or more body segments" (Gallahue & Donnelly, 2003, p. 52). FMS are typically categorised as locomotor (e.g., running, jumping), object control (e.g., throwing, catching), or stability (e.g., balancing, landing) (Gallahue & Donnelly, 2003). Traditional FMS assessment batteries isolate skills into single tasks and score performance against a predetermined ideal criterion movement model. The assessments are easy to implement and replicate whilst allowing researchers to draw comparisons across time (Hardy et al., 2013) and context (Barnett et al., 2016; Morgan et al., 2013). However, the assessment of a child's MSC in this way conflicts with an ecological perspective of movement skill (Handford et al., 1997; Kelso & Schöner, 1988). Specifically, it fails to account for the inextricable link between the child and their environment (Gibson, 1979). Thus, from an ecological perspective, MSC should be assessed utilising methods representative of child's play (e.g. running, jumping, landing, tumbling, tagging, changing direction). Therefore, the aim of the present study was to investigate the effects of a NP approach in primary school PE on children's MSC compared with a traditional LP approach, using assessments representative of children's play. It was hypothesised that both NP and LP children's MSCs would significantly improve during the intervention period. Furthermore, that the NP group would retain the improvements in MSC and the LP group would lose their MSC improvements during the retention period. This study is significant in that it contributes to a limited area of research regarding the impact of a NP approach to PE upon young children's MSC in a primary school setting. Further,

this study assessed the retention of any changes in children's MSC beyond the intervention period.

## Methods

### *Experimental Approach to Problem*

A quasi-experimental study with nonrandom participant assignment was conducted during the 2019 (Oct – Dec) school year. A repeated measures design was utilised to examine the effects of a NP approach within a Physical Education setting on MSC. Performance was assessed by the completion of tasks involving running and jump-landing (i.e., Harre Circuit Test), and tagging and changing direction (i.e., Wann time-to-contact judgement task). All assessment variables were analysed at three time points: baseline, post-intervention and retention.

Two classes from separate primary schools located in Auckland, New Zealand were recruited for this study. Both schools had a variety of equipment (e.g., balls, bats, cones, nets, hoops, hurdles, mats, skipping ropes) and space accessible to them for indoor (e.g., hall) and outdoor lessons (e.g., grass field, playground, court). Participants were placed in either a NP or LP group dependent upon the school they attended. An initial study ran for 9-weeks, consisting of baseline testing in week-1, a PE intervention during weeks 2-8, post-testing in week-9, and retention-testing 13-weeks post intervention. These time periods were utilised as they aligned with the New Zealand school term and holiday calendar. The NP group participated in 90-100 minutes of PE per week, which was completed over three PE lessons ranging from 25-40 min. All NP lessons had a learning focus representative of child's play (i.e., jump-landing, rapid stopping, tumbling, tagging, changing direction) in a variety of contexts relating to sports or physical activities of the children's choice. Learning foci were cycled on a bi-weekly basis to ensure an equal amount of time was spent on each (Table 1). The LP

group participated in 90-100 minutes of PE per week and this was completed over 5 lessons per week; two 30-minute sport skill lessons and three 15-minute physical fitness lessons per week. To ensure both training groups remained aligned with the respective pedagogies consistently throughout the study period, the lead author attended all PE sessions of the NP group and multiple check ins with the LP group to ensure their practices didn't change during the study period. He possessed extensive experiential knowledge and experience of authentic representations of both teaching approaches.

*Table 1. Example weekly physical education schedule of nonlinear pedagogy group.*

| Week | Movement Focus | Lesson | | |
|---|---|---|---|---|
| 1 | Changing direction | Whole year group Lesson 1 | Individual class Lesson 1 | Individual class Lesson 2 |
| 2 | Changing direction | Whole year group Lesson 2 | Individual class Lesson 3 | Individual class Lesson 4 |
| 3 | Jump-Landing | Whole year group Lesson 1 | Individual class Lesson 1 | Individual class Lesson 2 |
| 4 | Jump-Landing | Whole year group Lesson 2 | Individual class Lesson 3 | Individual class Lesson 4 |
| 5 | Rapid stopping | Whole year group Lesson 1 | Individual class Lesson 1 | Individual class Lesson 2 |
| 6 | Rapid stopping | Whole year group Lesson 2 | Individual class Lesson 3 | Individual class Lesson 4 |

The PE lessons of the NP group were guided by the NP principles outlined by Chow (2013). Specifically, the principles of constraints manipulation, functional variability, and attentional focus. Each NP lesson had a learning focus centred upon tasks representative of child's play, maximal time on task, variable challenges, and reflection. The first lesson of each week was utilised to introduce the movement learning focus for the week to all children. This was achieved by teachers designing a variety of tasks for the children to sample in small groups (<6 children) that all directly related to the week's movement learning focus. Notably, in the subsequent lessons the NP programme further accommodated individual learner needs by designing tasks of appropriate challenge, achieved by the freedom for children to choose and modify task

design, equipment utilised, and peers played with. To ensure the learning remained aligned with the learning focus of the lesson, the classroom teacher would consistently 'check in' with all children to guide learning and share ideas. For example, via the use of questioning "Can you show me where in this activity you change direction?"

The LP group's lessons were representative of this school's usual PE teaching practices as observed over numerous lessons by the lead author prior to the commencement of this study. Specifically, a FMS was selected as a lesson focus and taught via practices reflective of the classroom teacher's previous PE experiences. The PE lessons were representative of a traditional linear model of learning whereby lessons were characterized by; (1) isolated decontextualized skill practice, (2) step-by-step repetition of skill models presented by the teacher, (3) verbal instructions and corrections on movement technique provided by the teacher, and (4) application of the skill into a whole class game context. As per usual practice of the LP group's weekly schedule, a physical fitness component was also conducted consisting of 10-15-minutes of jogging, fitness circuits and/or video imitation dancing.

Both NP and LP groups conducted their respective PE lessons at consistent times throughout the period of study. All lessons were delivered by the children's respective NZ certified female classroom teacher. Prior to this study commencing, the lead researcher visited the NP and LP group teachers with their respective classes. Specifically, they worked alongside the NP group teacher for single 10-week school term in support of aligning their PE teaching practices with the principles of a NP approach. Explicitly, this involved the lead researcher role modeling PE lessons by delivering PE lessons, observing the NP teacher delivering PE lessons, and providing feedback. Separately, the lead researcher visited the LP teacher in their class on multiple occasions to ensure their teaching practices consistently aligned with a LP approach. No pedagogical feedback was provided as the LP group teacher had been adopting a LP

approach to PE for several years prior to participating in this study. During the study period, the lead researcher continued to visit the LP group teacher to ensure alignment with a LP approach. For the NP group, the lead researcher attended all NP group lessons to take notes, be available for the teacher to share their thoughts, and provide feedback regarding teaching practice alignment with a NP approach. If any teaching practices did not align with the principles of NP then action was taken to adjust the teaching approach.

***Participants***

A total of 60 participants began the study. NP group classes were identified by being in the year group that had received support adopting NP approaches to PE throughout 2019, had fully qualified teachers, and had been employed at the school for a minimum of one year. The LP group class was identified firstly as the school were in the same school organizational cluster as the NP group primary school. This was important as it meant the school, teachers, and children were of a similar socio-economic status to the NP group school. Next, the principal of the LP school identified the classes that may be able to be used for the study based on their whole school planning and teacher availability. Importantly this allowed for a similar school day timetable (i.e., 9am-3pm) and for the classes of the LP group to be like the NP group. Lastly following the sharing of research information, the teachers consented to participate in the study. NP and LP class characteristics are presented in Table 2. Children and parents were then invited to participate from classes where the teachers had consented to participate. The invitations were circulated to children and their families directly using the school electronic class notice system, a poster with email contact details to register interest was presented on the classroom noticeboard, and printed information was sent home directly with the children. All child participants required fully signed assent and consent forms with their

parents or guardians and always withheld the right to not consent or participate throughout the intervention with zero repercussion. Data from 46 individuals (m=25, f=21) were included in analysis (Table 2). Fourteen individuals were excluded as a result of missing either a post-test or retention-test session. The NP group consisted of 25 school children (m = 18, f = 7) and the LP group consisted of 21 school children (m = 7, f = 14).

*Table 2. Subject characteristics.*

| | NP (*n* = 25; m = 18; f = 7) | | | LP (*n* = 21; m = 7; f = 14) | | |
|---|---|---|---|---|---|---|
| | Baseline | Post-test | Retention-test | Baseline | Post-test | Retention-test |
| Age (y) | 7.24 ± 0.05 | 7.38 ± 0.05 | 7.64 ± 0.05 | 7.04 ± 0.06 | 7.19 ± 0.06 | 7.44 ± 0.05 |
| Height (cm) | 126.67 ± 1.17 | 127.86 ± 1.1 | 129.71 ± 1.07 | 123.35 ± 1.21 | 124.69 ± 1.23 | 126.26 ± 1.25 |
| Body Mass (kg) | 26.56 ± 0.89 | 26.80 ± 0.94 | 28.25 ± 1.1 | 25.88 ± 1.05 | 26.07 ± 1.08 | 26.88 ± 1.24 |
| BMI ($kg/m^2$) | 16.46 ± 0.35 | 16.28 ± 0.35 | 16.66 ± 0.42 | 16.92 ± 0.51 | 16.68 ± .50 | 16.76 ± 0.60 |

*Note.* NP = nonlinear pedagogy group; LP = linear pedagogy group. Data are presented as mean ± *SD.*

Inclusion criteria were as follows: (1) a child of the participating primary school class, (2) free from injury/illness that would contraindicate participation, and (3) provided written informed assent (children) and consent (legal guardian) prior to the study start. This study was approved by the Ethics Committee of Auckland University of Technology.

### *Testing Procedure*

Testing was conducted during the same time of day (0900-1100) and tests were performed in a randomized order. All testing took place in the respective school's indoor hall, with participants wearing their regular school uniform. At the study school it was normal practice for children to wear school uniform for PE lessons. During the pre-test session children had the choice to wear their usual footwear or barefoot (common practice in New Zealand), the children's choice was then noted by the

assessor to make sure the children completed the post-test and retention-test with the same footwear or lack thereof. Height, weight, and BMI were evaluated using standard protocols. Each physical assessment was demonstrated by the assessor after which the subject participated in a familiarization trial plus three test trials. The best performance was used for further analysis. The MSC assessments utilised in this study were selected for their representativeness of children's play, facilitation of individual variances in assessment completion, and simplicity in that they could be utilised by a generalist primary school classroom teacher in the future.

*General motor coordination test*

The Harre Circuit Test (HCT) is a popular test widely used in scientific literature to assess a participant's ability to coordinate complex motor tasks (Trecroci et al., 2015), and has been previously used with child populations (Chiodera et al., 2008; Dallolio et al., 2016; Lucertini et al., 2013), with previously reported intraclass correlation coefficient of 0.93-0.96 in primary school aged populations (Greco, 2020; Greco et al., 2019; Trecroci et al., 2015). Participants were instructed to complete the course as quickly as possible. The HCT begins with a forward somersault onto a gym mat, followed by three consecutive passages over and under three hurdle obstacles designed to break apart upon contact, and turning around a centrally positioned cone (Figure 3). Time to complete the circuit was recorded using double beam timing gates (Swift Performance, Australia) with the best performance utilised for further analysis. Three trials were performed. When a test was unsuccessful (e.g., touching the central cone), subjects had a further opportunity to perform the trial.

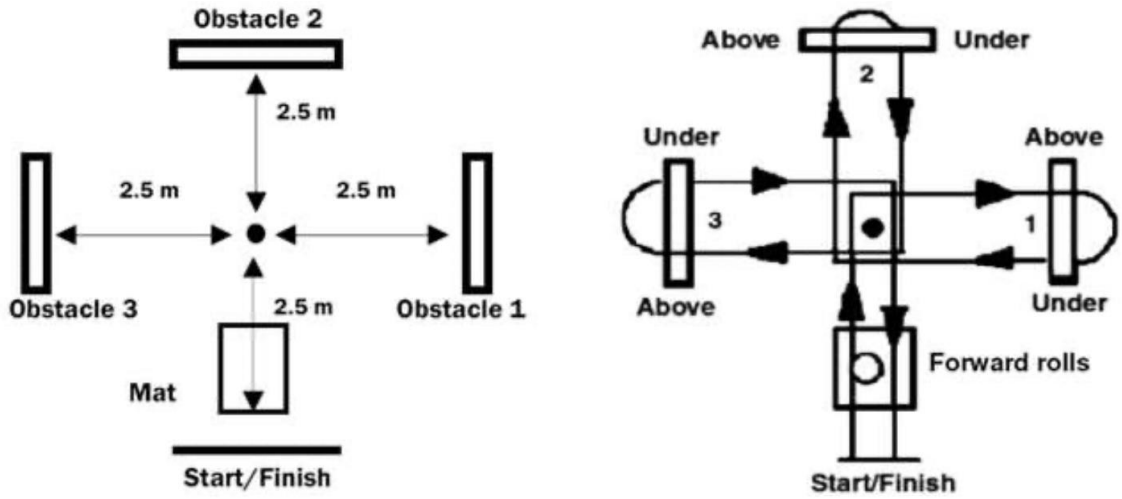



*Figure 3: Scheme of the Harre Circuit Test*

*Time-to-contact judgement task*

Assessment of time-to-contact judgement aligned with the methods of Wann et al. (1993) who also reported the test as reliable in child populations (SE $\tau$ = 0.02 ) (Wann et al., 1993). The task involved sequencing the following activities; run 8.5m, touch target, 180° turn, run 8.5m back to the starting point. The target was a bright coloured circle 16cm in diameter positioned at the height of the child's eye level upon a fixed partition. Participants were instructed to run as quickly as possible, 'tag' the target, and run back as quickly as possible. The target's position was fixed but loose, so if children attempted to use the target to assist them in stopping then the target would fall over and the trial would be considered void. Three trials were performed. If a test was unsuccessful (e.g., the target was knocked over), the assessor shared any necessary instruction and the subject was asked to repeat it. The criterion for a successful trial were to: (1) run in a straight line; (2) run at reasonable speed, and (3) not run around the target. Time to complete the circuit was recorded using double beam timing gates (Swift Performance, Australia) with the best performance utilised for further analysis.

### *Statistical Analyses*

Changes in general motor coordination and time-to-contact judgement were assessed using a repeated-measures analysis of variance with time as a within-subjects factor (baseline, post, retention), pedagogical approach and gender as between-subject factors, and BMI as a covariate. This analyses was specifically run to identify a time by group interaction. Data were screened for normality and outliers. Data are reported as means ± standard deviations (SD), with significance set at $p \leq .05$. When group by time interactions reached the level of significance, post-hoc Bonferroni tests were computed with significance adjusted to $p \leq .05$. Pre-, post-, to follow-up-test effect size (ES) for each assessment was calculated using the following formula: ES = [(post-testing mean – pre-testing mean) / mean of the standard deviations]. The magnitude of effects was determined in accordance with Cohen (1988). Effect sizes were interpreted as small (*d = .2*), medium (*d = .5*), and large (*d = .8*) based on benchmarks suggested by Cohen (1988). All statistical analyses were performed using IBM SPSS Statistics (v. 21, New York, U.S.A.).

## Results

Participants completed the study according to the procedures outlined, and no injuries were reported. The NP and LP groups had participation rates of 94% and 100%, respectively. Subject data was removed for not meeting the acceptable inclusion criteria for each test, which resulted in a total of 27 (NP = 18, LP = 9) and 35 (NP = 14, LP = 21) for the Harre circuit test, and time-to-contact judgement task performance analyses, respectively. There was no significant time by group interaction for any anthropometric variables (i.e., height, body mass and BMI) during the study period ($p > .05$). There were no significant between group differences in any baseline performance test measure ($p > .05$).

### *General Motor Coordination*

A significant time by group interaction was observed after the study period indicating that training-induced gains were observed over time from baseline to retention test. Specifically, the NP group made greater improvements (relative to LP) in the reduction in time taken to complete the HCT between baseline and retention with a small effect size ($p$ = .003, $d$ = .235) (Figure 3). Pairwise comparisons revealed that no significant differences between groups existed at baseline and post-test ($p$ > .05), however, a level of significance was reached at retention-test ($p$ < .05). A significant time effect for baseline to post-test, baseline to retention-test, and post-test to retention-test was exhibited for NP group only ($p$ < .05). Figure 4 provides a graphical reference illustrating the individual percentage changes for the NP and LP groups for general motor coordination performance from pre-test to retention-test.

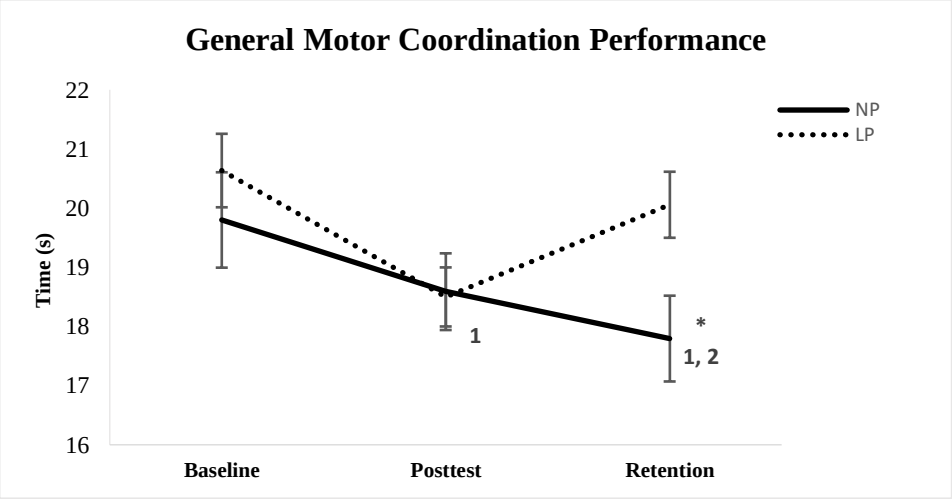



*Figure 4: Changes in Harre Circuit Test performance.*

*Note.* 1 Denotes significant ($p$ < .05) difference with baseline values; 2 denotes significant difference with post-test value; * denotes significant differences between groups; NP = nonlinear pedagogy group; LP = linear pedagogy group.

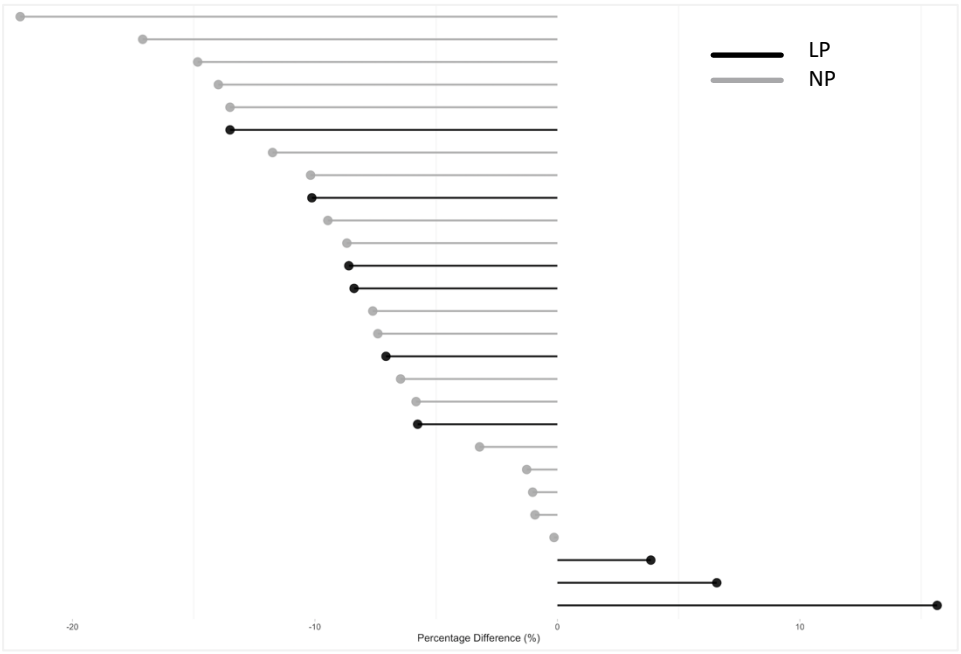



Figure 5. Graphical illustration of individual percentage change for Harre Circuit Test performance between pre-test and retention-test timepoints.
*Note.* NP = nonlinear pedagogy group; LP = linear pedagogy group.

***Time-to-Contact Judgement***

A significant time by group interaction was observed after the study period indicating that training-induced gains were observed over time from baseline to retention test. Specifically, the NP group made greater improvements (relative to LP) in the reduction in time taken to complete the time-to-contact judgement task between baseline and retention with a trivial effect size ($p$ = .022, $d$ = .119) (Figure 5). Pairwise comparisons revealed no significant differences between groups at any individual timepoint ($p$ > .05). A significant time effect for baseline to retention-test and post-test to retention-test was exhibited by NP group only ($p$ < .05). Figure 6 provides a graphical reference illustrating the individual percentage changes for the NP and LP groups for time-to-contact judgement performance from pre-test to retention-test.

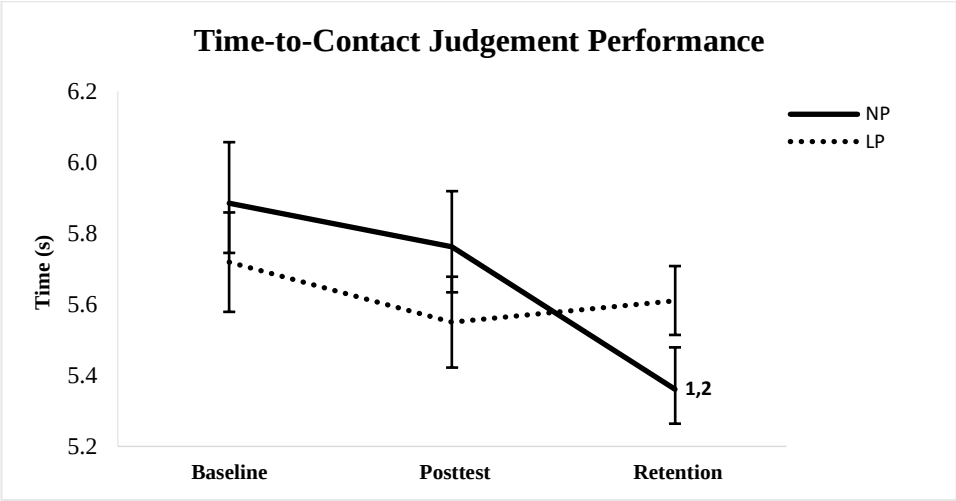



Figure 6. Changes in Time-to-Contact Judgement Test performance.
*Note.* 1 Denotes significant ($p < .05$) difference with baseline values; [2] denotes significant difference with post-test value; NP = nonlinear pedagogy group; LP = linear pedagogy group.

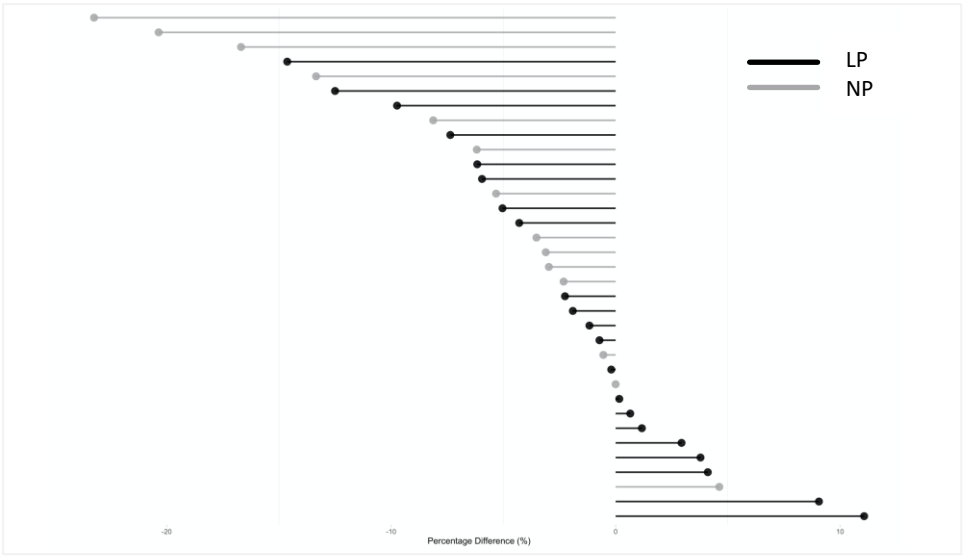



Figure 7. Graphical illustration of individual percentage change for Time-to-Contact Judgement Test performance between pre-test and retention-test timepoints.
*Note.* NP = nonlinear pedagogy group; LP = linear pedagogy group.

## Discussion

The primary aim of the present study was to investigate the effects of a NP approach to primary school PE upon the children's MSC compared with a traditional LP approach, using assessments representative of children's play. The first hypothesis that both groups would significantly improve their MSC during the intervention period was partially supported. The NP group did significantly increase HCT performance from

pre-test to post-test with no significant change in TTCJ. However, the LP group did not significantly increase HCT or TTCJ performance. The second hypothesis that the NP group would retain and the LP group would lose MSC improvements was not supported. The NP group significantly increased HCT and TTCJ performance post-test to retention-test and the LP group had no significant difference in HCT or TTCJ performance from post-test to retention-test. The main findings of this study were; 1) a significant time by group effect from baseline to retention test timepoints for both the Harre Circuit Test (HCT) and Time to Contact Judgement (TTCJ), 2) there was no significant time by group effect from baseline to post-test timepoints, and 3) the NP group had significantly greater performance in the HCT ($p$ = .003) and TTCJ compared with the LP group at a 13-week retention test timepoint. In summary, the main findings support the notion that NP is an effective pedagogical approach to PE for improving the MSC of primary school children.

A significant difference in MSC performance between the NP and the LP group was seen in the 13-week retention test but not the 9-week intervention post-test. This outcome adds to the discussion of previous literature that proposed, to detect a change in MSC, longer studies using NPs compared with LPs are required (Lee et al., 2014). For example, Lee et al. (2014) reported enhanced tennis skill performance following a 4-week nonlinear pedagogical approach to primary school PE, however, no significant difference existed between the NP and a comparative LP approach. The authors suggested that learners may take longer to discover and explore their movement solutions using NP approaches to MSC learning. The present study supports this notion with the finding of significant between group differences in MSC at the 13-week retention test, yet not at the post test time timepoint. More specifically, following the intervention period the NP group improved their MSC with time, while the LP group's MSC trended toward baseline performance. The trending decline of the LP group MSC

aligns with previous literature investigating the retention of fitness-related measures in child populations (Faigenbaum et al., 2013; Faigenbaum et al., 1996; Granacher et al., 2011; Tsolakis et al., 2004). Pertinent to this study, Faigenbaum et al. (2013) reported that 7-year old children retained fitness-related performance, however saw a decline in skill-related performance measures following the cessation of the intervention. The authors noted that the degree of strength, power, and skill required to perform the movement may influence the detraining response in young children. For example, from Faigenbaum et al. (2013), more complex movements requiring whole body coordination and the production of maximal levels of power, such as the long jump, may be more susceptible to detraining effects than movements that require less whole body coordination and lower levels of power, such as curl-up performance. Also, Faigenbaum et al. (2013) speculated that two 15-minute fitness program interventions per week for 8-weeks may not have been a great enough stimulus to stimulate sustained improvements in lower-body power. In agreement, our study also reported that a 9-week intervention was not sufficient in preventing the loss of MSC improvements in the LP group. However, MSC of the NP group did not decline post intervention. The difference in LP and NP groups' retention of MSC improvements may indicate that the teaching approach adopted in PE lessons can influence the retention of skill-related performance in children. Nonetheless, it is important to view these findings in light of the fact that this study had a small sample size (n=46) a natural byproduct of this research being conducted in situ at a New Zealand primary school across a longitudinal time period (>20-weeks). However, a larger sample size may have allowed for more representative results that could be transferred to a broader array of settings. This would be a worthwhile consideration for future NP approaches to primary school PE research. Nonetheless, our findings support the notion that NP approaches to PE may take longer

to support the development of MSC and suggest changes in MSC become more permanent as learners discover and explore their movement solutions.

In this study the significant improvement of the NP group's MSC is pertinent as all children were directly involved in the designing and modification of their PE lesson content. Improvements of MSC may have occurred due to the purposeful connection of PE lesson content to the physical activity interests of each child. For example, in the NP group, PE lessons consisted of movement-based problem-solving activities that were co-created by the children and their classroom teacher. The activities intentionally utilised a variety of equipment and movement problems that could be replicated and adapted by children in their own contexts (i.e., home, neighbourhood, beach, park) for continued play and practice to occur beyond the PE lesson. This approach is unlike much previous MSC intervention literature that is typically characterised by direct instruction from teachers or external movement experts (Dudley et al., 2011). Learners repetitively practice basic skills modeled by the teacher using predetermined sets of equipment in decontextualized environments (Moy et al., 2013). Despite short-term MSC improvements following these interventions, such environments have been associated with a reduction in intrinsic motivation (Moy et al., 2013). Juxtaposed to this, NP learning environments have been linked to heightened learner intrinsic motivation (Moy et al., 2015). This is important as intrinsic motivation is directly linked to behaviours such as effort, persistence, and problem solving that are critical to continued engagement and learning (Chow, 2013). Thus, we suggest that an enhanced intrinsic motivation in combination with access to the necessary knowledge and equipment has likely contributed to the long-term enhancement of children's MSC seen in the present study. Explicit measures of intrinsic motivation were beyond the scope of the present study, however, we propose such measures would be a worthwhile addition

to future MSC research in child populations. This provides a rationale for the qualitative research conducted in Chapter 6 as a more thorough analysis of experiences is needed.

Individual response data was included in the analysis as it aligned with the methodological foundations of this thesis. Ecological dynamics theory acknowledges the individuality of the learning process, thus it would be remiss to utilise group mean data only to show changes in MSC.

Individual data allows the reader to see variances in response to the PE intervention by the participants (see Figures 4 and 6). In this study, group mean data for the HCT showed that the NP group significantly improved MSC compared with LP group from pre-test to retention test timepoint (see Figure 3). Individual response data for the HCT (Figure 4) showed that the top five positive responders to the intervention were all children from the NP group. However, 2 out of the top 10 positive responders were children from the LP group. Figure 4 indicates that the results are not as clear as NP approaches to PE are superior to LP approaches for supporting the development of children's MSCs, instead suggesting that some children may respond as positively to LP approaches to PE. In support of this more nuanced discussion of LP and NP approaches, individual response data for the TTCJ (Figure 6) showed that 4 of the top 10 positive responders to intervention were children from the LP group. So, it does not seem to be as clear as NP is a more effective PE teaching approach than LP to develop children's MSC, as group mean data alone may allude to. Further investigation into the individual variance in response to NP and LP approaches is warranted to explore how and what individuals respond best to from different teaching approaches.

Individual response data can support further exploration of research limitations. Specifically, a limitation of the present study was the low sample size. Individual response data showed that three children out of twenty-seven had a decline in HCT performance from pre-test to retention-test (Figure 4). Notably all three children were

LP group participants. As the LP group had a small sample size (n=9) for the HCT, the performance of these three children likely had great influence on LP group data analysis that reported a trending decline in HCT performance from post-test to retention-test. In combination with the aforementioned positive responder data, the low sample size and negative individual response data adds to the argument for a more nuanced combination of NP and LP approaches to best meet the needs of the individual learner. Nonetheless, future research with larger sample sizes is warranted to better understand individual response to NP and LP teaching approaches to PE.

In the present study no significant difference between boys' and girls' response to the intervention were found. In fact, our findings showed that both genders improved MSC equally following the NP PE programme. Existent PE literature has critiqued traditional teaching practices for acting as a barrier to girls' participation (Flintoff & Scraton, 2006). Specifically, the use of sport based approaches has been critiqued for favouring sport-competent children, whom are typically more skilled boys, and neglecting the MSC development of all children (Kirk, 2003). Conversely, the present study demonstrated that contemporary NP approaches to PE in replacement of games can enhance the MSC of both boys and girls. Nonetheless, our findings were subject to an uneven sample size (n=25, m=18, f=7) and, therefore, further investigations regarding gender differences in MSC development following a NP approach to PE are warranted.

In this study the MSC assessments included time to completion as the primary performance variable. For example, the HCT required children to navigate an obstacle course as quickly as possible without knocking over equipment. Time to completion was used as a primary performance variable for two key reasons: 1) the facilitation of adaptability and individuality of skill, and 2) the task design was representative of children's play. Firstly, ED emphasises the inextricable individual-environment

relationship. Utilising time to completion (e.g., navigate the obstacle course as quickly as possible without knocking over the equipment) allowed for the assessments to be affordance based (e.g., acknowledging individual-environment-task interactions). Further, time to completion facilitated individuality of each child's movement (e.g., children could solve the task in their own unique way) without critique against a predetermined ideal movement model criterion, a limitation of traditional MSC assessment tools. Secondly, attempting to solve movement problems as quickly as possible is representative of real children's play, a key principle of the nonlinear pedagogy approach (Chow, 2013). For example, the requirement to move as quickly as possible, tag a target, and run away from the target as quickly as possible in the TTCJ assessment is movement representative of children's play.

It is important to note that the sole use of time to completion as a performance variable limited the depth of MSC assessment possible in this study. Specifically, variables relating to adopted movement strategies, performance errors, and deceleration profiles would have provided a more comprehensive measure of change in children's MSCs following the PE teaching intervention. The intention of this study was to measure other performance variables during the TTCJ assessment relating to change of direction profiles and reaching strategies to tag the target. For example, using a tape measure fixed to the floor and a camera to capture images to identify specific moments of movement decision making such as the initiating of an arm reach to tag the target. Target tagging strategies were of interest as during initial pilot work I had noticed that children who were able to complete the TTCJ assessment in less time often reached for the target whilst decelerating with a side on body orientation to the target. In comparison, children who took more time to complete the TTCJ often came to a complete halt before tagging the target with a square on orientation to the target. Nonetheless, this finding is anecdotal from personal observation and no objective data

was collected and analysed during the study due to equipment fault at pre-testing. Thus, despite the findings of this study being significant, the results must be viewed considering limitations of the employed MSC assessment tools. See chapter 4 for an in-depth discussion regarding the choice of MSC assessments utilised in this thesis.

In conclusion, this study aimed to provide insight into the teaching and learning of MSC in primary school PE settings. In this study, 9-weeks of a NP approach to PE significantly improved children's MSC (i.e. HCT, TTCJ). Moreover, 13-weeks following the cessation of the PE programme the NP approach group had significantly greater MSC compared with a LP approach group. These findings suggest that a NP approach to PE may be more effective than an LP approach in enhancing children's MSC in a manner that is more permanent. Thus, it seems appropriate that NP approaches to PE to improve MSC are utilised more readily within the primary school sector. Nonetheless, it must be noted that there was no significant between group difference in children's MSC immediately following the 9-week PE programme. This may be due to NP approaches to PE requiring extended periods of time for children to fully explore and discover their individual potential movement solutions. It is recommended that future research should focus on longer-term interventions that seek to ascertain the underlying perceptual and motor mechanisms responsible for the positive changes in MSC account for the mechanisms of which NP improves movement skill competence.

# Chapter 6: A Nonlinear Pedagogical Approach to Primary School Physical Education: A Case Study

This chapter presents an article submitted to the Journal of Teaching in Physical Education that has been accepted subject to minor revisions.

## Prelude

As raised in chapter 4, a MMR approach was adopted in this thesis to facilitate a more nuanced understanding of the impacts of adopting a NP approach to PE in primary school settings. Thus, expanding on the use of quantitative research methods in chapter 5, qualitative research methods were used in Chapter 6. Specifically, semi-structured interviews and focus groups captured teacher and learner experiences of adopting NP approach to primary school PE. The insights gained from the adult and child participants' voice in Chapter 6 provide a deeper insight into the quantitative data generated in Chapter 5 and the research summary presented in chapter 7.

## Introduction

Movement skill competence (MSC) is a global term utilised to reflect various terminologies used in previous literature (i.e., fundamental movement skill, foundational movement skills, general motor coordination) to describe goal-directed movements (e.g., running, throwing, jumping) (Robinson et al., 2015). MSCs during childhood have been related to a myriad of physical activity and health benefits (Gunter et al., 2012; Khan & Hillman, 2014; Proudfoot et al., 2019). Pertinently, children who possess greater MSC are more likely to engage in physical activities in adulthood (Jaakkola et al., 2016). The development of children's MSC through physical education (PE) has been addressed in curricula, national standards, and policies internationally (Dos Santos et al., 2016; Education Wales, 2008; New Zealand Ministry of Education,

2015; SHAPE America, 2015). MSC intervention literature has demonstrated that PE programmes in primary school settings can significantly enhance children's MSCs (Logan et al., 2012; Morgan et al., 2013), particularly when high quality instruction is used with the intervention (Morgan et al., 2013). A linear pedagogy (LP) approach (Moy et al., 2013; Vinson et al., 2016) is a popular example, typically characterised by a prescribed ideal movement model a learner aspires to achieve through repetitive practice of basic skills in highly structured, isolated, and decontextualised lessons (Wickens, 1989; Wickens, 1997). However, despite literature showing a traditional LP approach can improve the MSCs of children (Dudley et al., 2011), other studies have critiqued this methodology, highlighting its inappropriateness for child populations (Atencio et al., 2014; Gagen & Getchell, 2006). Further, traditional teaching approaches in education have been critiqued for dehumanising students as objects to be filled with learning (Broom, 2015). Evidently, traditional LP approaches have been correlated with heightened boredom, humiliation, marginalisation, and passive participation (Bunker & Thorpe, 1982; Ennis, 1999; Mitchell et al., 2006; Ntoumanis et al., 2004; Smith & Parr, 2006).

In contrast, learning environments that foster intrinsic motivation have been shown to increase engagement (Ntoumanis, 2001), student learning (Tjeerdsma-Blankenship, 2008), concentration and effort (Standage et al., 2003), sustained participation in PA (Ntoumanis et al., 2004), and positive psychosocial experiences (Vallerand, 2001). Intrinsic motivation is a drive towards self-improvement and development (Deci & Ryan, 2000) and is essential for long-term learning behaviours. Self-Determination Theory (SDT) provides a theoretical understanding of motivation pertaining to an individual's innate psychological needs (Deci & Ryan, 2000). SDT posits three psychological needs: 1) autonomy – freedom for self-choice and from external control, 2) competence – the ability or perceived ability to deliver effective

performance, and 3) relatedness – the need for interpersonal relations which provide connection (Legault, 2017). When these basic psychological needs are met, heightened learner motivation is likely. For instance, Chróinín et al. (2021) showed that when teaching facilitated shared ownership of learning foci, collaboration on learning activities and attention to individual learning experiences, more positive PE experiences for 9-10 year old children resulted. However, the application of these findings to a other schools is unknown. Thus, to better support the development of children's MSCs, a more comprehensive understanding of pedagogical approaches that satisfy the underlying psychological needs of the learner are warranted.

From an ecological perspective, individuals are inextricably linked to the environment (Handford et al., 1997). Specifically, a learner's movement competencies cannot be fully understood without specific reference to the environmental context within which they emerge (Renshaw et al., 2010). Furthermore, individuals are viewed as complex adaptive systems that display self-organising tendencies in interaction with constraints present in the environment (Kelso & Schöner, 1988; Schoner & Kelso, 1988). Constraints are important as they form the boundaries within which learners strive to self-organise and produce functional movement solutions (Newell, 1986). Briefly, Newell (1986) first classified constraints as individual, task, and environment specific (see Newell, 1986 for further detail). As learners explore and discover their individual movement solutions their MSC will emerge through nonlinear periods of sudden progression, regression, and no change (Kelso, 1995). The nonlinearity of MSC proposed from an ecological perspective conflicts with traditional LP approaches that prescribe ideal movement models for all learners to aspire to achieve (Chow, 2013). Thus, from an ecological perspective, a teaching approach that accommodates the needs of a nonlinear learner is required.

Principles of NP pertaining to assessment, lesson design, instruction delivery, and provision of feedback support teaching practices that accommodate the nonlinearity of movement skill learning (Chow, 2013). Specifically, the principles of NP are; (1) representativeness, (2) constraints manipulation, (3) attentional focus, (4) task simplification, and (5) exploratory learning (see Chow, 2013 for an in depth discussion). Primary school PE literature has showed teaching approaches grounded in the principles of NP to be effective at enhancing sports skills of children (Lee et al., 2014). Importantly, a NP approach can facilitate the underlying psychological needs of the learner paramount to intrinsic motivation (Chow, 2013; Lee et al., 2017). A NP approach can facilitate shared ownership of learning (Renshaw et al., 2010) in representative movement contexts (Seifert et al., 2017). Moreover, the learner-teacher relationship, sense of autonomy, and competence are likely strengthened as interactions are learner-centred and thus more supportive of individual exploration as opposed to critical and instructive (Renshaw et al., 2010). Notably, Moy et al. (2015) reported that when teaching hurdling skills a NP pedagogical approach was superior to a traditional LP approach in participant reported competence, relatedness, and autonomy. Nonetheless, articles discussing NP approaches to PE have commented on the lack of collaboration between pedagogues and movement scientists, with a specific need for in situ representative scientific investigation (Renshaw et al., 2010; Roberts et al., 2018). Thus a pertinent aim of this study was to capture the experiences of adults and children of a primary school changing their pedagogical approach to physical education (PE).

Moreover, in primary school PE investigations, the child's voice has often been missed. This is problematic as little is known about the factors children in primary schools perceive to be important during their experiences of PE. This study attempted to utilise auto-driven photo-elicitation methods (Ford et al., 2017) by incorporating photographs the children had taken themselves into the focus group. Photographs were

used to facilitate discussion between the investigator and subject in addition to creating a framework for the narrative of experiences to be drawn from (Everley & Macfadyen, 2017). Briefly, this can help with facilitating expression, accuracy of interpretation and addressing power distribution between investigator and subject. It was important to support children in better articulating themselves as the child voice can provide a basis of evidence that can guide the provision of positive experiences of PE in primary school settings. The child's voice could provide a clearer understanding of how and what children were learning from PE and how they perceived the teaching approaches adopted in their PE lessons as the children's perspectives guide how they interpret instruction and learn (Lee & Solomon, 1992).

In the present study, we aim to share adults experiences of making change to PE teaching approaches and children's motivational experiences of participating in PE at a New Zealand primary school adopting a nonlinear pedagogical approach to PE.

## Methodology

This case study is grounded within a pragmatic paradigm. Research positioned within a pragmatic paradigm places emphasis upon the practical nature of reality, focusing on what works rather than the search for objective truths (Frey, 2018). A pragmatic paradigm supports a comprehensive approach to the complexity of the research question and the context of the setting (Frey, 2018), in this case a primary school. Further, a pragmatic paradigm connects problems that arise in practice directly to the research process, this allows for the creation of practice-based evidence that can be utilised to enhance, in this instance, teaching practices.

Case study research typically aims to gain insight into a phenomenon through the utilisation of multiple methods of data collection (Carolan et al., 2016). Further, case studies are bound typically by time, place, context and activity, creating the conditions

for researchers to maintain focus and avoid a common problem of being too broad in scope (Baxter & Jack, 2008). This case study was informed by the work of (Stake, 1995; 2005) who classified case studies into three types: intrinsic, instrumental, and collective. This research adopted an instrumental case study approach (Stake, 1995). The purpose of an instrumental case study is particularisation and not generalisation, meaning the aim is to provide an insight into an issue and to engage the reader in a process of discovery (Stake, 1995). The case studied in this research focused on the PE practices of a primary school and drew upon the perspectives of a primary school principal, teachers, and children. This study was approved by the Ethics Committee of Auckland University of Technology.

The principal and their leadership team's motivation to be involved in this project stemmed from the desire to support more children to move competently in order to engage with physical activity opportunities as they arose in the future. However, with a large number of students and over fifty members of teaching staff this had previously proven challenging. The principal and their leadership team were therefore interested in learning more about supporting teaching staff to provide meaningful movement experiences for their classes that would facilitate the development of MSC. During this study, teachers had received three 10-week school terms, totaling more than 60-hours, of onsite professional development pertaining to movement skill development utilising a NP approach to PE. The onsite professional development was provided by the author.

### *Study design*

A single primary school located in Auckland, New Zealand, was utilised for this case study. The primary school had invested in a PhD student (lead author) to conduct research at the school regarding the development of their PE teaching practices. Specifically, the school principal and their leadership team wanted to better align their

PE teaching practices with the school learning vision. The project culminated in the development of a series of professional development opportunities delivered onsite by the lead author employing a NP approach to PE. The professional development consisted of several whole year-2 teaching group meetings and the author working alongside the teachers during their PE lessons provoking thought, action, and reflection regarding the use of a NP approach to PE. The group sessions were held in the school staffroom during the teachers allotted time of professional development (1-2 times per term). The professional development content was centred upon planning, preparing, delivering and reflecting upon adopting a NP approach to PE (as outlined by Chow, 2013) in a primary school setting, with a specific focus on constraints manipulation, functional variability, and attentional focus:

*Constraints manipulation:* Identifying key constraints in the lesson. Changing equipment shape, size, weight.

*Functional variability:* Challenge the children to solve the same problem in as many ways as possible. Encourage the use of the various equipment available to solve movement problems.

*Attentional focus:* An external focus of attention for distance throwing skills targets could be adopted by manipulating target sizes and positioning.

The lead author worked directly alongside five year-2 classroom teachers for four 10-week school terms during the 2019 school year. Classes at the school participated in 90-100 minutes of PE per week, divided over three 25–40-minute lessons, totaling 15-17 hours per term. All NP lessons were designed to be representative of child's play (i.e., jump-landing, rapid stopping, tumbling, tagging, changing direction) in a variety of contexts relating to sports or physical activities of the children's choice. All PE lessons were structured to facilitate shared ownership, maximal time on task, variable challenges, and reflection. The first PE lesson each week

introduced a weekly learning focus to all children, achieved by teachers designing a variety of movement-based tasks for the children to explore in small groups (<6 children). The following two lessons each week further accommodated individual learner needs by facilitating the freedom for children to choose, design, and modify task design, equipment utilised, and peers interacting with. To ensure the learning remained aligned with the learning focus of the lesson the classroom teacher would consistently 'check in' with all children to guide learning and share ideas. Check in was achieved by, for example, the use of questioning "Can you show me where in this activity you are using your landing skills?".

For the full duration of this study lessons were conducted by the children's respective NZ certified classroom teacher. Further, the classes had access to a variety of equipment (e.g., balls, bats, cones, nets, hoops, hurdles, mats, skipping ropes) and space accessible for indoor (e.g., hall) and outdoor lessons (e.g., grass field, playground, court).

***Participants***

A principal, year-2 classroom teachers, and year-2 (7-years old) students were recruited from the primary school to participate in separate focus groups. The principal's interview was conducted by the primary supervisor with the author present. The primary supervisor led the principal's interview and teachers focus group to limit any possible bias that may have influenced the interview due to the ongoing relationship between the principal, teachers and author who worked onsite throughout the study period. All year-2 teachers (n = 5) were invited and accepted to participate in the teachers' focus group. All year-2 children who participated in the quantitative study were invited to participate in the present study, following the same recruitment process as presented in the previous chapter. Four children were then randomly selected from the group of children

who agreed to participate in the focus group. A group of four children was decided upon in alignment with the guidance from previous research considering the composition of focus groups with children for desired research outcomes {Gibson, 2012 #404}{Gibson, 2007 #374}.

*Table 3. Presentation of research participants and methods.*

| | **Participant** | **Sex** | **Data Collection Method** | **Data Analysis** |
|---|---|---|---|---|
| **School Principal** | School Principal | Male | Interview<br>Conducted by 2nd author<br>1st author present | Audio recordings transcribed<br><br>General inductive approach analysis (Thomas 2006)<br><br>Individual key themes identified<br><br>Cross group key themes identified |
| **Year 2 Teachers** | Teacher 1<br>Teacher 2<br>Teacher 3<br>Teacher 4<br>Teacher 5 | Female<br>Female<br>Female<br>Male<br>Female | Focus group<br>Conducted by 2nd author<br>1st author present | |
| **Year 2 Children** | Child 1<br>Child 2<br>Child 3<br>Child 4 | Female<br>Female<br>Female<br>Male | Autodriven photo elicitation<br>Focus group<br>Conducted by 1st author<br>Female teacher present | |

### *The School*

The primary school in this study has 750-850 students aged 5-12 years. The school is situated in the north of Auckland, New Zealand, and has a government district rating 9 (out of 10), meaning it is in a high socio-economic community setting.

### *Interviews and Focus Groups*

Interviews with the principal and focus groups for teachers, and students were conducted separately. All interviews and focus groups were conducted during the fourth and final term of the school year, following three 10-week school terms of adopting a NP approach to PE.

All interviews and focus groups lasted between 30 and 45 minutes ensuring the engagement of all participants without placing too much of a burden on their time. The principal's interview was conducted during school time to accommodate the work schedule of the principal. The children's focus group was also conducted during school time to allow for the focus group to occur with proximity to the end of the PE lesson. The teachers' focus group took place during a break that aligned with all the teachers working schedules. All participants were informed in advance about the purpose of the study and the measures taken to ensure confidentiality throughout. Signed consent (and assent where appropriate) was obtained from the participants and parents/guardians of the child participants. All interviews and focus group discussions were audio recorded and transcribed. Prior to conducting the interview and focus groups, I completed pilot work within the case study school with a convenience participant sample of teachers and children. The aim of the pilot work was to allow me as the researcher to practice my interview technique and test the quality of the questions in alignment with the desired outcomes of the interview. Importantly, the pilot work was essential to developing the methods of better capturing children's voice. Multiple methods were tested with age

matched children at the school including, conversation based individual and small group reflective discussions, drawing of PE experiences using paper and coloured pencils, and the use of iPads during the PE lesson and the focus group. The learning from the pilot work process shaped the eventual methods and led to the design of the focus group methods employed in this study. For example, allowing access to iPads during the focus group proved distracting for the children and often to led to other apps being open and recordings being taken during the focus group session, ultimately reducing the quality of reflective insight that was generated.

A single visit semi-structured focus group was conducted to allow for open-ended questions and space for follow-up questioning to gain a better understanding of participant experiences (Patton, 2002). A focus group setting is proposed to assist in generating discussion from participants (Liamputtong & Ezzy, 2005) and can allow for discussion between participants themselves, generating a broad range of data whilst avoiding general consensus (Krueger & Casey, 2000).

### *Principal Interview*

A semi-structured interview was conducted with the school principal. The principal has more than 20-years' experience in the education sector with 10+ years in principal and deputy principal positions. The interview took place at the school, in the principal's office for comfort and convenience at a date and time decided by the principal.

### *Teachers Focus Group*

Five primary school teachers (f=4, m=1) aged between 30 and 60 years of age participated in the focus group. The sex breakdown of teacher participants in the focus group was representative of the sex distribution at the school where 1 in 7 teachers is male. The focus group was conducted in a quiet conference room commonly utilised by

the teachers. The focus group was led by the primary supervisor (male moderator, trained and experienced in qualitative methods), with the author (lead researcher at the school) present. The focus group was led by the second author so as to avoid any potential conflict of interest and bias that the lead author may have brought to the focus group as he was familiar with the teaching staff having worked closely with them during the study period at the school.

All teachers were teaching a year-2 class at the time of this study and had a minimum of three 10-week school terms experience of planning, delivering, and reflecting upon the use of a NP approach to PE with their class.

During the focus group, teachers were asked to comment on their experiences of utilising a NP approach to PE with their classes. The questions in this study were centred around the teacher's broad experiences, feelings, and behaviours within the PE lessons. For example, "Can you describe what it is that you are trying to do in your PE classes?", "What have you had to develop in your toolbox?", "Where would you like to take PE next?", "You have changed your teaching approach, how would you describe it now compared to before?", "What helped you to embrace the chaos of a novel pedagogical approach?" and a series of other questions and follow-up questions were used to elicit responses regarding teaching experiences using a NP approach to PE.

### *Children's Focus Group*

Four primary school children (f=3, m=1), 7 years of age participated in the focus group. Child-generated photo-elicitation methods were adopted to elicit a deeper understanding of the children's experiences of PE (Raby et al., 2018). Specifically, prior to the focus group, the children were issued with an iPad (a device they are culturally familiar with and frequently use within their regular classroom setting) to capture their experiences of a PE lesson. The children were asked to photograph their activities during the PE lesson

in the presence of the classroom teacher and first author. Children were instructed to only photograph the activities they were partaking in and the place the lesson was conducted. The lead author was present for the whole lesson to ensure the context within which the photos were taken did not directly influence the photos taken. For example, an adult teacher suggesting a child should take a photo of a specific element of the lesson. Following the lesson the iPads were returned to the first author, who prepared photographs for the focus group discussion.

To allow for all children to feel as comfortable and safe as possible, the focus group was conducted by the first author and female teacher from the school (both known to the children), in a room near their usual classroom setting (Everley & Everley, 2018). Following guidelines on conducting focus groups with children (Ford et al., 2017), photographs were used to facilitate discussion between the first author and children in addition to creating a framework for the narrative of experiences to be drawn from (Everley & Macfadyen, 2017). Previous research has suggested that the use of photographs can help with facilitating expression, accuracy of interpretation, and addressing issues of power distribution between the focus group moderator and children (Ford et al., 2017). This process allowed for the use of open-ended questions and follow-up questioning to gain a more thorough understanding of the children's experiences (Patton, 2002). The focus group was audio recorded using the dictaphone on a mobile phone, as this technology was culturally familiar to the children being interviewed (Everley & Everley, 2018).

### *Data Analysis*

All interview and focus group transcripts were analysed utilising a general inductive approach following the steps outlined by Thomas (2006): Format raw data files, close reading of text, creation of categories, overlapping coding and uncoded text,

and continuing revision and refinement of category system. All transcripts were imported into NVivo12 qualitative analysis software and analysed by the first author utilising Thomas (2006) general inductive approach. The general inductive approach was utilised as it provides a simple, straightforward approach for deriving findings in the context of focused evaluation questions, without limiting the scope of the findings (See Thomas, 2006, for in depth discussion). Regular meetings between the principal investigator and supervisory teams took place to discuss the coding and to refine codes as necessary. Codes were categorised and themes were then identified from the interview and focus groups. Lastly, transcripts were analysed to identify common themes across the principal, teachers, and children interview and focus groups and reviewed for their relevance to the overarching research question.

## Results

Following the interview and focus groups, eleven themes were identified, comprised of 3-4 themes per participant group (see Figure 7).

*Figure 8. Overview of themes raised by the principal, teachers, and children regarding PE.*

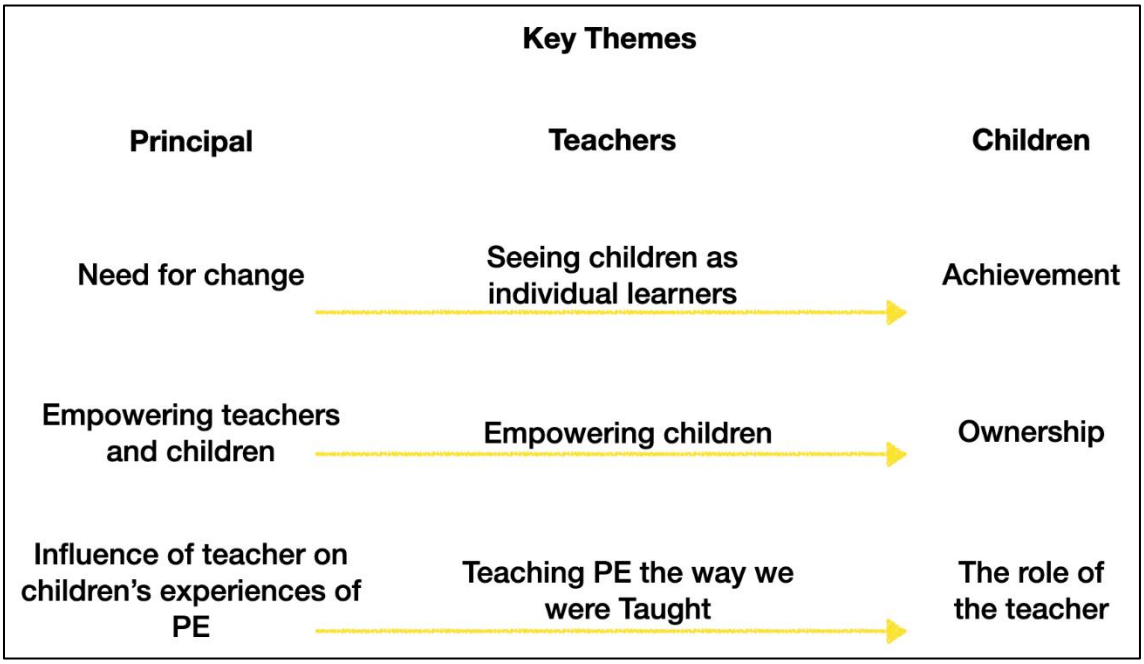


Figure 7 displays the themes for each participant group vertically and the yellow lines highlight the interlinking of themes across participant groups. For example, the principal's theme of 'empowering teachers and children', the teacher's theme of 'empowering children' and the children's theme of 'ownership'. The results will be presented from left to right of Figure 7, starting with the principal, then the teachers and lastly the children. All names referred to in the text are pseudonyms.

### *1. The Principal*

The principal shared the challenges faced in supporting change in the PE practices at the school. The dominant themes identified in our analysis of the interview were; a need for change; empowering teachers and children; and the influence of the teacher on children's experiences of PE.

*A need for change*

The principal, the principal's leadership team, and teaching staff had a very clear mission at the school to "be the best you can be". The principal elaborated "it is about taking an individual child and giving them a whole range of learning through their six years here that will enable them to figure out who they are and the things they love doing". The principal believed this outcome could be achieved through "choice" and "voice" of staff, parents, and children of the school alongside a clear learning vision of "connect, challenge, and empower".

Specifically pertaining to PE, the mission of the school was centred upon long-term sustainable changes for all children's futures in movement contexts:

> *…if opportunities ever came in front of them in their life, throughout their life, they can take those opportunities and they can engage in them in safe ways and in ways where they feel confident enough and competent enough to be able to step up.*

The principal believed changes needed to be made in the provision of PE at the school to better align with the mission of the school. For the principal this could be achieved by providing the opportunity for all children to move "competently, confidently, in lots of settings and in lots of ways". Specifically, for the principal the notion of empowerment and the influence of the teacher were two key factors to unpack.

*Empowering teachers and children*

The notion of empowerment of others to achieve change was a strong driver for the principal in supporting the realisation of the school mission. The principal believed that real and positive change was only possible through empowerment of both teachers and children, something that had been a philosophical shift for them. This realisation of the value of empowerment came to the principal gradually through his experiences in leadership positions at several schools over time. The principal had tried to enact change at a previous school, found the "change wasn't working", and through a process of reflection realised the need to empower others:

> *If you had asked me 10 years ago, the need I would have seen would have been, we need to upskill people to know the things they need to teach children, okay, so how to do the basics of throwing, catching and those sorts of things. What I've learnt over time is that that approach wasn't working […] you can go and run those lessons for those teachers, you can model them, you can get beside them, but at the end of the day it's not theirs, they don't own it, they are not empowered by it and they are less likely to continue it once you are out of the scene.*

For the principal, the children also needed to be empowered to ensure change was meaningful and sustainable and resulting in children's movement experiences being enhanced. To enable this, there needed to be a philosophical shift aligning with the school learning vision not just for the principal, but also the teachers and the school:

> *empower means, for us, giving or handing over the power to the children about their learning more and what they are engaging in and what it can look like and when they do things and what could be possibilities.*

Enacting change required a philosophical shift in the first instance, but needed to be followed up with practical, on the ground initiatives that would support teachers to initiate changes in their PE teaching practices. The principal saw opportunities to do this through intentional professional development: "[ . . . ], that has driven us to more of a philosophy whereby we expose some teachers to professional learning".

*Influence of teacher on children's experiences of PE*

During the interview it was evident the principal believed the staff had a "full range" of personal experiences pertaining to PE and sport:

> *[…] staff that was a mix of people who had played sport, to a reasonable level or at all, and then some who would dabble and enjoy exercise, some who dabble but don't enjoy but might do it for their own wellbeing and people who just don't like it.*

As a consequence, the children's experiences of PE were highly variable from class to class and this was directly linked to the teacher's personal experiences of PE and sport:

> *[…] we just had the full range of people so therefore that culture is reflected in the enthusiasm that gets shared with the children so you will get people who will go out and absolutely love taking kids outside for Phys Ed and you will the others who wouldn't go out there if you gave them a lot of money.*

Moreover, the principal perceived that the wide variety of experiences and valuing of PE amongst the staff also influenced the teaching approaches employed during PE. Specifically, the principal described teachers as "living their Phys Ed through what Phys Ed and sport they had as they grew up". The principal believed this resulted in "very traditional" and "teacher directed" teaching approaches to PE, with the

lesson content being guided by “teachers who will just do things that they know well” as this makes them feel “comfortable”. From the principal’s perspective, a means to influencing changes in teaching practice was through first, a philosophical shift, which could be brought about through professional development.

### *2. Teachers*

During a focus group teachers (n = 5) discussed their journey of changing their approach to teaching PE following a period of professional development. The dominant themes identified were; seeing children as individual learners in physical education; empowering children; letting go of control; and teaching physical education the way we were taught.

*Seeing children as individual learners*

Teachers considered that supporting children to feel accomplished “working at their own level” was a key outcome of their PE lessons. One teacher shared that this could be achieved by understanding “where they [the children] are and their own talents” and emphasising “personal progress, not comparison”, with another teacher confirming “it is pretty much what we do in the classroom”.

Throughout the focus group it was clear that the teachers shared an importance of seeing children as individual learners. This notion was connected to personal progress and emphasised a need for the teacher and child to identify the child’s current competencies and then appropriately challenge the child:

> *[…] knowing that where I am at is okay […] I can challenge myself and I can do better than I did before, I don’t have to worry that this person over here can run faster than me.*

Other teachers further elaborated that establishing a confidence in children knowing that they “don’t have to compare themselves to someone else” supported a

focus of individual learning that they believed facilitated increased active participation of all children in PE and activities beyond the PE lesson.

*Empowering children*

Throughout the focus group it was evident that all the teachers believed that "empowering" the children through their active involvement in the PE lessons was important. One teacher described how the children had the "power" in their PE lessons to adjust the design of their activities to appropriately challenge themselves and continue to be actively involved in the lesson.

As a living example of child empowerment happening at the school, one teacher shared a story of how the children were "taking learning beyond our lessons":

> *They were talking about the game that they had made and I […] said is that a challenge for you and then Toby [child] said "well some of the Year 2's played football at morning tea and lunchtime and we used different balls" […] they take different size footballs out, […] and play in their own free time and challenge themselves to get better at the skills because doing that one is too easy.*

For these changes in physical activity related behaviours to occur the teachers were required to adapt their approach to teaching PE:

> *Teacher 1: The kids have more control over what they do. Control over how they apply their movement skills. Less this is how you do it and here are the tools, now go and do it.*
>
> *Teacher 5: Like it's less prescribed isn't it.*
>
> *Teacher 3: Instead of ticking off a skills list, […], we are introducing their movement skills and incorporating them and scaffolding them as opposed to telling them, this is how you do it.*
>
> *Teacher 2: It's more student lead;*

*Teacher 1: Big set of voices, more creativity, more positivity, and more about I wonder.*

To support the empowerment of the children, the teachers experienced a challenge of "letting go of control" during their PE lessons. There was a feeling that to facilitate positive change in the children's physical activity behaviours both within and beyond PE the teachers had to struggle with "letting go of the structure and control", with another teacher agreeing "it's horrible isn't it". However, one teacher shared how letting go of control facilitated a personal revelation; "we came to the realisation actually the children can create far better activities than we can, we are robbing them of creative opportunities". Witnessing what they perceived as positive changes in children's behaviour offered powerful support for the teachers to continue to work outside their comfort zone.

*Teaching PE the way we were taught: playing safe*

As the teachers reflected on how they had taught PE prior to the professional development, they believed they had been teaching PE based upon their experiences of PE when they were at school; "I defaulted [to] where I had been in my schooling with PE, that's what my default became to teach PE". This appeared to be a common feeling across a number of teachers with others agreeing "I think we pull it from our background from what we had at school".

Two teachers who had graduated from initial teacher education programmes in the previous 12-months expressed that they did not feel equipped to take a PE lesson as they did not get "enough" exposure to teaching PE. Consequently, the teachers believed they had resorted to copying the PE teaching practices of their mentor teacher who were "old school PE teachers"; "you go to practice and you watch your teacher doing PE and you do it like they do, don't you".

### *3. Children*

During the focus group with the school children (n = 4) they shared their current experiences of PE. The photos the children had taken were present for them to view at the beginning of the focus group to provoke thought and discussion. Children were asked to describe their photographs and explain the meanings of them to the researcher. Analysis of the focus group resulted in the following dominant themes being identified; ownership; the role of the teacher; and achievement. Each identified theme aligned closely with the underlying psychological needs of the learner outlined by Deci & Ryan (2000) autonomy (ownership), relatedness (the role of the teacher), and competence (achievement).

*Ownership*

As the children shared their experience of PE it was evident they felt a sense of ownership over what they were doing in the lesson. The children believed they had the power to design activities within their PE lessons; "we use our imagination and just put our heads together and make up a nice game for us". For the children, some of their activities had needed modifying to provide an appropriate level of challenge for them to feel success:

> *…at first we put the cones like really far away from each other […] and Lola would have to try and throw the ball into Luna's cone, so when they did that they discovered that it was too hard because they were too far away so we tried going in closer and then they got better […] and then they started to get it in.*

During the focus group it was noticeable how the children's happiness was attached to their sense of ownership over what they did in their PE lessons. The children expressed feeling "happy" when they were playing "fun games" they had designed, able to choose to play with "people they've never worked with before" and modifying their games "you can ask them [the other children] if you can do something different".

Although the children enjoyed the ownership of the lesson the teacher shared with them, some children expressed how a lack of choice when working with their peers made them feel:

> *Child 1: I am not that happy if someone says you need to be there […] or you need to do this.*

> *Child 2: [I] don't like being bossed around because when I am being bossed around I feel like […] I'm their servant and I don't really […] want to be that.*

*The role of the teacher*

For the children, the teacher's role during the lesson was to "walk around and kind of look at things" and this would involve the children first having "to show her [the teacher] the game" which the children had designed. To expand on this one child shared how their activity designs would be challenged by the teacher if it did not align with the movement skill lesson focus of the lesson:

> *she's like, are you sure that's a nice game, […] I can't really see much of the movement skills,*

> *[…] she tells us to show her […] to see if we have all the movement skills and if we don't because sometimes we don't, […] maybe we need to put some more in if we don't notice that.*

Despite the teacher challenging the design of the children's activities they still appeared empowered by the alteration process as one child described how they would "decide as a team" how they would alter their activities. Expanding upon this, another child described an interaction their group had with the teacher when trying to solve a challenging movement problem in the PE lesson; "Shelley [the teacher] came over and said well what could you do to fix that and then Mia [a child] figured out maybe I could move out of the way and then try and get it".

*Achievement*

During the focus group it was evident that the children perceived their movement skill capabilities had positively changed following their PE opportunities. The children explained that their movement skills had changed "lots and lots and lots", with another child expressing "everything" had changed about their movement skills. Specifically, the children were eager to share some of their personal experiences of change; "I wasn't able to catch a ball when I threw it and then caught it again, I couldn't do that but now I can, I can throw it and catch it", "I was doing skipping […] forwards and backwards but I couldn't do that because I am used to doing it backwards […] then I tried it that way and I did it six times", "now I can feel myself running really fast".

## Discussion

This project was developed to gain insight into the experiences of a principal, teachers, and children at a NZ primary school utilising a nonlinear pedagogy (NP) approach to PE. The adoption of a case study methodology allowed for multiple sources of data collection. As this study involved focus groups with children, it was important to consider effective ways of conducting age-appropriate focus groups. Auto-driven photo-elicitation focus group methods were used with children as young as 7-years old for the first time in a primary school setting (to the authors' knowledge). The findings from this case study showed that NP approaches to PE can; 1) align with the wider school mission of empowerment, 2) facilitate a range of feelings in children during PE, and 3) be adopted by generalist primary school teachers.

Themes identified within groups were also interlinked between groups. For example, the connecting notion of empowerment across the principal's theme of 'empowering teachers and children', the teacher's theme of 'empowering children' and the children's theme of 'ownership' (see Figure 7). Empowerment at this case study

school was defined by the principal as “handing over power” to teachers and children. Empowerment has been defined as a social process that can be essential to individual’s gaining ownership of actions and developing a confidence in themselves in order to surmount the challenges faced when accomplishing difficult tasks (Hackman & Johnson, 2013; Losioki, 2020 ; Tindowen, 2019). In this case study, the notion of empowerment was linked to the teachers gaining confidence to take ownership of planning and teaching PE in ways that subsequently empowered children. The notion of empowerment was first referred to by the principal when discussing a prior experience of attempting to encourage teachers to adjust their teaching approaches to PE by actively taking over individual classroom PE lessons. Although successful in that PE opportunities were provided for the children, the principal felt his interventionist approach resulted in teachers lacking a sense of ownership over PE. The principal believed this to be problematic as teachers were less likely to continue with PE once the principal had removed themself from the lessons. Previously their autocratic approach apparently backfired, conversely to his intended outcome, and somewhat disempowered the teachers. The principal’s experience aligns with previous reports that suggest provision of primary PE by external providers, a common practice in NZ (Dyson et al., 2017), can result in an erosion of confidence and disempowerment of teachers (Dyson et al., 2016). From a motivational perspective, it is important that teachers have a sense of autonomy and ownership over their practice in order to overcome the challenge of changing or adopting a new teaching approach (Hackman & Johnson, 2013; Losioki, 2020 ; Tindowen, 2019). The principal’s reflections showed insight into his previous intervention in that it directly conflicted the notion of empowering the teachers.

Moreover, in this case study the school sought to empower children through their experiences of PE. The principal explained that if movement opportunities ever came in front of the children in their lives they would be equipped to “step up”. Existing

research has highlighted PE experience that empower children are important because of the potential to impact quality and quantity of life (Kretchmar, 2006). So, to support children to realise these potential benefits of PE it is important to understand what constitutes a positive experience of PE from a child's perspective. In this study, during the children's focus group it became evident that a sense of choice during the lesson was important to the children feeling happy. For example, the children believed the opportunity to design the lesson activities and choose the peers they played with made them feel happy during PE. The notion of choice aligns with the well-established motivational framework of self-determination theory (SDT) (Deci & Ryan, 2000). SDT has reported autonomy, a sense of ownership in one's actions, as a fundamental psychological need that if addressed can elevate an individual's propensity for learning and growing (Deci & Ryan, 2000). Specifically pertaining to investigations in primary school settings this research expands upon the study of Chróinín et al. (2021) who reported shared ownership of learning focus, collaboration on learning activities, and the teacher's attention to individual experiences were related to positive experiences of PE for 9-10 year old children. These specific reports from primary school children seem positive, however, the application of these findings to a broader set of contexts is unknown due to the limited sample size and number of studies capturing child voice. Moreover, it is important to note that without a control group the children's reflections on their experiences of PE may not have been solely due to the teachers adopting a NP approach to PE. Nonetheless, it seems reasonable that a NP approach to teaching primary school PE can facilitate a sense of ownership for children that is associated with a positive experience of PE.

In this study, it became clear the teachers believed they had adapted their approach to teaching PE. In particular, the teachers explained how prior to this study they had been "teaching PE the way they were taught PE" as a child at primary school

20-40 years earlier. Further, some teachers expressed how they had been influenced by their experience of PE at teachers' college. Existing literature suggest Australian teaching recruits identified with pedagogical approaches they had experienced from their PE teachers as a student (Moy et al., 2015) and as a result anticipated they would teach in a similar manner to the way they were taught (Moy et al., 2015). These findings are important to acknowledge as they suggest PE teaching practices are constrained by sociocultural and historical traditions. As a result, teachers can be resistant to change when contemporary teaching approaches challenge the status quo of traditional teaching approaches (Moy et al., 2015). Indeed, a recent investigation in an Irish primary school setting reported teachers felt a sense of apprehension when they perceived needing to change from their current PE teaching practices. Specifically, numerous teachers reported struggling with releasing control of PE lessons to the children (Beni et al., 2021). Similarly, the teachers in this study expressed struggling with the experiences of "letting go of structure and control". Nonetheless, the teachers believed they were able to better adopt teaching approaches to PE that empowered children through a sense of shared ownership following an extended period of time; "towards the end of the year everything clicked together like a jigsaw puzzle". In addition, Beni et al. (2021) reported teachers believed that only after 8-weeks into a teaching intervention did teachers perceive they saw the "fruits of their labour" from adopting a contemporary teaching approach. Thus, it seems possible that primary school teachers can overcome resistance to change from traditional teacher-centred teaching approaches and adopt contemporary approaches to teaching PE provided they commit to change for a sufficient period of time, and that professional development opportunities are provided to support their practice.

In summary, this study aimed to capture the voices of the principal, teachers, and children of a NZ school adopting a NP approach to PE. The principal sought to

make change to children's experiences of PE through the notion of empowering teachers to take ownership of PE. This need for change may have from resulted from the teachers becoming constrained by sociocultural and historical traditions that had previously led them to adopting traditional teacher-directed teaching approaches to PE. Thus, the change sought was through a shift toward a teaching approach that better facilitated a shared ownership with children, a factor children believed important to enable them to feel happy during PE. Notably, this study contributes to a limited body of research that aims to capture child voice in primary school PE settings. Further, the use of auto-driven photo-elicitation methods allowed us to actively involve and gain a deeper understanding of the child's perspective. Concluding, our findings suggest positive change to PE practices in a primary school setting can stem from a sense of need for change from school leadership (i.e. principal) who can support teachers to overcome the resistance necessary to adapt their teaching approaches to align with contemporary pedagogical literature to ultimately provide more positive experiences of PE for children.

# Chapter 7: Integrating Quantitative and Qualitative Methods: A Thesis Summary

## Chapter Introduction

This chapter serves two purposes: 1) to summarise the key findings and insights of this PhD project, and 2) to reflect on the MMR process. This chapter opens by revisiting the context within which this thesis began. The findings from Chapters 5 and 6 are then discussed, with connections made between chapters as appropriate.

## Summary

A problem identified by the principal at the study school was the genesis of this PhD. The school enabled the study to take place and created an opportunity to answer an important research question pertaining to the impact of teaching approaches to primary school PE. As discussed in Chapter 2, over more than 20 years of experience, the principal had witnessed a decline in the amount and quality of PE for the children under his care. The lack of purposeful PE opportunities was a problem from the principal's perspective because: 1) the school was not fulfilling its vision of supporting all children 'to be the best they can be'; and, 2) the principal believed general MSC was essential for laying the foundation for living a physically active and healthy life. The principal had tried making changes to the PE teaching practices at a previous school but failed. This real-world problem identified by the principal has been highlighted in research literature, where it has been shown that many classroom teachers feel they do not have the confidence or competence to teach PE (Broderick & Shiel, 2000). On reflection, the principal attributed this failure to trying to do it alone and not supporting the teachers to take ownership of PE for their classes. This time around he was seeking a more sustainable approach to the change. Previous literature investigating change in educational settings has highlighted how the school's principal plays a key role in

willingness to challenge current practices and seek change as a catalyst for improvements in school practices (Kadji-Beltran et al., 2013). In support of making change at the primary school, the PhD research team decided to take an MMR approach. The reason for this was to capture change in children's MSC and gain a greater understanding of the experiences of PE of the principal, teachers, and children. Thus, the overarching aim of this research was to gain a better understanding of developing children's MSC in primary school settings. The subsequent aims of this thesis were: 1) to understand the impact of adopting an NP approach to PE in a primary school setting upon children's MSC; and 2) to understand the experiences of children and adults adopting an NP approach to PE. Ultimately, a more thorough understanding would enable the development of more informed recommendations to support real-world change.

To achieve the purpose of the research, it was necessary first to understand the relevance of movement skill for children and contemporary learning theories that guide movement skill acquisition (Chapter 3). Briefly, previous research showed that MSC in children is related to a lifelong participation in physical activity, which leads to a myriad of positive health factors (e.g., cardiovascular fitness, bone strength and cognitive acuity) (Robinson et al., 2015; Robinson et al., 2017). Additionally, a review of previous literature showed that research pertaining to ecological dynamics and its recognition of the inextricable relationship between the learner and the environment underpin an NP approach to PE. However, it became clear that research investigating the use of a theoretically informed approach to PE upon the development of children's MSCs in a primary school setting was limited, and an investigation of this nature was warranted (Chapter 5).

To best answer the research questions and produce knowledge that could have the intended practical impact, it was essential an appropriate research process was

employed. Chapter 4 presented the research philosophy and methodology of this thesis. Philosophically, due to the practical nature of this thesis, a pragmatic research paradigm was adopted. Methodologically, an MMR approach is often philosophically guided by a pragmatic paradigm (Tashakkori & Teddlie, 2003). MMR was deemed an appropriate research tool to use in this research to better understand the complexities of adopting an NP approach to PE in a primary school setting. Thus, in this study, both quantitative (Chapter 5) and qualitative (Chapter 6) research methods were utilised to create practice-based evidence that could be used to develop PE practices at the primary school.

Chapter 5 investigated the impact of an NP approach to PE upon children's MSCs after a nine-week intervention and a 13-week follow-up. The results showed a significant improvement in children's MSC following the intervention, which contributes new evidence to the impact of the NP approach in PE in primary school settings. Moreover, participants exposed to the NP approach retained these skills better after 13-weeks of no PE lessons compared with the LP group. These findings are novel and provide supporting evidence for the use of an NP approach to PE in primary school settings. However, the findings also suggest that it takes time for learners to discover, explore, and adapt new movement solutions. Accordingly, we recommend that teachers allow sufficient time (i.e., more than the traditional 10-week school term) for changes in MSC to emerge. However, it is important to consider the findings and recommendations in light of the research limitations. A notable limitation of the research in Chapter 5 could be the sensitivity of the MSC assessments to real change in children's MSC. Firstly, the MSC assessments solely measured MSC through product-based assessments (i.e., time to completion). The additional inclusion of process-based measures where the focus is placed upon how a movement skill is performed could have provided a more comprehensive assessment of MSC. Provided that the included process-based

assessment aligned with ED theory, in that MSCs were not critiqued against a predetermined ideal movement model. Secondly, the MSC assessments focused primarily upon the locomotion component of traditional FMS with no assessment of object control skills. The inclusion of broader range of assessments tools inclusive of object control skills may have supported a more comprehensive understanding of children's MSC and ultimately the impact of the intervention. Nonetheless, future research should continue to investigate longer-term interventions that seek to ascertain the underlying perceptual and motor mechanisms responsible for positive and retained changes in MSC.

Traditional teaching practices in PE often involve the teacher delivering expert movement information to children. For example, teachers may provide the ideal throwing technique that all children are expected to replicate. Crucially, however, the findings in Chapter 5 show that when children are actively involved in designing and modifying their own PE lessons, MSC is enhanced beyond the intervention period. It was proposed that this improvement may have resulted from a purposeful connection being developed between the child and PE lesson content. However, this was a speculative hypothesis. Therefore, to better understand the perspectives of the children and adults involved, a case study was conducted to capture their voices.

As reported in Chapter 6, semi-structured interviews and focus groups with the principal, teaching group, and children were conducted. The aim of this study was to understand the influence of the pedagogical approach more deeply upon retaining MSC over time. Findings showed that having a sense of control over their actions in PE enhanced the children's feelings of happiness. This finding can in part be explained by SDT (Deci & Ryan, 2000). A well-established motivational framework, SDT describes autonomy, a sense of ownership in one's actions, as a fundamental psychological need that, when accounted for, elevates an individual's propensity for learning (Deci & Ryan,

2000). In my study, a sense of autonomy may have encouraged the children to persist through the challenge naturally associated with acquiring new movement skills and led to a heightened engagement in physical activities related to the learned movement skills beyond the boundaries of the PE lessons themselves (e.g., break times, at home). However, child motivation was not explicitly measured during this research and thus the link between motivation and the development of children's MSC is speculation.

Findings from focus groups conducted with teachers were also examined in Chapter 6. Of note, year-2 teachers reported how, prior to this case study, they had taught PE the way they had experienced it 20-40 years earlier while in primary school. This finding suggests that teaching practices are heavily influenced by sociocultural and historical norms. In practice, adopting a NP approach to PE was not without its challenges for the teachers. For example, working in the school I witnessed first-hand how one teacher struggled with their role being active as opposed to passive within the lesson. Initially the teacher adopted a 'just let them play' approach to the lessons, which required time. However, the focus group methods and analysis utilised in Chapter 6 did not capture the specific challenges the teachers faced when attempting to adopt a NP approach to PE. The analysis primarily focused upon common agreements between teachers that were important to the successful adoption of a NP approach in the case study school setting. The inclusion of individual teacher interviews in addition to the collective focus group may have better captured the range of experiences of the teachers when adapting their PE teaching practices. Ultimately, this would have provided a better understanding of what was important to teachers successfully adopting an NP approach to PE and the individual challenges the teachers faced when attempting to change their PE teaching practices.

Nonetheless, taken together, the findings from Chapter 5 and 6 support the use of an NP approach for teaching PE in a primary school setting. Chapter 8, practical

insights and applications are presented to support people seeking to make real-world change to MSC development in primary school settings and reflections from the author are presented relating to key data and aim of the thesis.

## Reflection on the Research Process

Previously, few studies have utilised MMR to understand the impact of adopting an NP approach to primary school PE. A notable strength of this research was the intention to create a positive impact on the teaching practices of a real-world primary school setting. The pragmatic paradigm adopted in this thesis emphasised the value placed upon solving a real-world problem, instead of solving a single version of reality (Giacobbi et al., 2005; Maxcy, 2003). Quantitative research methods can provide objective evidence about the impact of an intervention upon a specific population; however, the quantitative data is limited in that it does not provide evidence for why populations think, feel, or act the way they do (Queirós et al., 2017). In this research, an MMR approach allowed for an improved understanding of the problem, enabling a more nuanced understanding of the research aims (Creswell, 2014). A more nuanced understanding enabled the development of more informed recommendations to support real-world change. Previous literature has separately captured quantitative change in children's movement skills through primary school PE interventions (Dudley et al., 2011; Ericsson, 2008; van Beurden et al., 2003) and qualitatively captured children's experiences of primary school PE interventions (Beni et al., 2021; Chróinín et al., 2021; Domville et al., 2019); however, to my knowledge, this is the first research study to utilise an MMR approach to investigate the real-world impacts of an NP approach to primary PE.

To best answer the research questions posed in this thesis, a concurrent transformative research design was utilised, in which quantitative and qualitative data

were collected concurrently (Kroll & Neri, 2009). Crucially, as identified in this chapter, MMR facilitated a broader understanding of how NP approaches can be adopted in primary school PE to positively impact children's experiences of PE and their MSC (see Table 4).

From a practical perspective, concurrent data collection methods were utilised due to the logistics of the research project and to capture children's experiences more accurately in the focus group. Firstly, my role at the school expanded beyond the research project itself. The research project focused on the year-2 teaching group during the final school term of 2019. In agreement with the school leadership my role would change in 2020 to directly support teachers in other year groups and limit my capacity to work with the year-2 teachers. Consequently, it would not have been feasible to adopt a sequential approach to data collection that required me to work closely with the year-2 teaching group in 2020. Secondly, concurrent data collection facilitated the children's focus group to take place immediately following a PE lesson of the intervention period as opposed to an extended time following the intervention period. The limited time between intervention and the focus group was important as pilot work and insights from the teachers had noted that young children have a limited capacity to recollect past experiences with detail. Thus, the concurrent data collection allowing for the focus group to take place immediately following a PE lesson likely allowed for a more detailed recollection of the children's true experiences of the PE intervention.

Although a concurrent approach to data collection fit the logistics of this research, upon reflection a sequential approach to data collection may have provided a better insight into the impact of the PE intervention. A sequential approach would have allowed for the use of specific questions that targeted further exploration of the key findings of the quantitative data in chapter 5. For example, specific questioning during the focus groups would have provided a better understanding of the factors responsible

for the continued improvement of children's MSC 13-weeks following the cessation of the intervention. A finding that this thesis has only been able to explain through speculation and connection to alternate studies. Upon reflection, and with a greater experience of conducting MMR I would have adopted a sequential approach to MMR to allow for a more targeted approach to questioning that would have allowed for a greater understanding of the findings presented in chapter 5.

The order of quantitative data (chapter 5) being presented prior to qualitative data (chapter 6) was not important to the structure of this thesis. The order of data presentation is reflective of the order that data collection began, and the research was prepared for publication. Presenting quantitative and qualitative data together was considered, however, following consultation with a MMR expert it was acknowledged that I had limited experience with adopting a MMR approach and advised that the data be written separately and then integrated in subsequent chapters.

*Table 4. MMR integration of findings*

| **Quantitative data** | **Qualitative themes** | **Participant** | **Illustrative quotes** |
|---|---|---|---|
| A significant difference ($p < .05$) in MSC performance between the NP and the LP group was seen in the 13-week retention test but not the 9-week intervention post-test. | 1. Children's ownership over PE<br><br>If children are able to control the design and modification of their activities in PE lessons, then they are less dependent on the teacher to move beyond the lesson. | Child | *At first we put the cones like really far away from each other […] and Lola would have to try and throw the ball into Luna's cone, so when they did that they discovered that it was too hard because they were too far away so we tried going in closer and then they got better […] and then they started to get it in.*<br><br>*We use our imagination and just put our heads together and make up a nice game for us.* |
| | 2. Children's feeling of joy through PE<br><br>If children enjoy what they are doing, they are more likely to continue practicing, resulting in enhanced performance over time. | Child | *The children expressed that they felt "happy" during their PE lessons*<br><br>*The children's feeling of happiness was a result of the children playing "fun games", playing with "people they've never worked with before", and having choice over what they did in their PE lessons; "you can ask them [the other children] if you can do something different"* |
| | 3. Children's increased perception of self-competence<br><br>If children believe they are getting better at their movement skills, they are more likely to continue to engage. | Child | *I wasn't able to catch a ball when I threw it and then caught it again, I couldn't do that but now I can, I can throw it and catch it*<br><br>*The children explained that their movement skills had changed "lots and lots and lots"*<br><br>*Now I can feel myself running really fast* |
| | 4. Teacher's emphasising a lack of peer-to-peer comparison<br><br>Teachers noted how establishing a lack of comparison between | Teacher | *Working at their own level*<br><br>*Where they [the children] are and their own talents* |

| | | | |
|---|---|---|---|
| | children encouraged all children to actively participate within and beyond PE lessons. | | *Personal progress, not comparison*<br><br>*Knowing that where I am at is okay […] I can challenge myself and I can do better than I did before, I don't have to worry that this person over here can run faster than me.*<br><br>*Don't have to compare themselves to someone else* |
| | 5. <u>Co-ownership of lesson content</u><br><br>Teachers shared ownership of lesson and activity design with children supporting children to continue to practice beyond lesson. | Teacher | *They were talking about the game that they had made and I […] said is that a challenge for you and then Toby [child] said "well some of the Year 2's played football at morning tea and lunchtime and we used different balls" […] they take different size footballs out, […] and play in their own free time and challenge themselves to get better at the skills because doing that one is too easy.*<br><br>*Teacher 1: The kids have more control over what they do. Control over how they apply their movement skills. Less this is how you do it and here are the tools, now go and do it.*<br>*Teacher 5: Like it's less prescribed isn't it.*<br>*Teacher 3: Instead of ticking off a skills list, […], we are introducing their movement skills and incorporating them and scaffolding them as opposed to telling them, this is how you do it.*<br>*Teacher 2: It's more student lead;*<br>*Teacher 1: Big set of voices, more creativity, more positivity, and more about I wonder.* |
| | 6. <u>Intentional empowerment of children</u><br><br>A key component of the learning vision of the school was empowerment. The principal emphasised the importance of this for children in facilitating them in being able to take ownership and continue with their learnings beyond the PE lessons. | Principal | *empower means, for us, giving or handing over the power to the children about their learning more and what they are engaging in and what it can look like and when they do things and what could be possibilities.* |

For example, a notable finding for the quantitative study reported in Chapter 5 was the significant increase in children's MSC at a 13-week retention test timepoint. The discussion of this finding speculated that the NP teaching approach facilitated long-term behaviour change in the children. In alignment with a previous study (Domville et al., 2019), enhanced intrinsic motivation likely contributed to the long-term enhancement of children's MSC. Table 4, above, shows qualitative themes drawn from the focus group research reported in Chapter 6 that can help in gaining a greater understanding of the notable retention test findings in Chapter 5. However, it is important to note this hypothesis requires further investigation to develop knowledge of the factors impacting on the continued development of children's movement skills beyond the intervention period.

Previous research has identified intrinsic motivation as sitting at the centre of the long-term learning behaviours exhibited in Chapter 5. Intrinsic motivation has been defined as an individual's drive towards self-improvement by acting in ways that the individual deems important for their development (Deci & Ryan, 2000). SDT is a theory of human motivation concerning people's innate psychological needs (Deci & Ryan, 2000). The three underlying psychological needs of SDT are autonomy, competence, and relatedness (see Chapter 3 for a detailed review). Notably, as the children shared their experiences of an NP approach to PE, each of these psychological needs were identified (Chapter 6). Firstly, autonomy – it was evident the children felt a sense of ownership over what they were doing in the PE lessons. In other words, the children believed they had the power to design and modify the activities they participated in during their lessons. Next, competence – children shared how they perceived their MSCs had positively changed following their PE opportunities. One child shared their personal experience of change: "I wasn't able to catch a ball when I threw it and then caught it again, I couldn't do that but now I can, I can throw it and

catch it". Lastly, relatedness – an NP approach to teaching likely strengthened the teacher–student relationship as interactions were supportive and encouraged student ownership over their learning. One child explained an interaction with their teacher:

> *[…] she tells us to show her […] to see if we have all the movement skills and if we don't because sometimes we don't, […] maybe we need to put some more in if we don't notice that.*

It was clear that even in moments when the teacher challenged the designs of the children's activities, they still appeared empowered to work to modify their activities. So, from my analysis of the data in Chapter 6, it was evident the children described elements of self-determination. This is important as previous literature has highlighted the importance of satisfying the underlying psychological needs of SDT in children's enjoyment of primary school PE (Domville et al., 2019). Enjoyment has been highlighted as a key motivational focus of PE for primary school-aged children (Kirk, 2005) and, importantly, is associated with ongoing participation in PE in school and more broadly with physical activity outside of the school setting. Thus, the MMR process utilised in this research enabled a deeper understanding and insight into what may have contributed to the children continuing to enhance their MSCs 13 weeks after the PE lessons.

Individual participant data from the quantitative study in combination with the qualitative data provided interesting further insight into adopting NP approaches to PE. For example, a key theme identified from the teachers' focus group was a shift in PE settings to "seeing children as individual learners". With teachers sharing the importance of emphasising "personal progress, not comparison" in PE and the importance for children to understand that they "don't have to compare themselves to someone else" supported a focus of individual learning that they believed facilitated increased active participation of all children in PE and activities beyond the PE lesson.

Interestingly, the individual response data shows quantitative data in support of the views of the teachers. For example, figures 4 and 6 show a clear individual variance amongst the NP group children, with children improving, or not improving, their MSC at different rates within the same time frame of the study.

Individual participant data also provided further insight into the potential limitations of the data from the children's focus group. All four children who participated in the focus group improved their TTCJ performance, with two of the children in the top of three responders. Further, three of the children improved their HCT performance. It is important to consider how the children's personal positive experiences of the intervention (i.e., improved MSC) may have influenced their responses during the focus group, potentially generating an unbalanced view of the intervention in favour of the intervention as positive for children. Future MMR might consider conducting quantitative research and analysing the data in advance of recruiting participants for focus groups to better account for any potential bias within the focus group data.

To summarise, an MMR approach was adopted in this study to support the intention of having real-world impact upon the PE teaching practices of the school. In this chapter, I have discussed how an MMR approach contributed to better understanding the long-term changes in MSC identified in the quantitative study and facilitating a greater understanding of why this long-term change may have occurred through various themes identified in the qualitative research. Without the utilisation of both qualitative and quantitative research methods in this research, the practical impact it would have been able to make for the study school would have been limited. Therefore, this study and the use of MMR makes an important contribution in guiding the adoption of NPs in primary school settings. The next chapter seeks to demonstrate the practical impact and share real world examples from a NZ primary school.

# Chapter 8: Four Years Onsite at A New Zealand Primary School: A Reflective Account

## Chapter Introduction

The purpose of this chapter is two-fold: 1) to provide insights from my perspective of working in situ at a primary school over a four-year period, and 2) to share real-world practical examples of planning, implementing, and reviewing PE in a primary school setting. The recommendations made in this chapter are informed by numerous discussions with the principal, teachers, and children of the study school. The content in this chapter is intended for stakeholders seeking to make sustainable improvements to PE practices in a primary school setting. As such, this chapter uses practical and accessible language, intentionally avoiding technical jargon. The recommendations put forward in this chapter on sustainable improvements to PE practices are based upon my interactions with the principal, school leadership team, teachers, and children of a primary school in Auckland, New Zealand. Explicit discussion focuses upon five principles identified through the PhD project as fundamental to sustainable improvement to PE: the need for a leader who seeks change, role modelling, the onsite specialist, managing entrenched behaviours, and allowing time for change. These principles have consistently been discussed as crucial to the ability to realise positive change to PE practices at a primary school. The hope is that the insights presented in this chapter prove valuable for other people seeking to make change to primary school PE practices.

## Assessing Children's Perceived Competence

Self-efficacy is an individual's belief in their ability to accomplish a task or succeed in specific situations (Bandura, 1977). In the context of this research, if a child had an increased belief in their ability to succeed in movement settings (i.e., PE, PA, sport)

they would more likely participate in movement settings, subsequently enhancing their MSC. Indeed, research has shown a positive relationship between self-efficacy and participation in PA in child populations (Barnett et al., 2011; Strauss et al., 2001). Also, another psychological theory discussed earlier in the thesis, SDT, posits that a feeling of competence is an innate psychological need that provides a basis for intrinsic motivation (Deci & Ryan, 2000). Competence can be considered as actual or perceived. In the context of PE, if children perceive themselves to have improved capabilities to accomplish movement tasks, they are more likely to be motivated to participate in PE lessons and PA, again likely resulting in improvements to actual MSC. Thus, in this research I explored the use of measures of perceived MSC appropriate for young children, with two aims: 1) to analyse the relationship between perceived with actual MSC in children, and 2) to measure changes in perceived competence following the PE intervention.

Perceived MSC assessments for children aged 7-years and younger are somewhat limited. Nonetheless, for this thesis I explored using the Harter (1982) pictorial scale of perceived competence and social acceptance. Pilot work exploring the use of the physical perceived competence assessment section with multiple 6–7-year-old children highlighted two key limitations for using the pictorial scale as an assessment of perceived competence in this thesis. Firstly, the assessment tool had high administration demands, primarily in that testing each child took considerable time (more than 10-minutes) that teachers would unlikely commit to with their classes consisting of 20-30 children beyond the study period. This conflicted with the need for all assessments utilised in this research to be ecologically valid as discussed in Chapter 5. Secondly, when conducting the assessment, it became clear that 6–7-year-old children from New Zealand found it challenging to use the scale to articulate themselves. Consequently, I often had to provide further explanation for the children of

the possible responses presented on the scale. For example, children struggled with the language used to distinguish between responses in the assessment tool such as ‘sort of good’ and ‘pretty good’, and resultantly were not able to rate their physical competence without further explanation from me. As my explanations were required more often, I became cognisant of how my explanations of the difference in ratings on the scale may influence each child’s rating and render any collected data redundant. Thus, the need for further explanation and the administration resulted in a decision being made to omit the measure of perceived competence from this research. Alike to assessment tools of actual movement skill competency, perceived movement skill competency for children aged 7-years and younger also require development.

## 13-Week Post Intervention Movement Skill Competency Improvement

An intriguing finding of the quantitative study (Chapter 5) was the improvement of NP children’s MSC 13-weeks following the end of the intervention. Unfortunately, no data was captured during this period that could help to explain the continued improvement for the NP group or the trend towards baseline for the LP group. Nonetheless, my unique positioning within the school full-time during a 4-year period provided insights that may help to better understand the continued improvement of children’s MSCs. Before discussing potential factors that may have influenced the continued improvement in children’s MSCs, I will first address variables that were unlikely to have influenced this finding due to the design of the study.

As presented in Chapter 5, multiple external factors that may have influenced the LP and NP group differences were accounted for in the purposeful selection of the LP group. For example, geographic location, socio-economic standing, proximity and access to sport and recreation clubs, and weather all likely had a minimal effect on the results. The key reason for these factors unlikely influencing the outcome of this study

is the schools were located less than 4-kilometres apart and in the same socio-economic group. Considering the minimal role of the aforementioned factors is important as it can at least begin to narrow the scope of potential influences upon the continued improvement of NP children's MSC.

Reflecting upon the time I spent in the school both during and beyond the timeframe of study 4 I believe there are three key factors to consider that may have influenced the NP groups MSC improvement found at the 13-week retention test timepoint: 1) The increase in value placed on movement, 2) shared ownership of learning in PE, and 3) the intentional connection of lesson context to the children's individual contexts beyond school.

Firstly, there was a clear and obvious increase in the valuing of "movement" (i.e., physical education, physical activity, sport) throughout my four years at the school. For example, when I arrived at the school, PE was performed regularly (i.e., 3 times per week) by few classes, with any PE opportunities often centred upon "sporty children" that would dominate large whole-class games. Aside from this the school organised seasonal sports teams and an annual school sports day comprised of multiple traditional running, jumping, and throwing events. This make up of movement opportunities at the school was problematic because it limited all children's opportunities to develop their movement skills and the limited opportunities that were provided often only catered to a small group of children who were more competent in movement settings. In contrast, at the time of the study intervention there was a notable increase in the value of movement for all children. An example included, PE lessons happening more often for multiple classes throughout the school. This change was noticeable through walking the school grounds during the week and seeing PE taking place, PE related conversation taking place in the staffroom during breaks, and the creation of an equipment and school area booking system to solve conflict arising from

PE lessons clashing between classes. Additionally, PE or "PE with Dan" was replaced with the common language of "movement". I feel this change was critical to implicitly share the message of movement being for all children and all children having the capability to take ownership of their Movement experiences. These examples were physical changes that took place at the school that I believe were representative of Movement increasing in value across the school, change that many children may have noticed and may have influenced their Movement related behaviours potentially resulting in the continued improvements in MSC noted in Chapter 5.

Next, within PE lessons the pedagogical approach adopted by the teachers facilitated a shared ownership of the lesson content with the children. The shared ownership nurtured a sense of agency in the children that they were in control of their Movement experiences and had the capability to organise and do Movement activities. For example, on numerous occasions I had observed a PE lesson where children had designed novel activities and then later observed the same children doing the same activity during school break times. Relatedly, during the focus groups conducted in Chapter 6 one teacher shared how children in their class were experimenting with using different types of balls when playing football at break-time, a use of constraints manipulation that was common within their PE lessons.

Lastly, to further support transfer of learning beyond PE lessons, teachers intentionally connected lesson content to the individual child's context beyond school. Specifically, PE lessons concluded with reflective questions such as "Where do you use the movement shape from our lesson today outside of school?", facilitated by children thinking alone whilst curled up into "thinking balls" positions, sharing their ideas with a peer, and reflections being shared amongst the whole class. Additionally, PE lessons were co-designed by selecting lesson locations and utilising equipment that children would have access to beyond the PE lesson. For example, PE lessons took place onsite

at school playgrounds, courts, and grass fields where children had access to outside of school open hours (note it was the school holidays during the 13-weeks retention), and offsite at the public park a 5-minute walk from the school grounds, and at the nearby beach a 15-minute walk from the school grounds. Reflective accounts at the end of lesson would also include children sharing where they had used the movement they were practicing in the PE lesson outside of school. It was common for children to share experiences that used equipment alike to the equipment in the PE lessons and at locations where lessons had taken place including members of their family and friendship groups. It is my belief that the intentional connection of the PE lesson design to the children's lives beyond PE was critical to the continued improvement of MSC noted in Chapter 5.

## Teachers Continuing to Adopt Nonlinear Pedagogical Approaches

A key aim for the principal of the school was that the intervention was sustainable, meaning changes to PE practices would continue beyond my time working onsite. Being at the school over a four-year period allowed me to see how sustainable the changes made to the year-2 classes were. Following the intervention in Chapter 5, I began to work with other classes in the same school, however, I was still able to check-in regularly with the teachers and classes involved in the studies in Chapter 5 and 6. For example, the intervention concluded during term 4 of the 2019 school year then in term 1 of the 2020 school year I was uniquely positioned to be able to visit and observe the teaching approaches to PE adopted by the teachers on not a one off visit but frequently across many days and weeks. A notable change to the teaching approach that had stuck was accommodation of the individual needs of each child. Practically, teacher and children remained as co-designers of the learning environment (as opposed to teachers directly instructing ideal movement techniques), abundant opportunities for children to

explore and experiment with possible movement solutions were available, and children still had access to a variety of equipment that could be used to modify the movement problem.

In 2020, the long-term sustainability of the changes in teaching approach to PE were challenged by two major factors; staff turnover and Covid-19. At the beginning of the 2020 school year, a teacher who was seen as a leader of the year-2 teaching staff left the school. The impact was immediately noticeable in the inconsistency of year -2 PE planning and organisation practices. For example, the shared online document used for lesson planning was not regularly updated and a collection of equipment linked to the plan was not organised in advance of the lessons. Secondly, in March 2020 the New Zealand government imposed Covid-19 related restrictions of school activity that would last until December of 2021. Initially the most severe restrictions involved the complete closure of the school, meaning all teachers and children stayed home. Then gradually over a time course until December of 2021 various levels of restrictions were imposed upon the school. For example, when teachers and children initially returned to school the classes were isolated into individual groups. For our teaching intervention, this meant I was not able to visit the classes or teachers directly resulting in no lesson observations. Nonetheless, during this time I was able to still access the teachers' shared PE planning documents online. Admittedly, this was less than an ideal measure of sustainable change in teaching approach, however, it did allow me to see the thoughtful approach to designing PE activities that would present intentional movement problems for the children and allow the opportunity for individual exploration of movement solutions. Later in the year, once restrictions were eased, I was able to visit the year-2 classes who participated in this research. When I reconnected the classes, it was evident that the adoption of a NP approach to PE was occurring in the implementation of the lesson. For example, teachers and children were co-designing and modifying activities

during the lesson, children were afforded the freedom to explore their own possible movement solutions, and a variety of equipment was used to constrain the movement challenges in different ways. With that said, a challenge at this time was the passive role some teachers were adopting during PE lessons. Children were afforded the opportunity to explore the lesson's activities and the teacher viewed the activities as the teacher, adopting a passive role during the lesson. Thus, it is important to note that NP approaches to PE can be adopted by teachers at different rates and mould in different ways if continued support is not provided directly over and extended time course.

Lastly, my time onsite at the school ended in March 2022, however, I have remained in contact with the school principal and "movement leaders", two teachers that have allocated working time to support the development of PE provision throughout the school. In online discussion with the teachers, it is evident that shift from no PE provision, just playing games, or prescribed movement models has clearly shifted to the intentional design of movement problems. For example, one discussion with the teachers has centred around the designing and modification of activities to meet the individual needs of each learner. However, a longstanding challenge of the intervention continues to persist. A minority of teachers do not consistently commit to a minimum of three time per week PE provision. This problem remains despite support from the principal, multiple terms of direct support from me, the movement leaders continuing to share lesson plans, and teaching peers trying to encourage change. Consistently delivering PE was particularly challenging for teachers who were not physically active themselves and with an extensive background (more than 10-years) in primary school teaching, particularly if much of this time was in school systems where specialist PE staff took their classes for PE. In New Zealand, specialist PE staff are often only employed in private school settings and thus not a sustainable solution for most schools. Further work is certainly required to better understand how we may be able to better

support teachers who are more resistant to change to commit to consistently providing PE for their classes.

## Supporting Whole School Changes to Physical Education

An interesting development across four-years at the school was the growth of teachers as mentors to their peers. The year-2 teachers were provided support with adopting NP approaches to PE in advance of the years 3-6 teachers and initially began to share their experiences and learnings with their peers. For example, PE related conversations were taking place in the staffroom during break-times, something that never used to happen! Conversation then expanded to lesson plan sharing and invitations for other teachers to visit their PE lessons. Further facilitating this cross pollination of learning were existing structures within the school such as vertical learning groups, where year-2 classes connected with classes from years 3-6 once per week. This allotted time in the schedule was now sometimes used to share PE learnings across the year groups.

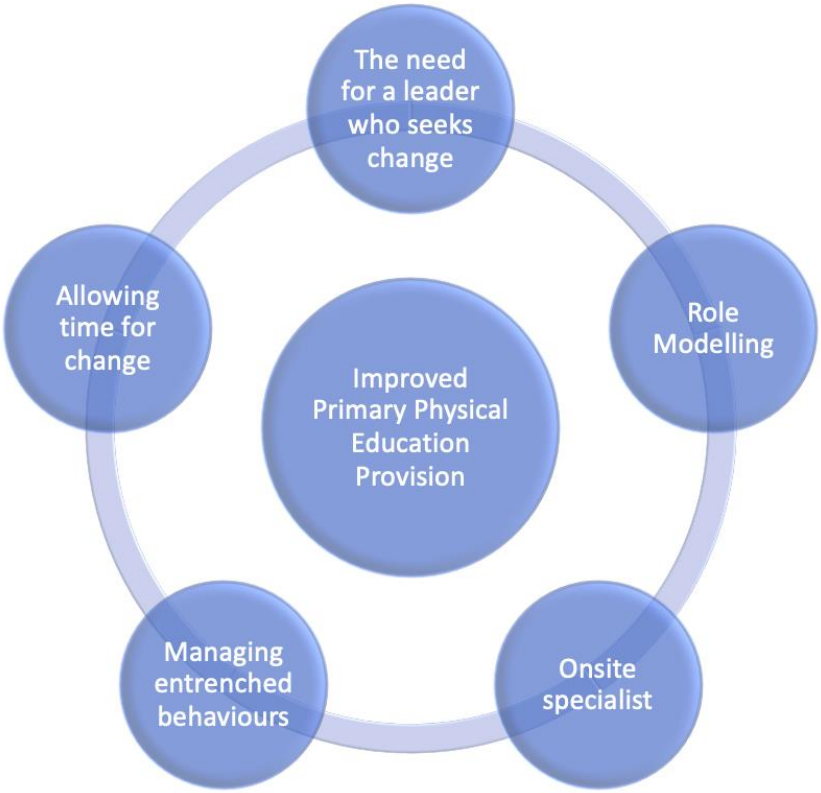
Later, as I began to work directly with the teachers of year 3-6 the role of the year 2 teachers remained critical to supporting other teachers to adopt NP approaches to PE. As an example, the school calendar can become congested for teachers with a wide variety of events happening throughout the school year alongside the wide curriculum of learning. Often this can prove problematic for adding something new for teachers to do, such as increasing the provision of PE and adopting a new teaching approach. The year 2 teachers initially were able to role model that this consistent change was possible for teachers despite the challenging school calendar. The years 3-6 teachers could tangibly see “somebody like them” successfully realising PE related change. For example, if a new schoolwide event was added to the calendar and required time, PE could often be the first to suffer. However, the year 2 teachers were able to role model

how PE could and should remain a priority for the children. Ultimately, I believe this supported more teachers to value PE and commit to consistently providing PE opportunities for their classes and working towards adopting NP approaches to PE.

Figure 8, below, provides a visual representation of the five principles I identified as critical to making change to PE practices at the study primary school. Within the context of this research, the principles are seen to be of equal importance to improvements in PE practices, represented in the figure through the circular organisation of the principles and absence of a hierarchical formation. Beyond the context of this study, it is expected that the principles would be adapted and moulded to best fit the needs of other school settings. Although the intention of the research was to support the development of PE practices by exploring the adoption of NP approaches to PE, the realities of teaching PE in a primary school setting often require a more nuanced teaching approach where elements of linear and nonlinear pedagogical approaches are blended to best meet the needs of each child at any given moment in time. It is my intention to show an appreciation for this nuance when addressing each principle individually.

Lastly, this model is not definitive and has the potential to grow with new knowledge. This is represented in the figure via the open spaces on the link connecting the principles.

*Figure 9. Five principles identified by me as critical supporting changes to improve primary school physical education practices.*




## The Need for a Leader who Seeks Change

Sustainable change to PE practices at the study primary school required support from school staff in leadership positions throughout the duration of the research project. Firstly, change was sought by the school principal after he noticed a problem. The principal perceived that children's movement skills and engagement in physical activities in the school setting had declined during his teaching career of more than 20 years. In an attempt to solve this problem at a previous school, the principal had taken PE for his teaching staff and their classes. The principal shared his reflections on this approach, noting that it was effective in the immediate term, in that classes that had not been receiving PE lessons were now regularly receiving PE lessons. However, the change made to PE lessons for the classes was not sustainable over the long term. The principal explained that, once he had stopped delivering PE lessons for the individual classes, the teachers were not empowered to take over teaching PE, ultimately meaning the children no longer received PE. This problem, combined with a desire for

sustainable change, led the principal to seek out opportunities for supporting school staff to make sustainable improvements to their PE practices.

To begin to solve their PE problem in an informed manner and at an equivalent financial cost to the current practice of employing local sports coaches, the school allocated finance to support a PhD project for a four-year period. It became apparent that for the PhD research project to successfully support improvements in PE practices, the principal (a person in a position of leverage) would play a critical role before, during, and after the PhD project. Before the PhD research project commenced, the principal had proposed the idea to the school's board of trustees, collaborated with Auckland University of Technology to create a PhD studentship position, and ultimately sourced the finance required to support the project. Once the research project had started, the principal communicated a new shared school vision for PE with all staff. For the duration of the PhD, the principal played a crucial role in implementing change across the school including: managing resistance to change from staff, allocating finance to purchase equipment, allowing time for the teachers to undergo professional development, working with leadership staff to communicate the importance of PE, and communicating the direction for PE in the school directly to the whole staff group. Once the PhD project at the school ends, the role of the principal will be essential in supporting the sustainability of the changes that have been made. There is a need to maintain the messaging to staff of the importance of PE through the school, and to support new staff onboarding into the school specifically regarding PE (i.e., including NP training as part of new staff induction process).

## Role Modelling

Change is more effective when it is led by example. In this study, I provided an example for the teachers by role modelling an NP approach to teaching PE. At the

beginning of the PhD project, PE teaching practices at the school consisted of whole-class games, running laps to "burn energy", explicit teaching and modelling of ideal sport skills, or no PE at all. To help the children to be physically active for life, there was a need to shift from such teaching practices to a more contemporary approach that aligned with teaching across the school curriculum. Adopting NP approaches to PE was the focus of the intervention with the teachers, however in reality the teacher blended elements of LP and NP teaching approaches to best support the needs of the children. For example, activity design shifted from a LP approach of lines of children waiting their turn to dribble a ball through a set of cones to a NP approach of all children dribbling a ball each through crowds of children. Then within the activity a more LP approach of technical demonstrations may have been used by teachers to nudge children towards exploring other methods of dribbling the ball.

At first, I worked with individual teachers and their classes to role model what using an NP approach to PE could be like. With me taking responsibility for planning and leading the lesson, the teachers were able to focus their attention on observing the practices of the lesson and subsequently reflect upon them. This space for thought was important for the teachers as it helped them to better see and understand what adopting an NP approach to PE could be like for their classes. The role modelling of lessons supported teachers to develop belief in their capabilities to adopt an NP approach to PE. For example, one teacher remarked how the teaching approach they observed was similar to their teaching practices in other subjects (e.g., mathematics, reading, writing). However, for reasons that are unknown (at this time), they approached teaching PE in ways that often contrasted with how they taught the rest of the curriculum. Far from a didactic comparison of LP versus NP, the teachers' reflections were more alike to a spectrum where a blend of LP and NP approaches were present. The teachers' pedagogical approach to PE would have been closer to the LP end of the spectrum,

whereas their teaching practices for other subjects would have been closer to the NP end of the spectrum. Through observation, discussion, and reflection teachers recognised that they possessed the skills to adapt their teaching approaches to PE and supported many teachers to take on the challenge of adapting their practice.

At the study school it was apparent that many teachers perceived various barriers to providing regular PE opportunities for their class. For example, teachers were unsure of what content to plan for, even how to access equipment from the PE shed, and how to support children in learning movement skills. Using role modelling, I helped the teachers design lesson plans, source equipment while at the same time manage their students and adopt NP principles during class. Role modelling was an effective way to support teachers to own, plan, implement and reflect upon their teaching practices in a realistic way.

## Onsite Specialist

Traditionally, professional development for teachers is delivered over a short period of time (e.g., a week-long course) and offsite (e.g., at conference centre). This approach can deliver information to large groups quickly but lacks hands-on, individual applicability. A better approach is for the mentor to walk beside the mentee on the learning journey inside a real-world environment. In this project, I facilitated specialist support for teachers through authentic moments of PE at school. For example, the teachers noted I was able to give them a “little tap every now and again” to challenge their thinking behind the lesson planning and implementation. Learning through authentic moments with their classes was important for developing teacher’s understanding of how to adapt their current teaching approaches to PE.

Additionally, throughout my time at the school it became increasingly apparent that my presence went beyond supporting teaching the content of PE lessons. Through

numerous interactions with multiple teachers, it was evident that social constraints had previously impacted the teachers' willingness to take on the challenge of adopting different approaches to PE or teaching PE at all. For example, teachers expressed a fear of judgement from their peers, leadership team, and parents when delivering PE lessons in open areas where their lessons would be on view. So, unknowingly (initially), my role became one of acting as a 'shield' for the teachers, as they expressed how I protected them from the perceived judgement from others. The perceived protection I provided for the teachers by being alongside them during PE lessons supported the teachers in taking on the challenge of adopting NP approaches to PE.

## Managing Entrenched Behaviours

An entrenched belief is a firmly established position that is difficult to change. At the beginning of this PhD project, it was evident that the teachers' approaches to PE were deeply entrenched in defaulting to teaching PE the way they were taught. For example, PE was often not thoughtfully planned compared with other curriculum areas (i.e., reading, writing, mathematics) and often consisted of large games, running laps, or avoiding teaching PE altogether. Initially, I sought to understand the roots of the entrenched teacher behaviours identified in Chapter 6 as: 1) 'defaulting' to their experiences of PE when they were a child, and 2) copying 'old school' PE teachers from their teacher college practicum. An understanding of the aforementioned behaviours was useful for bringing to the teachers' attention, particularly when contrasted with how they teach the rest of the curriculum (e.g., mathematics, writing, reading). Specifically, teachers reflected on how their teaching of other subject areas had been 'updated' over time to align with improved teaching practices; however, their teaching approach to PE remained unchanged. The teachers experienced a heightened awareness of their PE teaching approaches through: children sharing their reflections on

PE, teachers sharing their reflections with each other on adopting an NP approach, guided reading provided by me, and tracking objective change in the children's movement competence. Together these practices supported teachers to self-critique their long-held beliefs about teaching PE and provided encouragement for change towards a greater consideration for NP teaching approaches to PE. Nonetheless, it is important to understand that some teachers reflected positively upon their own experiences of PE and sport growing up, including their exposure to LP approaches that they believed helped them learn and could now help their children learn. The combination of positive prior experience of LP approaches combined with a greater understanding of contemporary NP approaches to motor skill learning often resulted in a blend of elements of LP and NP approaches within their PE lessons to suit their children and classes. However, acknowledging, understanding, and moving beyond entrenched behaviours required patience and extended periods of time.

## Allowing Time for Change

The project at the primary school teachers needed time (e.g., one school year) to adopt a NP approach to PE. In the teacher focus groups reported in Chapter 6, one teacher stated how they thought they understood an NP approach to PE, but then at the end of the year suddenly everything clicked together 'like a jigsaw puzzle'. In this instance, it took over three 10-week school terms of working alongside me for the teacher to feel they had an understanding of an NP approach to PE that was sufficient for them to continue utilising this approach with their classes in my absence. The allowance of time facilitated teacher understanding.

When adapting teaching approaches, it can take time for the teachers to realise the fruits of their labour. However, as discussed in Chapter 6, the witnessing of great change in the children likely increased the self-efficacy of the teacher. For example, one

teacher explained how adapting their approach to PE facilitated change for a child who had previously disengaged with PE. This child then explained to the whole class how they had been using movement skills learnt in their PE lessons in physical activities beyond the school setting. Increased teacher self-efficacy was important for teachers to continue to adopt NP approaches to PE with their classes long term.

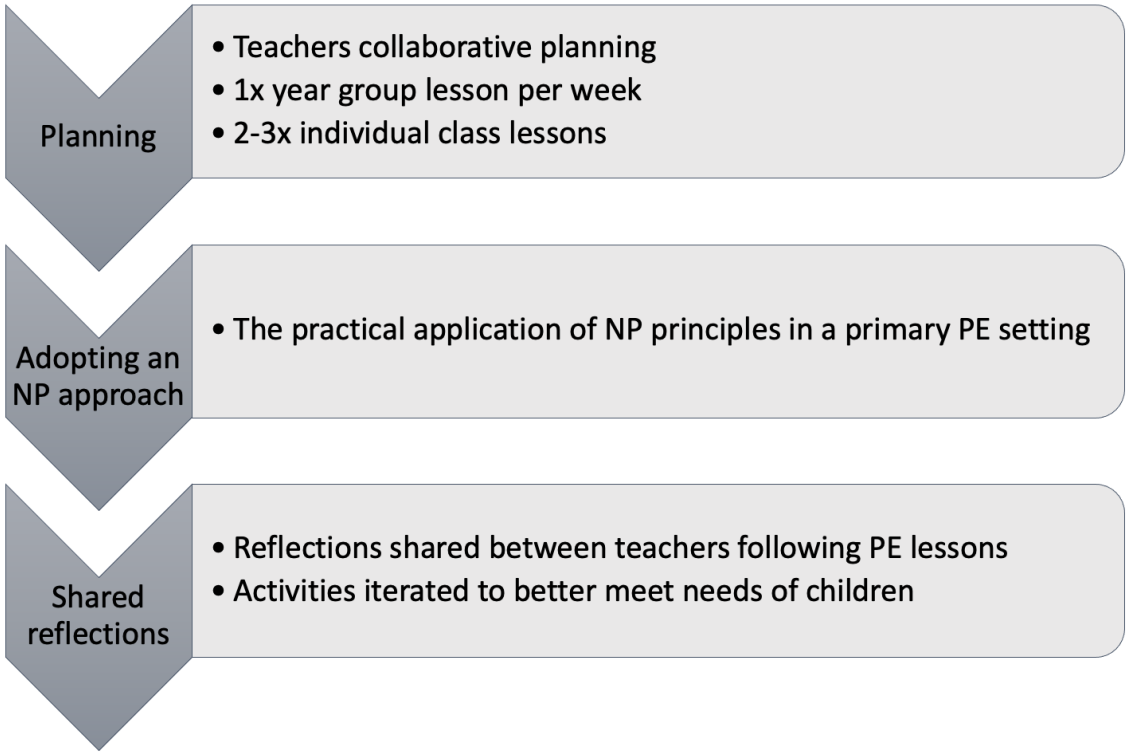
## Summary of Principles

This chapter outlined five principles identified through the PhD project as fundamental to sustainable improvement to PE. To help with understanding and contextualising these principles, the importance of each principle was discussed with specific regards to the success of the PhD project conducted at the primary school. It is my hope that the principles identified and discussed in this chapter can provide guidance for stakeholders (e.g., principals, teachers, boards of trustees) of other schools seeking to make sustainable improvements to their primary school PE practices.

# The Application of a Nonlinear Pedagogy Approach to Primary School Physical Education

The goal of this section is to share the practical applications discovered as part of putting this thesis together. Specifically, this section presents real-life examples from the study primary school that cover: 1) planning, 2) adopting an NP approach to PE, and 3) shared reflections (see Figure 9, below). Importantly, each example shared in this section was co-designed by the teachers in collaboration with the PhD student. As with the children's sense of ownership, it is important to note that the teachers' active involvement in the design of sessions likely supported their intrinsic motivation and supported them to make enduring change (Deci & Ryan, 2000). All names referred to in the text are pseudonyms.

*Figure 10. A flow diagram of how the teachers planned, implemented, and reflected upon their PE practices.*




***1. Planning***

During a typical 10-week school term, three to four PE lessons were conducted per week. Each week, the first session took place as a whole year-2 group. using a 'station rotation' format. During this lesson, several activities were set up for the children to move through in groups of approximately 20-30 children. Each station activity was planned for and run by one teacher. Additionally, one teacher 'floated' to support with managing the whole group.

Figures 11, 12, and 13, below, are examples of the teachers' shared planning documents showing teacher and student allocation, activity rotations for a whole-year-group lesson, and movement activity design respectively. Notably, the plan was created by the teachers at the study school in 2019, then adapted in 2020 to familiarise the new teachers and their classes with the PE practices. The first column shows the different

movement shape topics taught throughout the term and the other columns show what the teachers were individually responsible for teaching each week.

*Figure 11: A living example of a shared teacher planning document from weeks 2-9 of a 10-week school term.*

**Term 3 Timetable**

| | | Teacher 1 | Teacher 2 | Teacher 3 | Teacher 4 | Teacher 5 | Teacher 6 |
|---|---|---|---|---|---|---|---|
| Week 2 Rotation | 2:00 - 2:20 | Group 1 | Group 2 | Group 3 | Group 4 | Floating | Floating |
| | 2:25 - 2:45 | Group 2 | Group 1 | Group 4 | Group 3 | | |
| Week 3 Rotation | 2:00 - 2:20 | Group 3 | Group 4 | Group 1 | Group 2 | Floating | Floating |
| | 2:25 - 2:45 | Group 4 | Group 3 | Group 2 | Group 1 | | |
| Week 4 Marching Shape | 2:00 - 2:20 | Group 1 | Group 2 | Floating | Floating | Group 3 | Group 4 |
| | 2:25 - 2:45 | Group 2 | Group 1 | | | Group 4 | Group 3 |
| Week 5 Marching Shape | 2:00 - 2:20 | Lockdown | | | | | |
| | 2:25 - 2:45 | | | | | | |
| Week 6 Hip Hinge | 2:00 - 2:20 | | Lockdown | | | | |
| | 2:25 - 2:45 | | | | | | |
| Week 7 Hip Hinge | 2:00 - 2:20 | Group 3 | Group 4 | Floating | Floating | Group 1 | Group 2 |
| | 2:25 - 2:45 | Group 4 | Group 3 | | | Group 2 | Group 1 |
| Week 8 Managing Gravity | 2:00 - 2:20 | Floating | Floating | Group 1 | Group 2 | Group 3 | Group 4 |
| | 2:25 - 2:45 | | | Group 2 | Group 1 | Group 4 | Group 3 |
| Week 9 Managing Gravity | 2:00 - 2:20 | Floating | Floating | Group 3 | Group 4 | Group 1 | Group 2 |
| | 2:25 - 2:45 | | | Group 4 | Group 3 | Group 2 | Group 1 |

*Note.* The names at the top of the sheet note the allocation of each teacher to a learning focus. The multi-coloured groups are the groups of children allocated to each activity. The black block 'lockdown' demonstrates how this planning allowed for smooth adapting of schedules around Covid-19-related lockdowns.

*Figure 12: A visual example of how the classes would sample a variety of movement activities by rotating through movement stations during a whole year group lesson.*

Groups

| Group 1 M3 **Teacher 1** | Group 2 K1 **Teacher 2** | Group 3 M4 **Teacher 3** | Group 4 B10 **Teacher 4** |
|---|---|---|---|
| **LIST OF CHILDREN NAMES #1** | **LIST OF CHILDREN NAMES #2** | **LIST OF CHILDREN NAMES #3** | **LIST OF CHILDREN NAMES #4** |

**Rotation**

Teacher to remain on their activity/station and groups to rotate. Stations are 10 mins long with a 5 min allowance for transition time.
alternate roaming to assist/manage behaviour. You will always start with the group that is made up of your own class and a few extras.

| | ROAMING TEACHER NAME 1 | ROAMING TEACHER NAME 2 | ROAMING TEACHER NAME 3 | ROAMING TEACHER NAME 4 |
|---|---|---|---|---|
| 1:45-1:55 | Movement skill focus- introduction/demo | | | |
| 2:00-2:10 | Group 1 | Group 4 | Group 3 | Group 2 |
| 2:15-2:25 | Group 2 | Group 1 | Group 4 | Group 3 |
| 2:30-2:40 | Group 3 | Group 2 | Group 1 | Group 4 |
| 2:45-2:55 | Group 4 | Group 3 | Group 2 | Group 1 |

*Figure 13: A screen capture of Google document filled with activities co-created by the teachers and children at the study school.*

**Week 2-3**

*Movement skill focus- **Rapid stopping** (Long term plan can be found HERE) abc/ fgs/ fss*

| Teacher 1 | Teacher 2<br>**Equipment needed: 4 x hoops, 30 tennis balls, 4 buckets** | Teacher 3 | Teacher 4<br>**Equipment needed: 4 x hoops, 4 bean bags, 4 tennis balls (or other items)** |
|---|---|---|---|
| **Bandaid Tag**<br>all players can tag and be tagged. Once a person is tagged, he or she must put one hand on the spot they were touched to make a bandaid. Tagged again? Make a second bandaid with the other hand and continue to run. If a player is tagged for the third time, they must visit the "hospital" — a designated spot outside of the boundaries — and complete ten jumping jacks to heal and rejoin the game. | **Shooting 'hoops'**<br>Set up 4 stations with a hoop, tennis balls and a bucket each. In teams children run from a start line to the hoop, **stop** then throw a tennis ball into the bucket. They run back to the start, high five the next person in their group who then takes their turn. At the end the team with the most balls in the bucket wins.<br>When not having a turn children have to be moving...e.g. Running on the spot, star jumps, hopping etc | **Freeze**<br>Children to move around in various ways (animals, movement actions e.g. marching, jumping etc) Teacher says 'Freeze' children must freeze. If they move they must do set activity (e.g. star jumps) while next round is on then can join back in. | **Relay**<br>Set up 4 teams. Each team has a bean bag at the start of their line and a hoop at the end with a different item inside. Children sprint to the hoop where they **stop** and swap their beanbag for the item in their hoop. They sprint back to the start and hand over the item for their next team member to go.<br>When not having a turn children have to be moving...e.g. Running on the spot, star jumps, hopping etc |

### *2. Adopting a Nonlinear Pedagogy Approach to PE*

In this section, the discussion considers the application of NP principles through the context of a real activity designed by the teachers at the study school.

For this example, we will use the "shooting hoops" activity from the year-2 teachers' planning document (in Figure 12, above). Here is a list of possibilities of how the principles of NP can manifest themselves in primary school PE teaching practice:

Constraints manipulation: Manipulate the task constraints through the use of various ball shapes, sizes, and weights. Changing the target and presence of other people (i.e., opponents, teammates).

Task simplification: When manipulating constraints, consider a smaller ball that allows the children to move with the ball more easily. A larger target bucket may also facilitate a greater number of successful attempts of getting the ball into the bucket.

Attentional focus: To create an external focus of attention for distance throwing skills, the bucket could be placed further away from the child. There is no specific prescription for movement as each child will search for how they may now move to solve the problem of throwing at a target further away.

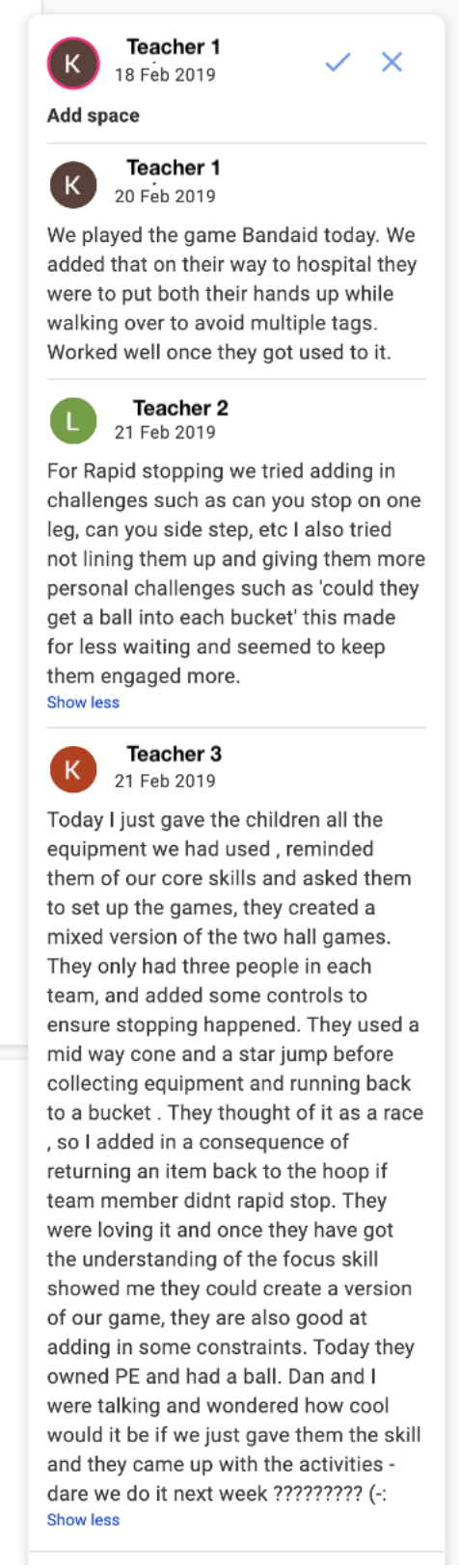
Representativeness: Running to the hoop could be replaced with moving like storybook characters. For example, the children may be tasked with moving like different animal characters from the children's book *Charlotte's Web*. With the aim to develop children's abilities to move in different ways, with a ball, towards a target, may represent a game like basketball.

Exploratory learning: The competitive element of 'most balls in the bucket wins' could be replaced with challenging the children to 'shoot' different types of equipment each turn. This could facilitate the children exploring new movements, leading them to more functional solutions.

### *3. Shared Reflections*

Throughout the year, teachers would share their activity planning and reflections through a shared Google document. This social accountability by doing the work as a team proved invaluable for the teachers' consistency in planning and conducting PE throughout the year. A systematic review by Vangrieken et al. (2015) noted a myriad of benefits emerging from teacher collaborations, including an enhanced ability to deal with the complexity of teacher work, improved teacher morale, and collective teacher efficacy. The teachers' documents also allowed the opportunity for teachers to share their reflections following implementing their activities with the children. These reflections were primarily useful in two ways: 1) to improve the activities for future whole class lessons, and 2) to support the teachers in best implementing the activities with their classes individually throughout the week. Then, throughout the year, the activities were iterated to better meet the needs of the children whilst working towards a purposeful PE outcome.

*Figure 14. Real examples of teacher reflections following teaching their respective movement activities.*




***Summary***

The intention of this section was to share practical applications of the research reported in this thesis through real-world examples from a primary school in Auckland, New

Zealand. The section outlined how practices of shared planning and reflections were employed, along with practical examples of adopting an NP approach to primary school PE. It is intended that the shared real-world practical examples can help support other people with making practical change to PE practices at their school.

# Chapter 9: Conclusion

Using a combination of quantitative and qualitative research methods in the research reported in this thesis revealed the complexities of change in a primary school setting. The findings show an NP approach to PE can support MSC development and satisfy the underlying psychological needs of children. Further, adult experiences pertaining to the adoption of an NP approach to PE highlight the importance of a curious leader and teachers with a commitment to development. A quantitative study described in Chapter 5 report the positive impacts an NP approach in PE has on children's MSCs compared with an LP approach. A qualitative study described in Chapter 6 utilised interviews and focus groups to generate a nuanced understanding of adults' and children's experiences when adopting an NP approach to PE. For example, a key finding in Chapter 5 was the continued improvement of children's MSC seen 13 weeks after the cessation of the NP approach to PE interventions. The methods in the quantitative study facilitated speculation as to why this finding occurred. The study in Chapter 6 provided greater insight as the key themes identified from the children's focus group (achievement, ownership, role of the teacher) closely align the motivational theory of SDT (Deci & Ryan, 2000) which has been previously associated with long-term learning behaviours. Thus, the combination of quantitative and qualitative research methods allowed for a deeper understanding of the impact of an NP approach to PE in a primary school setting.

As previously discussed, in Chapter 5, there was no significant between difference in MSC between the NP and LP approach to PE groups at the nine-week post-study timepoint. However, at the 13-week retention-test timepoint, significant between-group differences in favour of an NP approach to PE were apparent. An ecological dynamics perspective provides a further reason as to why this result may

have occurred. Specifically, an individual–environment interaction is used explain how individuals coordinate goal-directed movement (Kugler et al., 1980). Thus, ecological dynamics theory is a useful lens through which the development of children's MSC can be viewed. To develop MSC, an individual must better adapt their movement solutions to the problem presented by environment, requiring opportunities to adapt to the changeable circumstances of representative movement environments (Fajen et al., 2009). For individuals to attune to affordances (opportunities for action) in the environment and better adapt their individual movement solutions, an extended period of time can be required (Araujo et al., 2014; Button et al., 2020). Thus, the findings reported in Chapter 5 may be a result of the time taken for children adopting the NP approach to adapt their improved MSC. However, this is speculation as the methods of Chapter 5 did not include measures of what the children did during the 13-week retention period. Therefore, future investigation is warranted to continue to explore and better understand the factors associated with long-term change in children's MSC following an NP approach to PE.

A focal point of this research was the practical impact on the study primary school. In Chapter 6, the principal shared a sensed need for change at school to better align PE practices with the school learning vision of supporting all children "to be the best they can be". For change to PE practices to occur, it was essential a person in a leadership position (i.e., the principal) supported the myriad of changes that needed to be made. One key factor was supporting the teachers through the resistance to changing from their current teaching approaches to PE. In Chapter 6, teachers expressed how it took them extended periods of time to overcome the resistance to making change from their previous traditional practices of "teaching PE the way we were taught" to contemporary NP approaches where they sought to "empower children" in PE. As an example of the sustained practical impact of this PhD project, the teachers who

participated in the study reported in Chapter 6 are now role models and mentors for their teaching peers who are embarking on the process of adapting their teaching approaches to PE with their classes.

To successfully support the practical applications of the findings of this research, it was essential teachers were actively involved in the development of the project. The active involvement was important for me as a pragmatic researcher, because the value in the research findings is found in the practical impact in real-world settings. Thus, in Chapter 6 it was crucial to capture the voice of the teachers. Additionally, the practical applications shared in Chapter 8 were taken from real-world examples created by teachers at the study school. For teachers in other settings, the value of my research may be derived from guiding PE lesson design, modifications, and communication within the lesson to support children's long-term learning of movement skills. The hope is that by combining human movement science with the real-world pedagogical examples, the applications of this research will be more easily understood and useable for teachers in other schools.

## Limitations

The findings presented in this thesis provide a strong contribution to the movement skill scientific literature. Nonetheless, human movement behaviours and actions are complex, making the identification of factors associated with the development of MSC challenging. Thus, in this research a notable finding was the continued development of children's MSC 13 weeks after the intervention period; however, it was beyond the scope of this project to identify all factors contributing to the changes in MSC. For example, whilst the research findings suggest an NP approach significantly improved children's MSCs when compared with an LP approach, it is unclear exactly what factors resulted in this change, specifically during the 13-week retention period. While findings

from the qualitative research study suggested intrinsic motivation was a likely factor contributing to sustained improvements to MSC, explicit measures of intrinsic motivation were beyond the scope of this research and thus are recommended for future studies.

A strength of this study was the positioning of the entire research project in situ at a New Zealand primary school for an extended time period. In other words, working alongside the school leadership team, teachers, and children facilitated a deep understanding of school context and how the research could best support positive changes to the PE teaching practices of a primary school. However, researching in only a single school and for the duration of the study resulted in a limited subject sample size. Although the case study school facilitated a deep understanding of the research context, researching in less depth across multiple school settings with a larger subject sample size may have generated research findings more broadly applicable to other school settings. Specifically, a strength of this research was its development alongside the leadership team and teachers in a specific school setting. This positioning of the researcher in situ facilitated a meaningful impact on PE practices at the study school. However, it is possible that the problems faced and overcome in implementing an NP approach to PE successfully may not be broadly applicable to other school settings. For example, the principal and his leadership team had a vested interest in supporting change to PE practices at the school. Unfortunately, in some schools PE is not seen as a priority (Dwyer et al., 2003) and thus the multifaceted support and patience required to achieve the positive outcomes demonstrated in this thesis project may not occur in other schools where PE is not prioritised by school leadership teams and, consequently, teaching staff. Therefore, although valuable findings and insights are shared throughout this thesis, the findings of this project may not be applicable to other primary school settings.

## Suggested Future Research Directions

The findings of this thesis make a strong contribution to the MSC literature; nonetheless, considerable research is still required to advance the field. This thesis has reported that an NP approach was effective in improving children's MSC, and an important next step for future research is to provide a greater understanding of the factors that support the sustainable development of children's MSC, including sustainable change in teacher behavious. Directly, what were the key factors that supported children to continue to develop their MSCs 13 weeks after the cessation of the PE intervention? As MSCs have been closely linked with long-term physical activity participation (Logan et al., 2012; Morgan et al., 2013), a more comprehensive understanding of the key factors supporting MSC development during childhood could benefit lifelong health and wellbeing. This new knowledge could be used to purposefully design PE environments that support more children with sustained MSC development.

Although the findings from this research, in addition to those published in the literature previously, suggest the intrinsic motivation of the learner plays a pivotal role in long-term learning outcomes, future research is warranted. Explicit measures of children's intrinsic motivation throughout an NP approach to PE interventions would better guide teachers in designing learning settings that facilitate long-term MSC development. For future research, two key questions to investigate could be:

1) What are the perceptual and motor mechanisms responsible for long-term positive changes in children's MSC following an NP approach to PE?
2) How are explicit measures of intrinsic motivation related to long-term change in MSC following an NP approach to PE?

Another valuable direction for future research to undertake would be the development of MSC assessments to better gauge the impact of NP approaches to PE.

Both quantitative and qualitative assessment methods should be further developed. Firstly, current quantitative assessment methods of children's MSC are often limited from an ecological perspective as they are not representative of the play, sports, and physical activities children participate in (Cools et al., 2009). More recently, assessments have been designed to address this issue (Longmuir et al., 2017). Also, the MSC assessments used and reported in Chapter 5 were selected as they were more representative of real-world movement settings. Nonetheless, further investigation is required to assess children's MSC in ways that align with an ecological perspective of movement skill, whilst being practical for teachers in school settings. With improved quantitative assessments of MSC, researchers and practitioners alike will be able to measure the impact of interventions with greater confidence.

Additionally, there is a need to continue to utilise and develop qualitative methods to capture children's voice. Formally, providing opportunities for children to actively participate in research involving them is important (Cremin et al., 2011). Although novel approaches to capturing children's voice were adopted in this study, much work is required to better understand how to effectively capture children's voice in MSC research. An important outcome would be in supporting more children to be able to share their experiences of PE to guide better teaching practices. Finally, a key aim of the principal at the school was the sustainable change of teacher behaviour. Reflections from the author relating to sustainable change in teaching approaches to PE were presented in Chapter 8. However, it was beyond the scope of this thesis to explicitly measure sustainable to teaching behaviour and would be a worthwhile investigation for future research.

## Summary

This thesis contributes new knowledge to the movement skill learning literature. Now, future research should continue to investigate NP approaches to primary school PE along with exploring the key factors that support sustained changes in children's MSC. Further to the contribution to the scientific literature, this research has had a meaningful real-world effect on the study school. Importantly, the experiences of adults and children at the school were captured and revealed further insights into the impact of an NP approach to PE. Lastly, my insights as a researcher embedded into a primary school for four years along with the teachers' practical applications were shared in the hope of supporting other schools and teachers seeking to improve the provision of PE for children. Nonetheless, whilst the findings reported in this thesis are an exciting insight into the possibilities for the future of primary school PE, it is important view the research in light of its limitations and the clear need for continued investigation.

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# Appendices

## Appendix A: Study One Parent Information Sheet [Alternate School]

# Parent/Guardian Information Sheet

**Date Information Sheet Produced:**

### 4th October 2019

**Project Title**

How does a child-centred pedagogical approach to physical education impact movement skill learning in children?

My name is Daniel Cooke and I work at [Name Removed] as a coach of our movement skill programme and I am a PhD student conducting research at Auckland University of Technology. I would like to invite your child to participate in research I am conducting as part of my PhD studies. This sheet will provide information regarding this study. Your child's participation is entirely voluntary, and they may withdraw from this study at any time without penalty. Participation is dependent upon both your child and their parent/guardian signing assent/consent forms. As all assessments and physical education programmes will take place during our scheduled physical education time, your regular classroom teacher will accompany your child at all times.

**What is the purpose of this research?**

The purpose of this research is to enhance the quality of physical education lessons that children experience in primary school settings. We are looking into how a child-environment centred approach to learning can impact a child's movement skill development. With better knowledge of the impact of such an approach we may be able to better support a lifelong engagement in physically active lifestyle for all of our primary school children in the local community. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

As part of learning how we can better support children in the development of these movement skills we would like your permission to assess your child's movement skill competencies.

**How was I identified and why am I being invited to participate in this research?**

As Stanmore Bay School is part of the local learning community and the Principal at Stanmore Bay Primary Schol expressed an interest in the school being involved in the research project. Further, your child's classroom teacher has consented to take part in this research study.

To support in the efficient running of the study other researchers from Auckland University of Technology will be present during the performance of the assessments.

**How do I agree to participate in this research?**

A consent form has been enclosed for you with this information sheet. An assent form has also been included for your child. A returned and signed parent consent form, and signed child assent form denote agreement to participate in this research. Please note that if you decide for your child to not take part in

this research study, all lessons will continue as per usual, however your child will not be included in the physical assessments components.

Your child's participation in this research is voluntary (it is their and your choice) and whether or not they choose to participate will neither advantage nor disadvantage your child. You are able to withdraw your child from the study at any time. If you choose for your child to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to your child removed or allowing it to continue to be used. However, once the findings have been produced, removal of data may not be possible.



**What will happen in this research?**

This research will consist of movement assessments at three different time points (Week 1 of Term 4, Week 10 of Term 4, and at the beginning of Term 1 2020). All assessments will be conducted at Stanmore Bay Primary School during regular school hours.

Specifically, this research will consist of five movement assessments that will provide information regarding different components of your child's movement skill. The five assessments will involve:

1. Two standing long jumps where children will stand behind a line and jump as far as they can where the distance will be recorded.
2. An obstacle course style assessment that will involve going over and under three hurdles in various directions as fast as they can.
3. A change of direction assessment where children will run as fast as they can over a distance of 8.5m, touch a target, and run back to the beginning point as fast as they can.
4. A simple strength test will be included where children pull an immovable bar as hard as they can upwards from a semi-squat position.
5. A dot jump test. Children place a dot on the ground at the furthest distance they believe they can successfully jump to. They then perform a standing long jump as far as they can. The distance they place the marker at and the distance they successfully jump to will be recorded.

Three of the assessments will involve video recording (Standing long jump, a change of direction assessment, and the obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.

This study will measure the impact of a movement skill learning approach best suited to children. Accordingly, all assenting child participants in this study will:

- have the opportunity to continue with their regular physical education lessons.
- be assessed doing an obstacle course;
- have had parental permission to partake in the physical education lessons;
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;
- be safe. A teacher of Stanmore Bay School will be present at all assessment sessions.

All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

The movement assessments have been established based upon activities typical of a child's recreational activity and/or sporting environment and therefore present no greater risk than typical child play

environments. Some parts of the movement assessment will be video recorded for movement analysis purposes, however, the child's identity will remain confidential at all times.

**How will these discomforts and risks be alleviated?**

Certain aspects of the movement assessment session will be video recorded, this is part of the assessment that takes place afterwards by reviewing the video footage. All information will be entered into a secure and anonymous database at Auckland University of Technology. The raw video footage will only be accessed by the primary researcher (Daniel Cooke) and the project supervisor (Dr Craig Harrison). In alignment with Auckland University of Technology practices and as approved by the Ethics committee, the video footage will be securely stored on a password protected computer at the Sport Performance Research Institute New Zeland's offices for a period of 10-years prior to being destroyed.

All movement assessments will take place with full permission from Auckland University of Technology ethics committee and will be conducted at Stanmore Bay Primary School sports hall.

The identity of all participants will always remain anonymous. The identity of the participants will in no circumstances become public. Any information relating to the participants will be stored on a secure and anonymous database and will be protected by a password known only to myself and Dr Craig Harrison. You may withdraw your consent at any time before or during the study. If you decide to withdraw your consent all information provided by your child will be destroyed. The AUT Ethics Committee (AUTEC) has strict guidelines relating to research involving children and they have looked closely at my study and have approved the methods I am adopting.

**What are the benefits?**

This research will support your children in the assessment and development of their movement skills. It will also provide an opportunity for you as their parent/guardian to better understand their current movement skill capabilities. Additionally, the information learned from this research will help guide the development of physical education programmes for children of the future in our local community and wider communities of New Zealand Primary Schools. This information will also benefit me personally on the journey to completing my PhD studies.

**What compensation is available for injury or negligence?**

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

**How will my privacy be protected?**

Your child's identity will remain confidential at all times with the researcher (Daniel Cooke) and project supervisor (Dr Craig Harrison) only having access to the participants information. All video footage will be stored on a password protected computer in a secure office space at Sports Performance Research Institute New Zealand and only accessed by the lead researcher (Daniel Cooke) and project supervisor (Dr Craig Harrison). If you have any further concerns please speak to Daniel Cooke.

**What are the costs of participating in this research?**

Participation in the study will involve no time in addition to your child's regular school day. It will require a time commitment of 30-minutes on three separate occasions (Week 1 of Term 4, Week 10 of Term 4, and beginning of Term 1 2020). This will be discussed in conjunction with the classroom teacher to ensure minimal disruption to your child's day.

**What opportunity do I have to consider this invitation?**

If you would like to participate in this research, you have until Friday 18th October 2019 to consider this invitation and return the necessary documentation.

**Will I receive feedback on the results of this research?**

Yes, if you would like copies of any reports please indicate this on the consent form. Please note, in the interest of confidentiality, feedback will only relate to your child's information.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181.*

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

## *Researcher Contact Details:*

Daniel Cooke: Email dmcooke08@gmail.com

## *Project Supervisor Contact Details:*

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

**Approved by the Auckland University of Technology Ethics Committee 08/10/19, AUTEC Reference number 19/234.**

## Appendix B: Study One Parent/Guardian Information

# Parent/Guardian Information Sheet

**Date Information Sheet Produced:**

4th October 2019

**Project Title**

> How does a child-environment centred pedagogical approach to physical education impact movement skill learning in children?

My name is Daniel Cooke and as well as working within our teaching community and [Name Removed] I am a PhD student conducting research at Auckland University of Technology. I would like to invite your child to participate in research I am conducting as part of my PhD studies at [Name Removed]. This sheet will provide information regarding this study. Your child's participation is entirely voluntary, and they may withdraw from this study at any time without penalty. Participation is dependent upon both your child and their parent/guardian signing assent/consent forms. As all assessments and physical education programmes will take place during our scheduled physical education time, your regular classroom teacher will accompany your child at all times.

**What is the purpose of this research?**

The aim of this study to better understand the impact that our approach to our physical education lessons is having upon the movement skills of our children. With the knowledge of how our approach to physical education is impacting movement skill learning we will be able to better support a lifelong engagement in physically active lifestyle for all children within our local and wider community. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

**How was I identified and why am I being invited to participate in this research?**

Firstly your child's classroom teacher at [Name Removed]has registered their interest in the class taking part in this research study. As your child is in a year 2 class at [Name Removed] and the teacher has registered this interest, your child is being invited to participate in this research.

**How do I agree to participate in this research?**

A consent form has been enclosed for you with this information sheet. An assent form has also been included for your child. A returned and signed parent consent form, and signed child assent form denote agreement to participate in this research. Please note that if you decide to not take part in this research study, all lessons will continue as per usual, however your child will not be included in the physical assessments components.

Your child's participation in this research is voluntary (it is their and your choice) and whether or not they choose to participate will neither advantage nor disadvantage your child. You are able to withdraw your child from the study at any time. If you choose to withdraw your child from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of data may not be possible.

**What will happen in this research?**

At [Name Removed] we are aiming to gauge the impact of our physical education (PE) lesson programme upon the development of the movement skills of your child. During our PE programme all children are engaging in a variety of activities that are representative of sports skills, game skills, and child play in a variety of environments. All of this is delivered using a child-centre teaching approach to develop children's movement skills at an individualised level.

Specifically, this research will consist of five movement assessments that will provide information regarding different components of your child's movement skill. The five assessments will involve:

1. Two standing long jumps where children will stand behind a line and jump as far as they can where the distance will be recorded.
2. An obstacle course style assessment that will involve going over and under three hurdles in various directions as fast as they can.
3. A change of direction assessment where children will run as fast as they can over a distance of 8.5m, touch a target, and run back to the beginning point as fast as they can.
4. A simple strength test will be included where children pull an immovable bar as hard as they can upwards from a semi-squat position.
5. A dot jump test. Children place a dot on the ground at the furthest distance they believe they can successfully jump to. They then perform a standing long jump as far as they can. The distance they place the marker at and the distance they successfully jump to will be recorded.

These assessments will be conducted at three different time points (Week 1/2 of Term 4, Week 9/10 Term 4, and beginning of Term 1 2020) at [Name Removed]. Three of the assessments will involve video recording (Standing long jump, change of direction assessment, and obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.

Three of the assessments will involve video recording (Standing long jump, a change of direction assessment, and the obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.

All assessments will take place during regular school hours and around scheduled physical education lesson times. This will allow for the lead researcher to put the children through the physical assessments whilst allowing the teacher to conduct regular lesson activities with those children that are not participating in the research.

There are few studies that have used a child-centred approach to movement assessment in movement skill learning research. This study will measure the impact of a movement skill learning approach best suited to children. Accordingly, all assenting child participants in this study will:

- have the opportunity to continue with their regular physical education lessons.
- be assessed in child play surroundings (obstacle course style assessment);
- have had parental permission to partake in the physical education lessons;
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;
- be safe. A teacher of [Name Removed] will be present at all assessment sessions.

All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

The movement assessments have been established based upon activities typical of a child's recreational activity and/or sporting environment and therefore present no greater risk than typical child play environments. Some parts of the movement assessment will be video recorded for movement analysis purposes, however, the child's identity will remain confidential at all times.

**How will these discomforts and risks be alleviated?**

Certain aspects of the movement assessment session will be video recorded, this is part of the assessment that takes place afterwards by reviewing the video footage. All information will be entered into a secure and anonymous database at Auckland University of Technology. The raw video footage will only be accessed by the primary researcher (Daniel Cooke) and the project supervisor (Dr Craig Harrison). In alignment with Auckland University of Technology practices and as approved by the Ethics committee, the video footage will be securely stored on a password protected computer at the Sport Performance Research Institute New Zeland's offices for a period of 10-years prior to being destroyed.

All movement assessments will take place with full permission from Auckland University of Technology ethics committee and will be conducted at [Name Removed] sports hall.

The identity of all participants will always remain confidential. The identity of the participants will in no circumstances become public. Any information relating to the participants will be stored on a secure and anonymous database and will be protected by a password known only to myself and Dr Craig Harrison. You may withdraw your consent at any time before or during the study. If you decide to withdraw your consent all information provided by your child will be destroyed. The AUT Ethics Committee (AUTEC) has strict guidelines relating to research involving children and they have looked closely at my study and have approved the methods I am adopting.

**What are the benefits?**

This research will support your children in the assessment and development of their movement skills. It will also provide an opportunity for you as their parent/guardian to better understand their current movement skill capabilities. Additionally, the information learned from this research will help guide the development of physical education programmes for [Name Removed] children of the future and the wider community of New Zealand Primary Schools. This information will also benefit me personally on the journey to completing my PhD studies.

**What compensation is available for injury or negligence?**

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

**How will my privacy be protected?**

Your child's information and involvement within the study will remain confidential at all times with the researcher (Daniel Cooke) and project supervisor (Dr Craig Harrison) only having access to the participants information. If you have any further concerns please speak to Daniel Cooke.

**What are the costs of participating in this research?**

Participation in the study will involve no time in addition to your child's regular school day at [Name Removed]. It will require a time commitment of 30-minutes on three separate occasions (Week 1 of Term 4, Week 10 of Term 4, and beginning of Term 1 2020). This will be discussed in conjunction with the classroom teacher to ensure minimal disruption to your child's day.

**What opportunity do I have to consider this invitation?**

If you would like to participate in this research, you have until 18th October 2019 to consider this invitation and return the required documentation.

**Will I receive feedback on the results of this research?**

Yes, if you would like copies of any reports please indicate this on the consent form.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

***Researcher Contact Details:***

Daniel Cooke: Email dmcooke08@gmail.com

***Project Supervisor Contact Details:***

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

**Approved by the Auckland University of Technology Ethics Committee on *08/10/2019*, AUTEC Reference number *19/234*.**

# Appendix C: Study One Teacher Information Sheet [Alternate School]

## Teacher Information Sheet

## Date Information Sheet Produced:

4th October 2019

## Project Title

How does a child-centred pedagogical approach to physical education impact movement skill learning in children?

### An Invitation

My name is Daniel Cooke and as well as working within our teaching community at [Name Removed] I am a PhD student conducting research at Auckland University of Technology. As you have previously expressed an interest in participating in our research project I would like to take this opportunity to share this information sheet with you.

I would like to formally invite you to participate in research I am conducting as part of my PhD studies at Auckland University of Technology. This sheet will provide information regarding this study. Your participation is entirely voluntary, and you may withdraw from this study at any time without penalty. Participation is dependent upon you signing the consent form.

## What is the purpose of this research?

The purpose of this research is to enhance the quality of physical education lessons that children experience in primary school settings. We are looking into how a child-environment centred approach to learning can impact a child's movement skill development. With better knowledge of the impact of such an approach we may be able to better support a lifelong engagement in physically active lifestyle for all of our primary school children in the local community. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

As part of learning how we can better support children in the development of these movement skills we would like your permission to assess your child's movement skill competencies.

There are few studies that involve the assessment of primary school aged children's movement skill development. This study will measure the change of children's' movement skills over time, and will help to inform teaching practices around physical education for the local Hibiscus Coast and wider National primary school community.

## How was I identified and why am I being invited to participate in this research?

As Stanmore Bay School is part of the local learning community and the Principal and you have expressed an interest in participating in this research via conversation you have been invited to participate in our research. Further, as you have experience delivering physical education lessons at the same class level (year 2) as some teachers we are following at other Primary Schools you have been invited to participate in this research. If you are no longer interested in participating in this research, you withhold the right to withdraw from the research at any time.

## How do I agree to participate in this research?

A consent form has been enclosed for you with this information sheet. A returned and signed consent form will denote agreement to participate in this research.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

## What will happen in this research?

This research will consist of movement assessments at three different time points (Week 1 of Term 4, Week 10 of Term 4, and at the beginning of Term 1 2020). All assessments will be conducted at Stanmore Bay Primary School during regular school hours.

Specifically, this research will consist of five movement assessments that will provide information regarding different components of children's movement skill. The five assessments will involve:

1. Two standing long jumps where children will stand behind a line and jump as far as they can where the distance will be recorded.
2. An obstacle course style assessment that will involve going over and under three hurdles in various directions as fast as they can.
3. A change of direction assessment where children will run as fast as they can over a distance of 8.5m, touch a target, and run back to the beginning point as fast as they can.
4. A simple strength test will be included where children pull an immovable bar as hard as they can upwards from a semi-squat position.
5. A dot jump test. Children place a dot on the ground at the furthest distance they believe they can successfully jump to. They then perform a standing long jump as far as they can. The distance they place the marker at and the distance they successfully jump to will be recorded.

Three of the assessments will involve video recording (Standing long jump, a change of direction assessment, and the obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.

This study will measure the impact of a movement skill learning approach best suited to children. Accordingly, all assenting child participants in this study will:

- have the opportunity to continue with their regular physical education lessons.
- be assessed doing an obstacle course;
- have had parental permission to partake in the physical assessments;
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;
- be safe. A teacher of Stanmore Bay School will be present at all assessment sessions.

Additionally, at four time points through the term I will arrange to observe some of your physical education lessons and meet with you to record information relating to the description of the children's physical activities through the school week. Specifically, I will record notes relating to:

- Attendance
- Session structure
- Equipment provided
- Teacher intervention frequency
- Teacher intervention type (i.e. general, specific, question, directive etc.)

All field notes will be recorded manually using paper and pen during sessions, within 7 days all notes will be typed up and stored on a password protected computer at SPRINZ in AUT-Millennium, at this point all raw notes will be destroyed.

All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

There are minimal risks associated with this research, however you may find discomfort in my observation of your physical education lessons. However, this is necessary in order to best describe how your teaching approach has impacted the children's the movement skills.

**How will these discomforts and risks be alleviated?**

You always withhold the right to withdraw from participation in the research. Observation protocols will take place with full permission from Auckland University of Technology ethics committee.

**What are the benefits?**

This research will support children in the assessment and development of their movement skills. It will also provide an opportunity for you as their teacher to better understand their current movement skill capabilities. Further, it will provide you with an understanding of how your teaching approach to physical education lessons impacts the development of their movement skills over time.

Additionally, the information learned from this research will help guide the development of physical education programmes for [Name Removed] children of the future and the wider community of New Zealand Primary Schools. This information will also benefit me personally on the journey to completing my PhD studies.

**What compensation is available for injury or negligence?**

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

## How will my privacy be protected?

Your identity will remain confidential at all times with the researcher (Daniel Cooke) and project supervisor (Dr Craig Harrison) only having access to the participants information. If you have any further concerns please speak to Daniel Cooke.

## What are the costs of participating in this research?

Participation in the study will involve no time in addition to your regular schedule physical education lessons at Stanmore Bay School during a normal school day.

## What opportunity do I have to consider this invitation?

If you would like to participate in this research, you have until 27th September 2019 to consider this invitation and return the necessary documentation.

## Will I receive feedback on the results of this research?

Yes, if you would like copies of any reports please indicate this on the consent form.

## What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

## Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

# Researcher Contact Details

Daniel Cooke: Email dmcooke08@gmail.com

# Project Supervisor Contact Details

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

**Approved by the Auckland University of Technology Ethics Committee on *08/10/2019*, AUTEC Reference number *19/234*.**

# Appendix D: Study One Teacher Information Sheet

## Teacher Information Sheet

## Date Information Sheet Produced:

4th October 2019

## Project Title

How does a child-environment centred pedagogical approach to physical education impact movement skill learning in children?

An Invitation

My name is Daniel Cooke and as well as working within our teaching community and [Name Removed] I am a PhD student conducting research at Auckland University of Technology. As you have previously expressed an interest in participating in our research project I would like to take this opportunity to share this information sheet with you.

I would like to formally invite you to participate in research I am conducting as part of my PhD studies at [Name Removed]. This sheet will provide information regarding this study. Your participation is entirely voluntary, and you may withdraw from this study at any time without penalty. Participation is dependent upon you signing the consent form.

## What is the purpose of this research?

The aim of this study to better understand the impact that our approach to physical education lessons is having upon the movement skills of our children. With the knowledge of how our approach to physical education is impacting movement skill learning we will be able to better support the lifelong engagement in a physically active lifestyle for all of our children at [Name Removed] and the wider community. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

## How was I identified and why am I being invited to participate in this research?

As you have expressed an interest in participating in this research via conversation you have been invited to participate in the research. Further, as you have experience delivering physical education lessons utilising a contemporary teaching style you have been invited to participate in this research. If you are no longer interested in participating in this research you withhold the right to withdraw from the research at any time.

## How do I agree to participate in this research?

A consent form has been enclosed for you with this information sheet. A returned and signed consent form will denote agreement to participate in this research. Please note that if you decide to opt out of this research study, all lessons will continue as per usual, however your class will not be included in the physical assessment components.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

**What will happen in this research?**

At [Name Removed] we are aiming to gauge the impact of our physical education (PE) lesson programme upon the development of the movement skills of your child. During our PE programme all children are engaging in a variety of activities that are representative of sports skills, game skills, and child play in a variety of envrionments. All of this is delivered using a child-centre teaching approach to develop children's movement skills at an individualised level.
Specifically, this research will consist of five movement assessments that will provide information regarding different components of your child's movement skill. The five assessments will involve:

1. Two standing long jumps where children will stand behind a line and jump as far as they can where the distance will be recorded.

2. An obstacle course style assessment that will involve going over and under three hurdles in various directions as fast as they can.

3. A change of direction assessment where children will run as fast as they can over a distance of 8.5m, touch a target, and run back to the beginning point as fast as they can.

4. A simple strength test will be included where children pull an immovable bar as hard as they can upwards from a semi-squat position.

5. A dot jump test. Children place a dot on the ground at the furthest distance they believe they can successfully jump to. They then perform a standing long jump as far as they can. The distance they place the marker at and the distance they successfully jump to will be recorded.

Three of the assessments will involve video recording (Standing long jump, a change of direction assessment, and the obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.

These assessments will be conducted at three different time points (Week 1 of Term 4, Week 10 Term 4, and beginning of Term 1 2020) at [Name Removed].
Three of the assessments will involve video recording (Standing long jump, change of direction assessment, and obstacle course style assessment), this is solely to aid in the assessment of the child's performance of the movement assessment and will only be seen by the lead researcher Daniel Cooke and his supervisor at AUT, Dr Craig Harrison.
These movement assessments will not disrupt your child's usual school activity as the assessments will take place during our scheduled physical education lesson time slots.
There are few studies that have used a child-centred approach to movement assessment in movement skill learning research. This study will measure the

impact of a movement skill learning approach best suited to children. Accordingly, all consenting teacher participants in this study will:

- have the opportunity to continue with their regular physical education lessons.
- have their classroom children doing an obstacle course;
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;

Additionally, during your class physical education lessons I will observe the lessons at four different time points to record information relating to the description of the sessions. Specifically, I will record observational notes relating to:

- Attendance register
- Activity register
- Session structure
- Equipment provided
- Teacher intervention frequency
- Teacher intervention type (i.e. general, specific, question, directive etc.)

All field notes will be recorded manually using paper and pen during sessions, within 7 days all notes will be typed up and stored on a password protected computer at SPRINZ in AUT-Millennium, at this point all raw notes will be destroyed.

This study will contribute towards my PhD qualification, presentations and peer-reviewed publications, all of which participant information will remain confidential at all times. All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

There are minimal risks associated with this research, however you may find discomfort in my observation of your physical education lessons. However, this is necessary in order to best describe how your teaching approach has impacted the children's the movement skills.

## How will these discomforts and risks be alleviated?

You always withhold the right to withdraw from participation in the research.

Observation protocols will take place with full permission from Auckland University of Technology ethics committee.

## What are the benefits?

This research will support children in the assessment and development of their movement skills. It will also provide an opportunity for you as their teacher to better understand their current movement skill capabilities. Further, it will provide you with an understanding of how your teaching approach to physical education lessons impacts the development of their movement skills over time.

Additionally, the information learned from this research will help guide the development of physical education programmes for [Name Removed] children of the future and the wider community of New Zealand Primary Schools. This information will also benefit me personally on the journey to completing my PhD studies.

## What compensation is available for injury or negligence?

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

## How will my privacy be protected?

Your identity will remain confidential at all times with the researcher (Daniel Cooke) and project supervisor (Dr Craig Harrison) only having access to the participants information. If you have any further concerns please speak to Daniel Cooke.

## What are the costs of participating in this research?

Participation in the study will involve no time in addition to your regular schedule physical education lessons at [Name Removed] during a normal school day.

## What opportunity do I have to consider this invitation?

If you would like to participate in this research, you have until 27th September 2019 to consider this invitation and return the required documentation.

## Will I receive feedback on the results of this research?

Yes, if you would like copies of any reports please indicate this on the consent form.

## What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

## Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

**Researcher Contact Details:**

Daniel Cooke: Email dmcooke08@gmail.com

**Project Supervisor Contact Details:**

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

**Approved by the Auckland University of Technology Ethics Committee on *08/10/2019*, AUTEC Reference number *19/234*.**

# Appendix E: Study One Child Information Sheet and Assent Form [Alternate School]

Study One – [Name Removed] Primary School

## Title of research

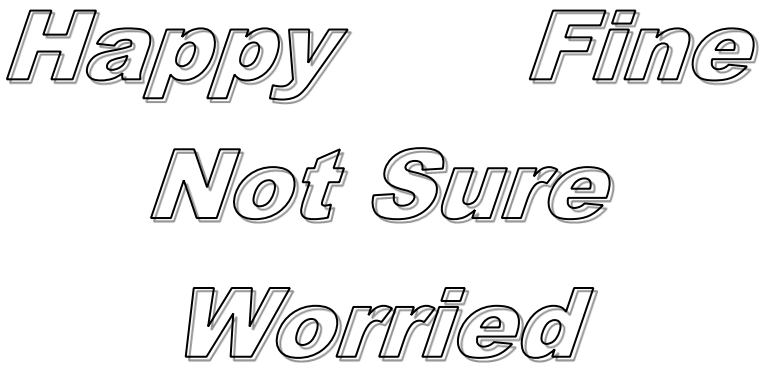
How does a child-centred pedagogical approach to physical education impact movement skill learning in children?

*(parent/caregivers please read to children)*

*This form will be kept for a period of 10 years*

Hello – my name is Daniel Cooke.

You may recognise me as I have been at the school alongside your teacher for some of your sport lessons. I would like to spend some time with you at Stanmore Bay Primary School to see how you complete different movement activities.
When I am there I will do some writing and you will notice me. You will know that I am not one of your teachers. You can talk to me and we can get to know each other. You can ask me about my work whenever you want to. Sometimes I might use a video camera. Let me know how you feel about this by colouring in one of these words.



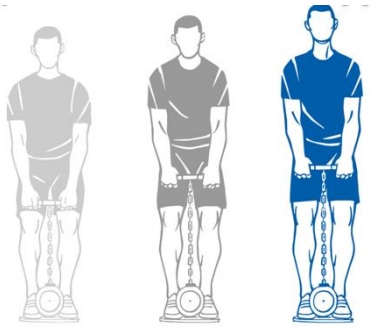

If you are not sure or worried come and talk to me about it or ask one of your teachers or your parents about this.

I am finding out about how to help you move your body in lots of different ways – you might like to find out about this as well. How our body moves is very important. Our activities involve moving around equipment like you have at your school playground. I will be videoing and measuring this as you play. If you would like to know more, please ask me.

Here are pictures of some the movement assessments.


Jump as far as you can!

Pull



as hard as you can!

Other assessments include

- Running as fast as you can, tagging an object, and then running back as fast as you can
- Completing an obstacle course, going over, under, and around hurdles as fast as possible.

Please circle YES if you would like to take part in this movement activitity.

Please circle NO if you do not want to take part in this movement activity.

Please circle MAYBE if you are not sure. If you cannot decide that is fine because you can come along anytime and tell me or your parents that you want to join in.

○ Please colour this circle if you agree to be video recorded during some of the assessments.

This is my photo

I hope we can do this together. It will be great to meet you and you will know who I am because of my photograph. I will also wear a badge with my name on, Daniel, when I am at Stanmore Bay Primary School.

Thank you for completing this form – will you ask your parent/caregiver to sign here if they feel that you understand what the project is about and give this form back to me please.

(signature)

(Date)

Researcher Name: Daniel Cooke

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Daniel Cooke, dmcooke08@gmail.com, 021922181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

**Approved by the Auckland University of Technology Ethics Committee on *type the date final ethics approval was granted*, AUTEC Reference number *type the reference number*.**

# Appendix F: Study One Child Information Sheet and Assent Form

Study One – [Name Removed] Primary School

## Title of research

How does a child-centred pedagogical approach to physical education impact movement skill learning in children?

*(parent/caregivers please read to children)*

*This form will be kept for a period of 10 years*

Hello – my name is Daniel Cooke.

You may recognise me as I have been at the school alongside your teacher for some of your sport lessons. I would like to spend some time with you at [Name Removed] to see how you complete different movement activities.
When I am there I will do some writing and you will notice me. You will know that I am not one of your teachers. You can talk to me and we can get to know each other. You can ask me about my work whenever you want to. Sometimes I might use a video camera. Let me know how you feel about this by colouring in one of these words.

Happy Fine

Not Sure

Worried

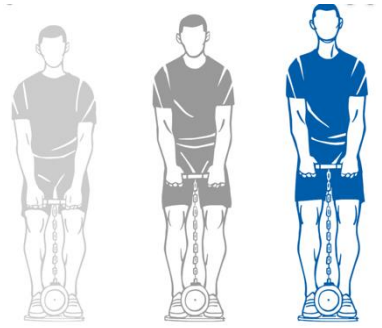
If you are not sure or worried come and talk to me about it or ask one of your teachers or your parents about this.

I am finding out about how to help you move your body in lots of different ways – you might like to find out about this as well. How our body moves is very important. Our activities involve moving around equipment like you have at your school playground. I will be videoing and measuring this as you play. If you would like to know more, please ask me.

Here are pictures of some the movement assessments.


Jump as far as you can!

Pull



as hard as you can!

Other assessments include

- Running as fast as you can, tagging an object, and then running back as fast as you can
- Completing an obstacle course, going over, under, and around hurdles as fast as possible.

Please circle YES if you would like to take part in this movement activitity.

Please circle NO if you do not want to take part in this movement activity.

Please circle MAYBE if you are not sure. If you cannot decide that is fine because you can come along anytime and tell me or your parents that you want to join in.

○ Please colour this circle if you agree to be video recorded during some of the assessments.

This is my photo

I hope we can do this together. It will be great to meet you and you will know who I am because of my photograph. I will also wear a badge with my name on, Daniel, when I am at Stanmore Bay Primary School.

Thank you for completing this form – will you ask your parent/caregiver to sign here if they feel that you understand what the project is about and give this form back to me please.

(signature)

(Date)

Researcher Name: Daniel Cooke

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Daniel Cooke, dmcooke08@gmail.com, 021922181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

**Approved by the Auckland University of Technology Ethics Committee on *type the date final ethics approval was granted*, AUTEC Reference number *type the reference number*.**

## Appendix G: Study One Children & Parent/Guardian Consent Form

### Children

### Parent/Guardian's Consent Form

*Project title:* **How does a child-environment centred pedagogical approach to physical education impact movement skill learning in children?**

*Researcher:* ***Daniel Cooke***

*Project supervisors:* ***Dr Craig Harrison***

***Dr Sarah Kate Millar***

***To be completed by the parent/guardian***

***Please tick all the circles***

○ I have read and understood the information provided about this research project in the Information Sheet.

○ I have had an opportunity to ask questions and to have them answered.

○ I understand that I may withdraw my child/children or any information that we have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.

○ I understand that some assessments involve video recording of my child for movement assessment purposes.

○ If my child withdraws, I understand the relevant information about my child including video footage and assessment information will not be used.

○ I agree to my child/children taking part in this research.

Child/children's name/s : ……

……

Parent/Guardian's signature: ……

Parent/Guardian's name: ……

Parent/Guardian's Contact Details (if appropriate)

……

……..

Date:

***Approved by the Auckland University of Technology Ethics Committee on 08/10/19 AUTEC Reference number 19/234***
*Note: The Participant should retain a copy of this form.*

## Appendix H: Studies One and Two Teacher Consent Form

# Teacher Consent Form

*Project title:* ***Movement Skill Learning in Children***

*Researcher:* ***Daniel Cooke***

*Project supervisors:* ***Dr Craig Harrison***

***Dr Sarah Kate Millar***

***To be completed by the teacher***

***Please tick all the circles***

○ I have read and understood the information provided about this research project in the Information Sheet.

○ I have had an opportunity to ask questions and to have them answered.

○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.

○ I agree to take part in this research.

Teacher's name :……
……

Teacher's signature: .....……

Teacher's Contact Details (if appropriate)
……..
……..
……..

Date:

***Approved by the Auckland University of Technology Ethics Committee 08/10/2019 AUTEC Reference number 19/234.***
*Note: The Participant should retain a copy of this form.*

## Appendix I: Study Two Parent/Guardian Information Sheet

# Parent/Guardian Information Sheet

**Date Information Sheet Produced:**

20th October 2019

**Project Title**

> Learner experiences of the implementation of child-environment centred pedagogical approach to primary school physical education.

My name is Daniel Cooke and as well as working within our teaching community and [Name Removed] I am a PhD student conducting research at Auckland University of Technology. I would like to invite your child to participate in research I am conducting as part of my PhD studies at [Name Removed]. This sheet will provide information regarding this study. Your child's participation is entirely voluntary, and they may withdraw from this study at any time without penalty. Participation is dependent upon both your child and their parent/guardian signing assent/consent forms.

**What is the purpose of this research?**

The aim of this study to better understand the impact that our approach to our physical education lessons is having upon the movement skills of our children. With the knowledge of how our approach to physical education is impacting movement skill learning we will be able to better support a lifelong engagement in physically active lifestyle for all children within our local and wider community. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

Specifically, the purpose of this research is to better understand the experiences of the children participating within our physical education lessons. This can then be used to inform better practice for physical education within [Name Removed], the local community, and beyond.

**How was I identified and why am I being invited to participate in this research?**

Firstly your child's classroom teacher at [Name Removed] has registered their interest in the class taking part in this research study. As your child is in a year 2 class at [Name Removed] and the teacher has registered this interest, your child is being invited to participate in this research.

**How do I agree to participate in this research?**

A consent form has been enclosed for you with this information sheet. An assent form has also been included for your child. A returned and signed parent consent form, and signed child assent form denote agreement to participate in this research. Please note that if you decide to not take part in this research study, all lessons will continue as per usual, however your child will not be included in the focus groups.

Your child's participation in this research is voluntary (it is their and your choice) and whether or not they choose to participate will neither advantage nor disadvantage your child. You are able to withdraw your child from the study at any time. If you choose to withdraw your child from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of data may not be possible.

**What will happen in this research?**

At [Name Removed] we want to better understand the experiences of the children that are participating in our physical education (PE) lesson programme. During our PE programme all children are engaging in a variety of activities that are representative of sports skills, game skills, and child play in a variety of environments. All of this is delivered using a child-centred teaching approach to develop children's movement skills at an individualised level in a positively motivational learning environment.

Specifically, this research will consist of two components:

1. At a single PE lesson your child will be handed an iPad at the beginning of the lesson and be asked to photograph their activities during the lesson. These photographs will be used to create a framework for conversation during a follow-up focus group. **Children will be instructed to not photograph people or events, and only the activities they are partaking in and the place the lesson is being held.*

   All photographs will only be used during the focus group conversation and will never be shared or published in a public forum.

2. Following the PE lesson the children will be invited to participate in small focus group of five children with the lead research and a female teacher familiar to your child.

This will be a one-time visit focus group conducted at [Name Removed] and will require a maximum time of 30-minutes from your child during their regular school day. The children will be asked to describe their photographs and explain the meaning of them to the lead research (Daniel Cooke). The focus group will be audio recorded and subsequently transcribed by the research team for the sole purpose of data analysis and will only be accessed by the lead researcher (Daniel Cooke) and his supervisors at AUT (Dr Craig Harrison and Dr Sarah Kate Millar). Your child's responses and information will remain confidential.

There are few studies that have used a child-centred approach to physical education. This study will aim to better understand children's experiences of such a teaching approach. Accordingly, all assenting child participants in this study will:

- have the opportunity to continue with their regular physical education lessons;
- have the opportunity to photograph their activities during a physical education lesson;
- have had parental permission to partake in the focus group;
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;
- be safe. A teacher of [Name Removed] will be present at the physical education lesson and focus group.

  All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

The focus group will be audio recorded and subsequently transcribed by the research team. Nonetheless, the audio and text files will only be accessed by the lead researcher and his supervisors. Furthermore, the child's identity will remain confidential at all times.

**How will these discomforts and risks be alleviated?**

All information will be entered into a secure and anonymous database at Auckland University of Technology. The raw audio files will only be accessed by the lead researcher (Daniel Cooke) and the project supervisors (Dr Craig Harrison and Dr Sarah Kate Millar). In alignment with Auckland University of Technology practices and as approved by the Ethics committee, the audio files will be securely stored on a password protected computer at the Sport Performance Research Institute New Zeland's offices for a period of 10-years prior to being destroyed.

The focus group will take place with full permission from Auckland University of Technology ethics committee and will be conducted at [Name Removed] in a conference room near to the child's regular classroom.

The identity of all participants will always remain confidential. The identity of the participants will in no circumstances become public. Any information relating to the participants will be stored on a secure and anonymous database and will be protected by a password known only to myself and Dr Craig Harrison. You may withdraw your consent at any time before or during the study. If you decide to withdraw your consent all information provided by your child will be destroyed. The AUT Ethics Committee (AUTEC) has strict guidelines relating to research involving children and they have looked closely at my study and have approved the methods I am adopting.

**What are the benefits?**

This research will support your children in having their voice heard regarding their learning experiences during our PE lesson programme. Additionally, the information learned from this research will help guide the development of physical education programmes for [Name Removed] children of the future and the wider community of New Zealand Primary Schools. This information will also benefit me personally on the journey to completing my PhD studies.

**How will my privacy be protected?**

Your child's information and involvement within the study will remain confidential at all times with the researcher (Daniel Cooke) and project supervisors (Dr Craig Harrison and Dr Sarah Kate Millar) only having access to the participants information. If you have any further concerns please speak to Daniel Cooke.

**What are the costs of participating in this research?**

Participation in the study will involve no time in addition to your child's regular school day at [Name Removed]. It will require a time commitment of 30-minutes on one occasion to participate in the focus group and involve them taking photographs during a regular physical education lesson. This will be discussed in conjunction with the classroom teacher to ensure minimal disruption to your child's day.

**What opportunity do I have to consider this invitation?**

If you would like to participate in this research, you have until 2nd December 2019 to consider this invitation and return the required documentation.

**Will I receive feedback on the results of this research?**

Yes, if you would like copies of any reports please indicate this on the consent form.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

***Researcher Contact Details:***

Daniel Cooke: Email dmcooke08@gmail.com

***Project Supervisor Contact Details:***

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

# Appendix J: Study Two Teacher Information Sheet

## Teacher Information Sheet

## Date Information Sheet Produced:

20th October 2019

## Project Title

Teacher experiences of the implementation of child-environment centred pedagogical approach to primary school physical education.

An Invitation

My name is Daniel Cooke and as well as working within our teaching community and [Name Removed] I am a PhD student conducting research at Auckland University of Technology. As you have previously expressed an interest in participating in our research project I would like to take this opportunity to share this information sheet with you.

I would like to formally invite you to participate in research I am conducting as part of my PhD studies at [Name Removed]. This sheet will provide information regarding this study. Your participation is entirely voluntary, and you may withdraw from this study at any time without penalty. Participation is dependent upon you signing the consent form.

## What is the purpose of this research?

The aim of this study to better understand the experiences of our teachers when utilising a child-environment centred pedagogical approach to physical education. With the knowledge of how our teachers experience this approach to physical education we will be able to develop our PE programme to be more enjoyable and sustainable for teachers as well as children. This is very important as physical activity throughout life is associated with numerous long-term health benefits.

## How was I identified and why am I being invited to participate in this research?

As you have expressed an interest in participating in this research via conversation you have been invited to participate in the research. Further, as you have experience delivering physical education lessons utilising a contemporary teaching style you have been invited to participate in this research. If you are no longer interested in participating in this research you withhold the right to withdraw from the research at any time.

## How do I agree to participate in this research?

A consent form has been enclosed for you with this information sheet. A returned and signed consent form will denote agreement to participate in this research. Please note that if you decide to opt out of this research study, all lessons will continue as per usual, however your class will not be included in the focus group components.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

**What will happen in this research?**

At [Name Removed] we are aiming to better understand the experiences of the teacher during our physical education lessons. During our PE programme all children are engaging in a variety of activities that are representative of sports skills, game skills, and child play in a variety of environments. All of this is delivered using a child-centre teaching approach to develop children's movement skills at an individualised level. In scientific literature, little is known regarding teachers experiences when utilising such a pedagogical approach for physical education. Specifically, this research will consist of a single visit focus group. The focus group take place at [Name Removed] in a private conference room, outside of school hours, and will take a maximum of 30-minutes to complete. The focus group will be led by the lead researcher (Daniel Cooke) and will involve a maximum of four other year 2 teachers at [Name Removed]. The focus group will involve questions relating to your personal experiences when teaching physical education to your class. The focus group will involve an audio recording, this is solely to aid in the analyses of the content of the focus group discussion and will only be accessed by the lead researcher (Daniel Cooke) and his supervisors at AUT (Dr Craig Harrison and Dr Sarah Kate Millar).

There are few studies that have attempted to understand a teacher's experience of implementing a child-environment centred approach to physical education. This study will aim to achieve this in an efficient and effective manner for all involved. Accordingly, all consenting teacher participants in this study will:

- have the opportunity to continue with their regular physical education lessons.
- clearly understand the purpose of the research, agree to participate, and have the right to stop participating at any stage;
- have their identity remain confidential;

All audio files will be, uploaded and stored on a password protected computer at SPRINZ in AUT-Millennium within 7-days of the focus group.

This study will contribute towards my PhD qualification, presentations and peer-reviewed publications, all of which participant information will remain confidential at all times. All published results in academic journals or reports will ensure that no one person, school or particular group of people will be identifiable.

**What are the discomforts and risks?**

There are minimal risks associated with this research, however you may find discomfort in the audio recording of the focus group. However, this is necessary in order to best analyse and describe your experiences of teaching physical education.

All of your information will remain confidential at all times, and only be accessed by the lead researcher (Daniel Cooke) and his supervisors (Dr Craig Harrison and Dr Sarah Kate Millar).

### How will these discomforts and risks be alleviated?

You always withhold the right to withdraw from participation in the research. Audio recording protocols will take place with full permission from Auckland University of Technology ethics committee.

### What are the benefits?

This research will provide an opportunity for teachers to share their experiences of delivering physical education lessons at [Name Removed]. The sharing of your experiences will help advance the delivery of physical education at [Name Removed], within the local community and nationally. This information will also benefit me personally on the journey to completing my PhD studies.

### What compensation is available for injury or negligence?

In the unlikely event of a physical injury as a result of your participation in this study, rehabilitation and compensation for injury by accident may be available from the Accident Compensation Corporation, providing the incident details satisfy the requirements of the law and the Corporation's regulations.

### How will my privacy be protected?

Your identity will remain confidential at all times with the lead researcher (Daniel Cooke) and project supervisors (Dr Craig Harrison and Dr Sarah Kate Millar) only having access to the participants information. If you have any further concerns, please speak to Daniel Cooke.

### What are the costs of participating in this research?

Participation in the study will involve a one-time commitment of 30-minutes outside of school hours at [Name Removed]. Nonetheless, the focus group will be conducted after the conclusion of a school day to prevent the case of having to attend the school on a separate day.

### What opportunity do I have to consider this invitation?

If you would like to participate in this research, you have until 2nd December 2019 to consider this invitation and return the required documentation.

### Will I receive feedback on the results of this research?

Yes, if you would like copies of any reports please indicate this on the consent form.

### What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Dr Craig Harrison, email craig@athletedevelopment.org.nz, and phone 0272265181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

### Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

### Researcher Contact Details:

Daniel Cooke: Email dmcooke08@gmail.com

**Project Supervisor Contact Details:**

Dr Craig Harrison: Email craig@athletedevelopment.org.nz

# Appendix K: Study Two Child Information Sheet and Assent Form

Study Two – [Name Removed] Primary School

**Title of research**

Learner experiences of the implementation of child-environment centred pedagogical approach to primary school physical education.

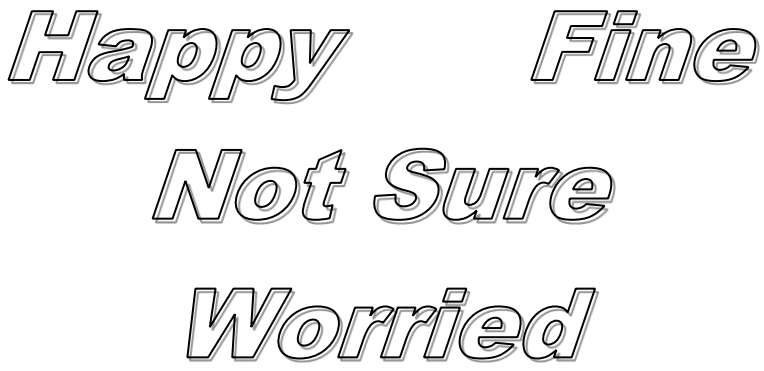
*(parent/caregivers please read to children)*

*This form will be kept for a period of 10 years*

Hello – my name is Daniel Cooke.

You may recognise me as I have been at the school alongside your teacher for your movement lessons. I would like to spend some time with you at [Name Removed] to hear about your experiences during your lessons.

When I am there, I will lend you an iPad for one of your lessons, this is so you can take photographs of your favourite activities. It is very important you do not photograph any people. You can ask me about my work whenever you want to. Once you have taken your photographs I would like to ask you some questions about the photographs you have taken. Your voice will be recorded on an iPad when you answer, let me know how you feel about this by colouring in one of these words.




If you are not sure or worried come and talk to me about it or ask one of your teachers or your parents about this.

I am finding out about your experiences during our physical education lessons. During one of your PE lessons you will be asked to take photos and then share them with me in a group with some of your classmates afterwards. This will help me to understand how you feel during your PE lessons. If you would like to know more, please ask me.

Please circle YES if you would like to take part in this movement activitity.

Please circle NO if you do not want to take part in this movement activity.

Please circle MAYBE if you are not sure. If you cannot decide that is fine because you can come along anytime and tell me or your parents that you want to join in.

○ Please colour this circle if you agree for your voice to be recorded during some of the assessments.

This is my photo

I hope we can do this together. It will be great to meet you and you will know who I am because of my photograph. I will also wear a badge with my name on, Daniel, when I am at [Name Removed].

Thank you for completing this form – will you ask your parent/caregiver to sign here if they feel that you understand what the project is about and give this form back to me please.

(signature)

(Date)

Researcher Name: Daniel Cooke

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Daniel Cooke, dmcooke08@gmail.com, 021922181*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

## Appendix L: Study Two Parent Consent Form

# Children
# Parent/Guardian's Consent Form

*Project title:* Learner experiences of the implementation of child-environment centred pedagogical approach to primary school physical education.

*Researcher:* ***Daniel Cooke***

*Project supervisors:* ***Dr Craig Harrison***

***Dr Sarah Kate Millar***

***To be completed by the parent/guardian***

***Please tick all the circles***

○ I have read and understood the information provided about this research project in the Information Sheet.

○ I have had an opportunity to ask questions and to have them answered.

○ I understand that I may withdraw my child/children or any information that we have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.

○ If my child withdraws, I understand the relevant information about my child including individual focus group information will not be used.

○ I agree to my child/children taking part in this research.

Child/children's name/s : ……

……

Parent/Guardian's signature: .....

Parent/Guardian's name: .....

Parent/Guardian's Contact Details (if appropriate)

……..

……..

……..

Date:

## Appendix M: Thesis Publications