The effects of a school based intervention on fundamental movement skills

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ABSTRACT

Fundamental movement skills (FMS) are a growing area of interest among developmental, public health, education, sport and recreation and psychology researchers. These prerequisite motor skills allow a child to develop more advanced motor coordination skills that in turn, leads to the ability to participate in, and enjoy physically active play, sports and individual pursuits. This motor development process transpires through the interaction of a child's perception, cognition and motor abilities allowing individuals to interact and respond to their environments. There is a growing body of evidence that suggests that FMS development may have positive impacts on a child's: physical activity behaviours, obesity, cardiovascular risk factors, bone density, self-esteem, motivation to try new activities, perceptions of own motor abilities, and academic readiness to learn.

This growing body of evidence has led to an increase in school based FMS interventions delivered during curriculum time in an attempt to achieve positive outcomes. Internationally, methods vary greatly and there are limited interventions delivered throughout the optimal developmental years of five to eight. The body of work presented here is a robust evaluation of a current FMS intervention being delivered to five to eight year olds throughout primary schools in Auckland, NZ. This thesis includes a quasi-experimental study that evaluates the effectiveness of an eight week, in class, FMS intervention (Get Set Go) that includes teacher professional development, class delivery, homework for the children and integrated learning support.

At baseline, four FMS (run, skip, catch, overarm throw) of 138 children aged five to eight years, were measured using a modified version of the Test of Gross Motor Development-2. All 138 children were assessed again post intervention and again at follow up, twelve weeks later. The RE:AIM public health intervention framework was applied to evaluate the intervention and permitted research translation and dissemination. This robust evaluation framework directed investigation through five domains of the intervention: Reach, Efficacy, Adoption, Implementation and Maintenance; through a variety of quantitative and qualitative measures across all levels of the socio-ecological model.

Analysis through generalised linear modelling allowed all two way and three way interactions to be explored. Significant increases were observed across all four FMS and total FMS score over the assessment periods. Younger children (mean age = 5.4 years – 6.3 years) displayed greater incremental increases than children aged over (m) 7.2 years supporting developmental theories, potential to master FMS between 7-8 years. Maori/Pacific children scored significantly ($p<0.001$) higher for motor control skills than any other ethnicity. Boys attained greater overarm throw scores than girls when matched with their age groups. Significant differences were also observed between schools as the two decile six schools scored significantly higher than the two decile nine schools at baseline for catching, overarm throw, skipping and total scores. There were no significant differences observed at follow up between the two school deciles.

The results from this research suggest that Get Set Go is an effective school based FMS intervention that not only increases, children's FMS but also teacher's confidence and knowledge about teaching physical education.

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ATTESTATION OF AUTHORSHIP

I hereby declare 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.

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INTELLECTUAL PROPERTY RIGHTS

The intellectual property (IP) of Get Set Go belongs to Athletics New Zealand. Thanks are given to Athletics NZ for the opportunity to evaluate their national FMS programme.

LIST OF ABBREVIATIONS

FMS	Fundamental movement skills
BSS	Basic sport skills
FS	Foundation skills
PA	Physical activity
MVPA	Moderate to vigorous physical activity
PE	Physical education
H&PE	Health & physical education
ANZ	Athletics New Zealand
GSG	Get Set Go
PENZ	Physical education New Zealand
PD	Professional development

CHAPTER ONE: INTRODUCTION

Physical activity (PA) is fundamental to the healthy growth and development of children, including reducing the risk of obesity and risk factors for non-communicable disease (Ministry of Health 2008 & 2000; Barnett et al, 2009). PA is defined as any bodily movement produced by the contraction of skeletal muscle, resulting in significant increase in energy expenditure (Bouchard, Shepherd & Stephens, 1993). Children predominantly achieve their PA through a range of playful activities (Pellegrini and Smith 1998) which are intrinsically driven, freely chosen, imaginative and opportunistic with sporadic bursts of high intensity (Sturgess 2003). Adults predominantly achieve PA through organised or structured activities or activities of daily living (Pate, Pratt et al. 1995; Ainsworth 2000). It is important to recognise the differences between physical activities of children and adults because of the influence of PA on a child's development. Personal attributes that are developed through children's PA are a sense of mastery through increased self-esteem and awareness; physical, cognitive and social development; problem solving skills; creativity; social skills; concentration; and the organisation and integration of stressful experiences (Pellegrini and Smith 1998; Sturgess 2003; Ginsburg 2007).

It is known that PA behaviours that are developed in early life track throughout childhood into adulthood (Malina 1996; Malina 2001; Reilly, Kelly et al. 2006) and that the same can be said for overweight and obesity (Clarke and Lauer 1993; Serdula, Ivery et al. 1993; Singh, Mulder et al. 2008). Childhood obesity in New Zealand (NZ) has increased considerably in recent years with figures now reaching 33% of children classified as overweight or obese (Ministry of Health 2013). Considering the low activity levels and high sedentary behaviours (linked with increased obesity) observed in NZ children (Duncan et al, 2006; Hamlin and Ross, 2005; Maddison et al, 2014; NZ State of Play Report, 2012) it is important to implement efficacious and appropriately evaluated interventions that may encourage positive childhood PA behaviours.

There has been a growing body of research over the past 15 years, indicating that a worldwide decrease in fundamental movement skills (FMS) correlates with a reduction in childhood PA (Okely and Booth 2000; Sallis, Prochaska et al. 2000; Hands and Martin 2003; Hume, Okely et al. 2008). It

has been purported that by increasing FMS not only might children become more active but they may also benefit from increased self-esteem and enjoyment of PA, academic success, and improved health outcomes (Okely and Booth 2000; Lubans, Morgan et al. 2010; Lopes, Rodrigues et al. 2011; Westendorp, Hartman et al. 2011; Lopes, Santos et al. 2013). The limited longitudinal studies available suggest that children with greater FMS competency are more likely to be fit and active in later childhood and adulthood (Trudeau, Espindola et al. 2000; Hardy, Barnett et al. 2013; Lai, Costigan et al. 2014).

Childhood movement experiences are the building blocks of life and provide children with opportunities to master FMS. FMS can be defined as the prerequisite motor functions required to participate, and enjoy, a wide range of recreation and physical activities; not only in childhood but throughout the life stages (Okely, Booth et al. 2001; Okely, Booth et al. 2004; Hardy, Barnett et al. 2013). FMS are grouped in to three categories: 1) Locomotor skills (moving the body from one point to another), 2) Stability skills (static or dynamic balancing), and 3) Manipulative skills (handling and controlling objects).

There is growing evidence that children who achieve higher levels of FMS mastery have greater motor competence, spend more time in moderate to vigorous physical activity (MVPA), have a higher perception of their motor skills, attempt and participate in a wider range of activities, and are more physically active in adulthood (Reilly et al. 2006; Wrotniak, Epstein, Dorn, Jones, and Kondilis, 2006). More time spent in MVPA is linked with increased health benefits throughout the lifespan by reducing the risk of developing cardiovascular disease and associated risk factors, type 2 diabetes and osteoporosis (Chad, Bailey et al. 1999; Strong, Malina et al. 2005; World Health Organisation Review, 2012).

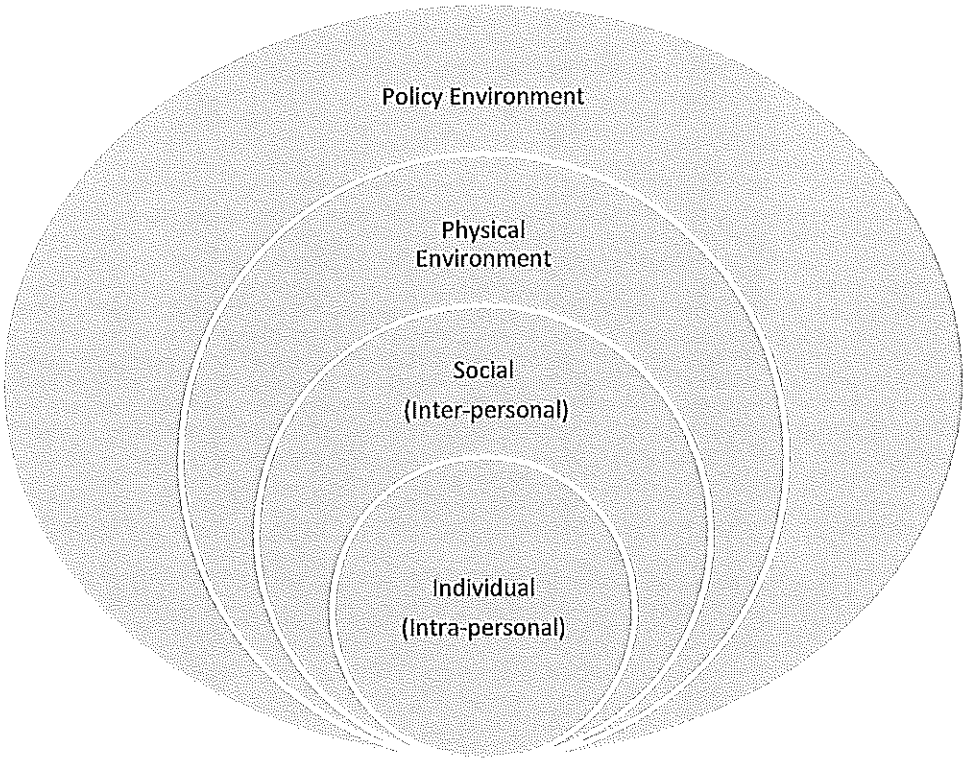
In contrast, children with low levels of FMS mastery have lower motor competence; spend less time being physically active through sport, recreation, and play; have low perception of their motor skills; lower fitness levels; and are more likely to be overweight or obese than their more competent counterparts (Okely, Booth, & Chey, 2004; Williams et al,. 2008; Hume et al,. 2008). Evidence suggests that school aged children should participate in 60 minutes of MVPA or more per day,

which should be developmentally appropriate, enjoyable, and involve a large range of activities to achieve positive health and PA behaviour effects (Strong, Malina et al. 2005).

It is not clear yet if children's FMS mastery increases PA participation or if PA participation increases FMS. It is known however, that there is an important relationship between FMS mastery and children's PA (Lopes, Rodrigues et al. 2011). Therefore, fundamental to FMS intervention planning and implementation is an understanding of factors that are related to children's PA. Research indicates that NZ children, aged five to eight years, are predominantly more active during school time rather than the weekend suggesting that daily PA requirements are reached through school based activities (Duncan et at, 2006; NZ State of Play Report, 2012). Moreover, early intervention during the primary school years is an optimal life stage to focus FMS intervention efforts (Gallahue 1993), for both short term and long term health benefits through improved PA (Sallis, Prochaska et al. 2000).

PA behaviours are influenced at multiple levels. Implementation of a socio-ecological model can help to fully understand the complexity of these dynamic interrelations (Figure 1.1). A socio-ecological model recognises the multiple influencing levels of children's PA, including the individual (intra-personal level), social (inter-personal level), physical environment, and policy environment (Salmon & King, 2010). Environmental factors that influence PA behaviours in schools include infrastructure, policies, equipment, facilities, and qualified staff to facilitate a range of curricular and co-curricular PA to all students. The levels of influence these factors have on children's PA are largely dependent on the school, the perceived value for each factor by individuals, parents and teachers, and the resources available to implement and maintain high standard of service delivery.

Figure 1.1 A socio-ecological model of influences of physical activity behaviour



In the broader context of PA promotion and public health interventions, this thesis focuses on the various levels of the socio-ecological model with respect to FMS, where appropriate. The purpose of this thesis is to critically evaluate the impact of FMS interventions delivered in the school setting for children aged 5-8 years. FMS mastery is a developmental process which will be explored using a socio-ecological model to clearly identify research justification. The remainder of this chapter will 1) identify the developmental process of FMS; 2) focus on the four socio-ecological levels (individual factors, social factors, school environment, school policies) of influence within the context of a school-based intervention for improving children's FMS for improved PA; and 3) identify appropriate research questions through identification of gaps in the FMS knowledge base.

Fundamental Movement Skills

Movement is an essential component of life, allowing individuals to perform fundamental functions of daily living; to walk, to run, to play. Movement emerges from the interaction of the individual (intra-personal level), the task (inter-personal level) and the (physical) environment, such as; a child (individual) generates movement to play a game with friends (task) in the playground at school (environment). These three factors are ways in which various physical properties of both the human system and the environment naturally develop the control and coordination of body and limbs in skilled activity (Newell, 1984). Within these factors are constraints which are characteristics that can influence the production and development of movement (Gagen & Getchell, 2006). A constraint can exist as a characteristic of an individual (age, skill level, height), an element of the environment (weather, indoors, outdoors, different playing surfaces), or as part of the task an individual is trying to do (catching a ball, skipping). Some constraints are more important than others when shaping PA behaviours and many can be adapted to influence greater motor development.

The child's motor ability determines how well they are able to undertake a task within the environmental demands. This functional capability arises from the interaction of a child's perception, cognition and movement skills. These movement skills are an important part of childhood motor development (Shumway-Cook & Woollacott, 2001).

Motor development is a complex, continuous process of modification. Due to the complexity it is essential that motor development is not seen as the development of a physical product or skill (ability to skip, perform and overarm throw or a 2 footed jump). The whole child must be considered as an individual as motor development occurs through the interaction of several factors. Factors that influence motor development include neuromuscular and biological maturation, physical growth, behavioural characteristics and development, the residual effects of previous experiences, and new movement experiences (Malina 2004).

The term 'developmental milestone' represents the achievement of control and coordination of specific movement patterns during childhood (Harris and Heriza 1987). These achievements are critical components of childhood motor development and provide the medium for which children

experience many dimensions of their environments. It is often believed that children naturally learn how to perform milestones and movement skills but they must be nurtured, promoted and practiced (Clark 2007).

The general sequence of major motor milestones seen in infancy include sitting, creeping, crawling, pull-to-stand, independent stance and walking (Gallahue 1989; Who Multicentre Growth Reference Study and de Onis 2006). This acquisition of independent walking does not indicate a mature walking pattern. The mature walking pattern is developed over a two stage process, with the first stage taking part between three to six months after onset of walking. The initial phase is where infants learn to control balance. An increase in the control of balance can be observed with changes in step width, step length and double stance. This observation suggests that children integrate posture into movement patterns during the first stage of walking. In the second stage, which lasts through to five years of walking, the movement pattern is refined (Shumway-Cook and Woollacott, 2001). Balance is very important in the refinement of walking and in the development of other movement skills (Leppo, Davis et al. 2000). As a child develops more control over their movement an increasing experimentation with a variety of movements can be seen.

Some FMS start to develop during the preschool years including: locomotor skills (run, jump, gallop, hop, skip), and manipulative skills (throw, kick, strike, catch) and are key indicators of sensory development. The sensory system in the body is made up of three components – the vestibular sensors, the vision sensors and the proprioceptors. All three components work with the central nervous system to provide postural control and coordination. This development of the sensory system is integral to stability skills (static and dynamic balancing).

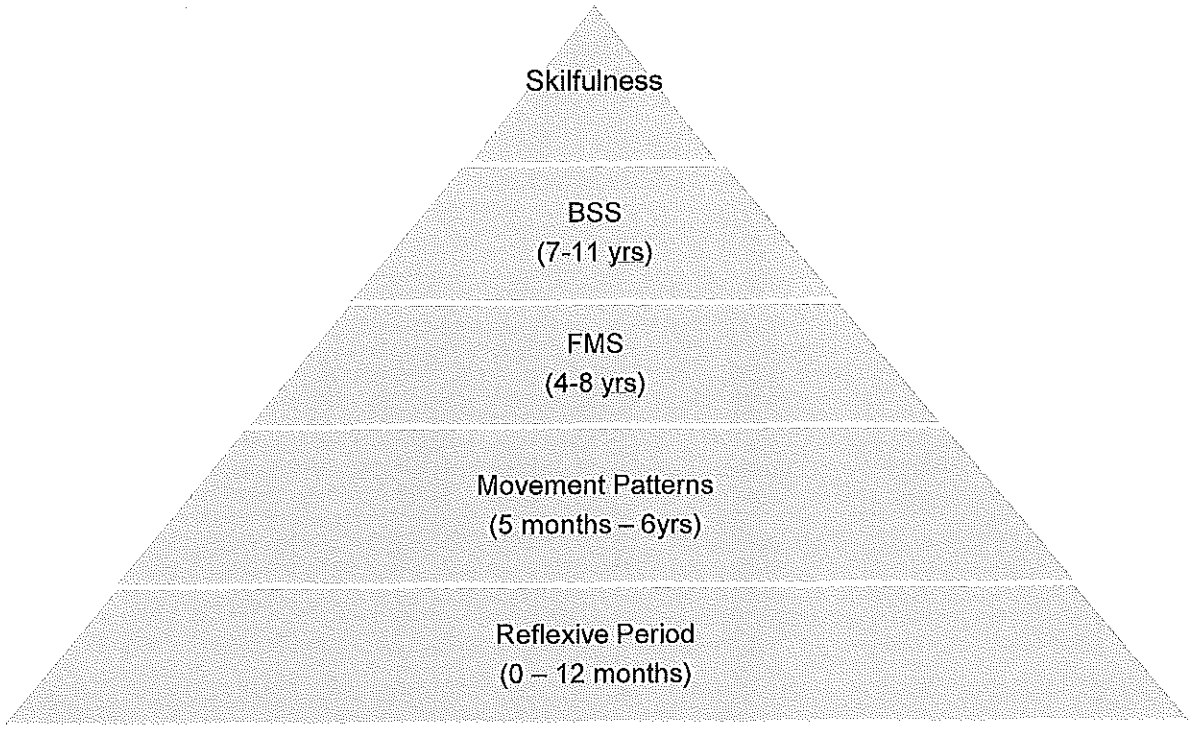
By the age of three all pre-schoolers should show immature stages of a run as the double stance phase of gait disappears and push off stance appears. By four most children can hop and gallop. The gallop develops slightly earlier than the hop. Although a large proportion of four year olds can hop, surprisingly, only small proportions are able to skip (step-hop). At this stage gait is essentially mature with only small improvements seen through to age seven (Shumway-Cook and Woollacott, 2001).

Preschool aged children have developed basic motor skills but lack the mastery of balance, coordination, power and endurance. Movement patterns are the basic foundation which other FMS are developed from and refined (Tsao 2002). Movement skills offer children a chance to be independent and opportunities to practice are essential for preschoolers' development of these sophisticated abilities (Dwyer, Baur et al. 2008).

Development progresses rapidly through the preschool years and continues well into middle childhood for some FMS (Clark 2007) however studies (Booth, Okely et al. 1999; Hardy, Barnett et al. 2013; Lubans, Morgan et al. 2010; Sanders and Kidman 1998) are increasingly reporting children as having FMS deficiencies. It is has been reported that mastery of many FMS should be attained by the age of seven (Gallahue 1989) so that children can progress into the development of basic sports skills (BSS). BSS are the integration of two or more FMS delivered through a game based approach and allow children to increase their opportunities to participate and enjoy sports and other physical activities. However the authors (Booth, Okely et al. 1999) of an Australian study found that the mastery and near mastery of FMS amongst school children aged 9.3 years (mean age) to 15.3 years (mean age) was moderate when compared to previous research (Walkley 1996). It can take years to master certain FMS, like jumping and throwing (Clark and Metcalfe 2002; Clark 2005; Ericsson 2011) and to assist with development it is essential for children to attain these skills within the critical developmental window of 4-7 years of age (Gallahue 1993; Gallahue and Ozmun 2006).

Research investigating the ability of children at different ages to integrate FMS concluded that children aged 6 years were less efficient at integrating two movement skills than children aged 9-12 years (Gimenez, De J. Manoel et al. 2012). This is an indication that FMS may be developmental components and supports previous findings that, teaching children BSS before mastering FMS reduces individual performance ability throughout life (Vandorpe, Vandendriessche et al. 2012). This development process is diagrammatised in Figure 1.2.

Figure 1.2: Motor development stages adapted from (Clark and Metcalfe 2002)



BSS = Basic sport skills, FMS = Fundamental movement skills

Assuming there is a clear understanding of the physiological and physical development of FMS it is also essential to understand how the socio-ecological levels influence FMS development. The following section will focus on personal (intrapersonal and interpersonal), environment and policy factors within the schools setting that influence the development of FMS for improved PA.

Fundamental Movement Skills of Children

National data collected in NZ through the Ministry of Education's National Education Monitoring project (NEMP) suggest that movement skill levels have typically remained the same between 2002 and 2006 (Sport NZ, 2012). This finding is similar to previous nationally reported data from Australia (Hardy, Barnett et al. 2013). Both reports revealed that skill levels varied widely among

individual children of the same age and sex; making it important to provide developmentally appropriate activities and experiences.

Like other NZ research (Mitchell et al, 2013), the NEMP data indicated that motor skills improved with age, with older students generally performing skills better than younger students. Mitchell et al, (2013) also reported definitive skill performance differences between NZ boys and girls, with boys obtaining greater mastery of running and object control activities of overarm throw and kicking younger than girls, and girls mastering balance oriented activities and skipping younger than boys.

Internationally it has been shown that boys tend to attain development of overhand throwing and kicking earlier than girls (Leppo, Davis et al. 2000; Breslin, Murphy et al. 2012). However, girls develop hopping and skipping abilities earlier than boys. These differences between the sexes have been identified in children as young as four with researchers (Iivonen, Sääkslahti et al. 2009) suggesting that for FMS development, boys benefit from parental involvement while girls benefit from more independent play. This may be a reflection of parents' role behaviour whereby parents may favour more vigorous activities demanding gross motor skills from boys and more stationary activities for girls. Without evaluating all levels of influence on FMS it is difficult to make assumptions for the observed differences between sexes. Research into the effects of FMS and play area at school suggest that boys are more active than girls and benefit more from increased free space to play in (Harten, Olds et al. 2008).

Further differences observed between boys and girls are in association with socio-economic status; prevalence of skill mastery is directly associated with socioeconomic status more consistently with girls than boys (Booth, Okely et al. 1999). Regardless of the reasons for these observed differences it is important to implement FMS interventions that, while recognising the differences between boys and girls learning styles realise the genetic and developmental potential for all children to perform FMS. Successful interventions report initial differences between boys and girls have been shown to significantly decrease at follow up (Salmon, Ball et al. 2008).

The friends that children play with have also been reported as a key influence on PA behaviours (Gesell et al. 2012; Salvy et al. 2008; Veitch et al. 2006). Gesell et al. (2012) reported that children with low activity levels (as recorded through observation) who played with active children increased

their activity levels significantly. Likewise if active children are asked to play with a group of children that are predominantly less active than themselves their PA levels decrease. This demonstrates how a child's peers, friend choices and experiences can influence their PA behaviours and incidentally FMS development.

Fundamental Movement Skills in Schools

There is evidence to suggest that in NZ children are entering school with low FMS levels (Sanders and Kidman 1998) that may discourage participation in PA. Research suggests that early intervention is paramount for FMS development (Gallahue 1989; Malina 1996; Woollacott and Shumway-Cook 2002; Stodden, Goodway et al. 2008) and the primary school setting offers an ideal location to target the various dimensions of children's learning through a socio-ecological model. (Lopes, Rodrigues et al. 2011). It is important to best utilise the education curriculum to deliver effective interventions by creating experiential learning environments.

Teachers (and schools) are often reported as playing a large role in the development of FMS (Callea, Spittle et al. 2008; Breslin, Murphy et al. 2012) and school based physical activities promoting FMS are achieved through a combination of curricular and co-curricular activities. However, NZ primary schools continually struggle with the effective implementation and representation of curricular and co-curricular physical activities (Gatman, 2005). Correct representation of curricular and co-curricular activities delivered at different levels, by parents, teachers and peers may provide further FMS opportunities.

Despite this, teachers are reporting inability to implement appropriate physical education (PE) sessions as they are uncertain of what and how to teach this subject (Gatman 2005). Teacher confidence at planning and implementing FMS activities through PE is reported as low (Callea, Spittle et al. 2008: Gatman 2005). Reason's for low confidence include inadequate training, negative past experiences, or low confidence through lack of knowledge around providing age appropriate activities, appropriate planning techniques, class management skills outside the classroom, or how to assess children's motor development needs (Callea, Spittle et al. 2008). It is

generally assumed by teachers that PE is any form of PA and it is quite common that during PE many children are set to 'running around tasks' that allow them to 'burn off energy' or 'get the blood pumping' (Callea, Spittle et al. 2008; Foweather, McWhannell et al. 2008). Teachers do play a large role in FMS development and it is important to have trained and confident teachers that have the skills required to teach appropriate PE lessons that promote FMS development.

Although there are FMS programmes in NZ (both in the early childhood and school settings), programme design and implementation methodologies vary widely. Many of the programmes fail to successfully capture efficacy in terms of skill acquisition and to the knowledge of the researcher there is limited monitoring and evaluation. Internationally there are a number of school based interventions that have successfully increased FMS competency and MVPA in children (van Beurden, Barnett et al. 2003; Salmon, Ball et al. 2008; Piek, McLaren et al. 2013).

Fundamental Movement Skills and Policy

School based FMS interventions demonstrate greater effects when they are aligned with policy on a national level (Trudeau, Espindola et al. 2000; Hardy, Barnett et al. 2013). In NZ, the national curriculum policy for Health and Physical Education (H&PE) clearly states the acquisition of motor skills as a key component for child learning and development. How this policy is interpreted and implemented throughout the country varies greatly between schools and often between classes in schools. There are no clear guidelines for interpretation and as previously discussed teachers often struggle to understand how or why to teach this subject. Schools that provide further policy around FMS that is supported with guidelines and professional development (PD) for teachers receive greater benefits from FMS interventions (Foweather, McWhannell et al. 2008; Dudley, Okely et al. 2011; Lai, Costigan et al. 2014). Policy is an important influence on FMS development but only when understood and implemented correctly at all levels throughout the school.

Statement of the Problem

There is increasing amount of time and resources being spent worldwide on the implementation of FMS interventions in the school environment. Of those that are implemented, methodologies vary greatly and often neglect to cater for teachers' ongoing PD needs for sustained effectiveness. Systematic reviews evaluating the effectiveness of school based FMS interventions (Dudley, Okely et al. 2011; Logan, Robinson et al. 2012; Lai, Costigan et al. 2014) fail to identify interventions delivered through the critical child development period of 5-8 years. Robust multilevel interventions and investigation involving this age group is critical for future intervention implementation.

Auckland, NZ, is one of the country's largest and most multicultural cities and to date there is no published research on FMS interventions delivered in Auckland schools. Moreover, of the limited peer reviewed articles on FMS interventions, few are implemented in any NZ schools. To implement effective interventions in the NZ context, there must first be a clear picture of the state of play in regards to FMS. There are no significant intervention studies that investigate the influence of culture on FMS internationally or in NZ. Cross sectional data from NZ suggests that significant differences in FMS are observed between different ethnic groups (Mitchell, McLennan et al. 2013; Sport NZ 2012). Pacific and Māori children are reported as having greater FMS mastery of object control skills than NZ European or other ethnicities. Due to the cosmopolitan nature of Auckland it is essential to explore these findings through intervention evaluation.

Taking into account that NZ children are: 1) entering school with insufficient FMS skills for meaningful engagement in PA, 2) more active when in school than at home, (3) often experiencing unsuitable PE lessons, 4) develop PA behaviours that track throughout childhood into adulthood, 5) are at the optimum developmental age to master FMS, 6) in a school environment that can influence a range of factors of the socio-ecological model at various levels, and 7) accessible as a whole consortium; consideration should be given to the benefits of a school based FMS intervention delivered in curriculum time. This research recognises that co-curricular and home-based interventions may also be influential to FMS development but pragmatically the scope of this research is to further build on existing evidence.

One of the current interventions delivered into primary schools across NZ is the Athletics NZ 'Get Set Go' Programme. Like many other FMS programmes in NZ there has been no structured objective assessment of the intervention. This thesis will utilise the Get Set Go programme as the intervention for this research. This intervention will be critically evaluated to provide answers to the research question and sub questions below.

Primary Research Question

Is the Get Set Go programme delivered in Auckland schools an effective FMS intervention for children aged 5-8 years?

Secondary Research Questions

1) Can peer reviewed research articles that are of high quality identify characteristics of effective school-based FMS interventions for 5-8 year olds?

2) Does the impact of the Get Set Go FMS programme on children's FMS skills differ by children's ethnic group?

3) Can the RE:AIM (Reach, Efficacy, Adoption, Implementation, Maintenance) assessment framework be applied to evaluate a school based FMS intervention, and if so, how does the Get Set Go programme perform when evaluated using the RE:AIM framework?

Thesis Format

The literature review (Chapter Two) will identify previous peer reviewed school based FMS interventions. Method quality of identified research will then be critiqued using a criteria checklist tool. Lessons will be learnt from studies that are deemed have high quality methods, around the characteristics of an effective school based FMS intervention. This will be followed by a Methods chapter (Chapter Three) that will clearly identify the steps undertaken to evaluate the Get Set Go

intervention, through to the final data collection point. Findings (Chapter Four) of objectively measured FMS of children participating in the Get Set Go intervention will be reported. Statistical analyses will provide valuable data of FMS levels of NZ children, adding to the limited data currently available. Using the RE-AIM theoretical evaluation framework (Chapter Five) the Get Set Go intervention will be critically evaluated. This work will be collated and comprehensively discussed in the broader context of this thesis in Chapter Six (discussion chapter).

Study Aims

The aims are as follows:

1. To review methodological quality of existing school based FMS interventions.
2. To identify characteristics of effective school-based FMS interventions.
3. To objectively measure the impact of a school based intervention delivered across four schools, on the FMS of 138 children aged 5 – 8 years.
4. To evaluate the effects of a school based FMS intervention at the different levels of the socio-ecological model using the RE:AIM model framework.
5. To identify any recommendations for future implementation of the FMS intervention.

Significance of the Research

The significance of the research is as follows:

1. This work will add to the limited body of knowledge of FMS in NZ children, including:
    a. Providing a measurement of FMS levels in a sample of 138 children aged 5-8 years from Auckland, NZ.
    b. Providing new data on differential impacts of a school-based FMS programme.
2. The research will contribute original knowledge to the international literature by:

a. Providing an in depth examination of the effectiveness of a school-based FMS programme using the RE:AIM framework. To the knowledge of the researcher the RE:AIM framework has not previously been used to assess a school based FMS intervention.

b. Providing determinants of effective school based FMS interventions aimed at 5-8 year olds that can be utilised during planning, monitoring and evaluation of future FMS programmes.

Study Delimitations

Specific parameters were identified as delimitations of the study:

1. Original ethics approval was granted for a randomised controlled trial, however due to the time constraints encountered as a result of scale and duration of the data collection, the researcher was not able to recruit a control group within the scope of a Master's thesis. Participants were recruited through schools that had previously agreed to engage in the Get Set Go programme. Attempting to form relationships with new schools to firstly invite them to participate in the Get Set Go programme and then the delivery so that they could participate in this research was extremely time consuming. To counteract the limitation of no control group a theoretical framework to evaluate the multi-level impact of the intervention was applied.

2. Objective motor skill assessments were conducted by a trained researcher that was provided with field training prior to the assessment process. However no further training was conducted once the assessments were in progress.

Study Limitations

Study limitations are identified and acknowledged:

1. Direct observation was used to assess FMS which may not have allowed for a true reflection of children's abilities. Although every effort was made to reduce any test like conditions children varied on days dependent on personal, emotional and environmental factors. On a few occasions children acted up through excitement of being outside of class and did not perform the skills proficiently even if they were able to. Yet, this process was seen to be a more valid procedure for the purposes of this research as it captures FMS as they are performed, under controlled conditions, and not as they are reported.

2. The Test of Gross Motor Development-2 (TGMD-2) is a process assessment that identifies specific skill criteria of FMS. Process assessments are useful for identifying skill features but have more inherent challenges than product oriented assessment tools. Children normally perform FMS for a purpose, generally to play. As previously discussed children's PA and FMS are complex behaviours and the TGMD-2 is not able to capture this.

3. The study was limited in its representation of different ethnic groups as the sample were predominantly NZ European.

CHAPTER TWO: A CRITICAL REVIEW OF THE EFFECTIVENESS OF SCHOOL BASED INTERVENTIONS TO IMPROVE FUNDAMENTAL MOVEMENT SKILLS

Introduction

Childhood movement experiences are the building blocks of life and provide children with opportunities to master FMS. FMS are prerequisite motor functions essential to participate in lifelong PA and perform activities of daily living. The development of FMS is a complex journey which takes years of influence at various levels of the socio-ecological model (Clark 2007). Mastery of FMS leads on to more specialised complex skills which are needed to competently participate in and enjoy sport, recreation, and PA. Children who develop mastery in these important FMS within the early primary school years have been shown to have greater participation levels in PA experiences, both throughout later schooling and adult life; they also have higher levels of fitness and self-esteem (Okely and Booth 2004; Gallahue and Ozmun 2006; Hume, Okely et al. 2008).

FMS are reported to be lower in children who are overweight or obese compared to children who are normal weight (D'Hondt et al, 2009; Vameghi et al, 2013). Although FMS interventions assessed to date have had little effect on children's body mass index (BMI), they have been effective in increasing PA and FMS, indicating that early preventative interventions may help efforts to reduce obesity prevalence in children (Cliff, Okely et al. 2009; Lubans, Morgan et al. 2010; Cliff, Okely et al. 2012).

In addition to observed child health, growth and development benefits, increased FMS and PA have been linked with academic achievement (Westendorp, Hartman et al. 2011; Singh, Uijtdewilligen et al. 2012; Lopes, Santos et al. 2013). Although high quality studies are limited it is important to identify the scope of FMS benefits and the impact this could have on a child in a school environment. Previous intervention research (Bond 2011) worked with schools to identify children who demonstrated low FMS competency in an attempt to bridge the learning gap between these children and children perceived to have normal FMS competency. Teachers themselves have reported a marked difference in children's behaviour and ability to retain information when their

class has participated in an FMS intervention (Foweather, McWhannell et al. 2008; Morgan and Hansen 2008).

Despite the well documented benefits of focusing on FMS development, these prerequisite motor functions are still being reported as low in Australia (Booth, Okely et al. 1999; Hardy, Barnett et al. 2013), Sweden (Ericsson 2008), and the UK (Fisher, Reilly et al. 2005; Foweather 2010). These skills are not developed through a process of maturation but require an element of instruction and opportunities to practice (Clark 2005). If children do not perceive themselves as being competent to perform FMS, they will be less likely to participate in or enjoy any physical activities (Stodden, Goodway et al. 2008).

Many programmes have been implemented to improve FMS across the varying levels of child education settings, from preschools and early childhood education settings (children aged 3-5 years), to primary schools (children aged 5-12 years), and beyond (youth aged 12-16 years attending secondary/high schools) (Booth, Okely et al. 1999; Sääkslahti, Numminen et al. 1999; Hardy, King et al. 2010; Eather, Morgan et al. 2013). Outcomes have been variable with greater improvements in FMS achieved in children within the optimum age range (3-7 years) for developing FMS. This would come as no surprise to developmental theorists (Gallahue 1993; Clark and Metcalfe 2002; Wiepert and Mercer 2002) who suggest a wide range of FMS mastery should be attained by the age of seven years.

Internationally, intervention methodologies vary widely but results share some similarities; with boys attaining a greater development of overhand throwing and kicking earlier than girls, and girls develop hopping and skipping earlier than boys (Booth, Okely et al. 1999; Sääkslahti, Numminen et al. 1999; Leppo, Davis et al. 2000; Hardy, King et al. 2010; 2012; Hardy, Barnett et al. 2013). Clear guidelines and characteristics of effective FMS interventions are yet to be determined. More investigation is required across the various socio-ecological levels to determine best practice for increasing FMS mastery among boys and girls.

Early childhood interventions are reported as potential conduits for developing FMS (Goodway and Branta 2003; Deli, Bakle et al. 2006) although the balance of how much structure is required is yet to be established (Petrunoff et al, 2009). Studies of extended length are hampered by staff

retention issues and staff engagement (Petrunoff et al, 2009; Kirk and Rhodes 2011) which may be due to lack of knowledge provided during in-service training (Robinson, Webster et al. 2012).

The primary school environment is often seen as an ideal location for FMS interventions; fitting into the H&PE curriculum framework. Research suggests that children in NZ are more active in school than at weekends or evenings (Sport NZ, 2012; Duncan 2008) and that children are entering school with inadequate FMS levels to participate in health promoting physical activities. In addition, parents believe schools should play a part in the healthy development of children as they have the infrastructure, trained staff and accessibility to all children (Eccles 1999).

There are numerous FMS interventions being implemented internationally and as previously discussed, little is known about what constitutes an effective school based FMS intervention. From the limited research, it is known that multi component interventions that: consider environmental factors such as facilities, include opportunities to practice and social support for the children, successfully capture skill acquisition and include an element of foundation skill training are more effective at increasing FMS (Robert and Yongue 2004; Dudley, Okely et al. 2011; Kirk and Rhodes 2011; Lai, Costigan et al. 2014). It is essential to identify effective interventions to determine characteristics that can be used as guidelines for future planning and implementation.

The aim of this Chapter is thus to identify and critically review method quality of current school-based FMS interventions following a systematic process. Studies that are deemed to be of high method quality will be cross referenced to draw inferences around characteristics of effective school based FMS interventions.

Methods

This critical review of the literature was conducted and reported in line with previously published literature (Liberati, Altman et al. 2009) following a systematic process, PRISMA.

Selection of the Literature

A computer search was conducted in electronic bibliographic databases PubMed, SportDiscus, ERIC, and Science Direct from 1980-2013 to provide evidence of evaluated and peer reviewed FMS interventions. The search strategy consisted of derivatives and combinations of the following: Skills (key words – fundamental, movement, motor), AND/OR Children (key words – youth, children, primary, school), AND/OR Interventions (key words – school based, fundamental movement skill, motor competence, motor skills, motor proficiency, physical education).

The selection process included an initial check of the title and abstracts of articles identified through the search process. Studies were included if they were prospective studies examining the effects of school based FMS interventions. Eligible studies demonstrated 1) children participants aged between 5-10 years, 2) school based FMS interventions, 3) publication in peer reviewed journal 4) full written text, 5) English language, 6) published after 1980. Bibliographies of sourced articles were also reviewed to identify any additional relevant research.

Data Extraction

Data were extracted (Table 2.1) from the identified studies including (a) author and country, (b) study population, (c) research design, (d) measure of FMS or motor competence (e) intervention design, (f) assessment information (dates, format and inclusion of follow up), and (g) significant results (if any). Studies were then independently scored on their method quality. Scoring was based on a criteria list (Table 2.2) adapted from previous research (Tooth, Ware et al. 2005; Singh, Mulder et al. 2008; Logan, Robinson et al. 2012). The criteria list included 16 items and assessed the study quality in the following five measurements: (1) study design, (scoring range 0-1), (2) study population, (scoring range 0-4), (3) study attrition, (scoring range 0-3), (4) data collection, (scoring range 0-2), and (5) data analysis, (scoring range 0-6). A positive answer was given if the article provided an informative description and met the quality criteria. A negative score was given in case of an informative description but an inadequate performance, inadequate information to make a decision, or no recorded information. If a study stated that intervention methods had been

previously published in a separate article both articles were reviewed when completing the criteria checklist.

Each of the studies was given an overall score based on the number of positive criteria scores. The overall score was used to determine a percentage score for each study. Total percentage score, and scores for each of the five method quality measurements identified (study design, study population, study attrition, data collection and data analysis) were calculated. Study quality was deemed to be low, high, or extremely high using the thresholds for total scores of ≤50%, 51%-70%, and >70%, respectively which is in line with previous research (Tooth, Ware et al. 2005; Singh, Mulder et al. 2008; Dudley, Okely et al. 2011; Logan, Robinson et al. 2012). Studies rating highly were cross referenced to identify determining characteristics of effective school based FMS interventions.

Table 2.2. Checklist criteria for assessing the study quality of the school based FMS intervention studies included in this research

Criteria (rating of criteria: + = yes, - = no, - = not/insufficiently described)	I, V/P
Study Design	
1. RCT/experimental design	V/P
Study Population:	
2. Sufficient description of study population	I
3. Sufficient description of recruitment methods (period, setting, geographical location)	I
4. Sufficient description of baseline study sample (age, gender, number of participants)	I
5. Recorded (baseline) assessment for more than 80% of study sample, including mean and std deviations	I
Attrition: (RCT/Experimental only)	
6. Exact number of participants at each follow up provided	I
7. Exact information on follow up procedure and duration provided	I
8. Data from follow up measurements presented	V/P
Data Collection:	
9. Sufficient description of data collection methodology	I
10. Standardised measurement of FMS carried out by trained researcher using a validated tool	V/P
Data Analysis:	
11. Sufficient description of analysed sample	I
12. Analysed sample consists of >_ 100 participants	I
13. Type of analyses conducted clearly stated	
14. Age and gender specific presentation of FMS data at baseline and follow up	V/P
15. Presentation of the measures of association including confidence intervals	I
16. No selective reporting of results	V/P

I = criteria on information; V/P = criteria on validity/precision

Adapted from (Tooth, Ware et al. 2005; Singh, Mulder et al. 2008; Logan, Robinson et al. 2012).

Results

The initial literature search yielded 12,987 potentially relevant publications. In total, 34 were identified as potentially relevant and full text was retrieved. Upon further analysis only eight studies fulfilled all inclusion criteria and were included in the research. The 25 studies that were excluded were because a) they did not meet the age requirements or b) were not based in curriculum (school) time.

Study Characteristics

Of the studies included, three were randomised controlled trials (RCT), three were quasi-experimental and two were cross sectional. All studies included a follow up assessment except one (Capio, Poolton et al. 2013). There was a form of comparable control group in all of the studies except one which was also the only NZ based intervention (Mitchell, McLennan et al. 2013). Country of implementation varied including Hong Kong, Northern Ireland, Iran, Sweden, and NZ, and three of the eight studies were delivered throughout Australia.

Not all of the studies reported their mean age of participants, of the three that did, mean age was identified as 5.42 years, 9.16 years and 10.8 years. Participant numbers ranged from N = 177 to N = 1045.

Intended intervention outcomes varied with four of the interventions focusing on FMS development as well as PA, TV viewing time, obesity, healthy eating, children's perceptions of FMS/PA, and/or teacher confidence teaching FMS. This research only included the FMS variable outcome in the analysis.

Out of the eight interventions, four were conducted over a period of at least one year, two were implemented over a six month period but had follow up assessments at 12 months and two were delivered over comparably shorter timeframes of five and six weeks.

Method quality ratings are outlined in Table 2.3. Quality was widely varied (between 25% - 88%) between the studies and of the eight studies included, two were deemed to be of poor quality (Fotrousi, Bagherly et al. 2012; Mitchell, McLennan et al. 2013).

Table 2.3: Method quality of studies meeting the inclusion criteria

Author, year, country	Criteria	Design	Population	Attrition	Collection	Analysis
Fotrousi et al. (2012), Iran	25%	1	0	0	0	3
Mitchell et al. (2011), New Zealand	31%	1	0	2	2	5
Ericsson. (2008), Sweden	56%	1	2	2	1	3
Van Beurden et al. (2003), Australia	56%	1	1	0	2	5
Breslin et al. (2012), Northern Ireland	62%	0	4	0	1	5
Capio et al. (2013), Hong Kong	81%	1	4	2	2	5
Salmon et al. (2008), Australia	81%	1	4	3	0	6
Piek et al. (2012)	88%	1	4	3	2	5

Thresholds for total scores: Low = ≤50%, High = 51%-70%, Extremely high = >70%, (1) study design, (scoring range 0-1), (2) study population, (scoring range 0-4), (3) study attrition, (scoring range 0-3), (4) data collection, (scoring range 0-2), and (5) data analysis, (scoring range 0-6).

Of the eight included studies, six scored highly or extremely highly when it came to statistical analysis. Of the six that were scored as either high or extremely high quality, one of the studies (Capio, Poolton et al. 2013) did not include a follow up assessment and due to the short intervention time that was implemented (5 weeks) it was not factored into the final analysis of characteristics. Method scores of the remaining five studies were reduced by inadequate or

missing information around study attrition and data collection processes. Attrition information largely focused on follow up measurements and procedures.

Three of the five studies with high method quality reported a significant increase in FMS: Ericsson et al (2008) implemented an RCT over three years in one school with three school year groups. Year groups included were the first three years at school. Associations between FMS mastery, increased PA and extra motor training in school were analysed through the Cramer's index. The Cramer's index is performed after chi square testing to determine the significance of any identified relationship between variables. A score on the Cramer's index is identified between '0 – 1'; the closer to '1' the stronger the association, the closer to '0' the weaker the association. Results for year one were a Cramer's index of 0.24, and for year three, a Cramer's index of 0.37. An increase in the Cramer's index from year one to year three indicates the difference of FMS mastery between the control and intervention group increased over time. Children in the intervention group continued to gain greater FMS increases than the control group.

Piek et al. (2012) implemented a six month long FMS intervention with 511 children with a mean age of 5.42 years age group. Multi-level mixed effects linear regression revealed a significant improvement of FMS in the intervention group only ($p = 0.035$). Like previous research this intervention also reported significant interaction with sex and time, with boys improving their FMS score by 3.84 points over time more than girls ($p = 0.22$). Van Beurden et al (2003) also reported significant increases in FMS for most of the eight skills assessed (sprint run, side gallop, kick, throw, jump, hop, catch, balance). Skills where no significant improvements were observed were sprint run for girls ($p = 0.149$), hopping for boys ($p = 0.174$) and balance for boys and girls ($p = 0.079$ and $p = 0.197$, respectively). The programme was implemented over 18 months with nine intervention schools and nine control schools. FMS of 1045 children aged 7-10 years were tested (53% boys and 47% girls).

Table 2.1 Description of curriculum based interventions targeting fundamental movement skills

Author, date and country	Study sample	Research design	FMS Measure	Intervention design	Post intervention (PI) and follow up (FU)	Results
Breslin et al. (2012) Northern Ireland	n=177 mean age NR (7-8yrs) (I) x 107 (C) x 70	Cross sectional	Adapted tool from existing validity tested assessments	FMS Programme – Dept of Education (2001). (I) Teacher PD and resources. (C) No teacher PD	1 year after trained teachers taught a class	I/C No sig diff between FMS Sig diff between schools regardless of I/C
Capio et al. (2013) Hong Kong	n=216 mean age 9.16 years	Quasi-experimental	TGMD-2	Error reduced training environment. (I) 5 PE lessons teaching overarm throw in *ERE, 1.process 2.product oriented assessment (C) 5 PE lessons teaching overarm throw in *ESE, 1.Process 2.product oriented assessment	(PI) 5 weeks	Sig increase in overarm skill
Ericsson, I (2008) Sweden	n=251 (I) x 152 (C) x 99	RCT	observation	MUGI intervention. (I) PA and motor training – one lesson every day (C) School's normal PE x 2p/w	(PI) year 1 (PI) year 3	Year 1 Cramer's index 0.24 Year 3 Cramer's index 0.37

Fotrousi et al. (2012) Iran	n=40 mean age NR (7-10yrs)	Semi-empirical	TGMD-2	(I) Mini Basketball exercises for 3 sessions p/w x 12 weeks (C) normal activities for 12 weeks	PI 12 weeks	I/C No sig diff at baseline I & C sig increase in motor skills PI Increase in motor skills sig diff for I compared to C
Mitchell et al. (2011) NZ	n=701 before n=598 after mean age NR (5-12yrs)	Cross sectional	TGMD	Project Energize – ongoing. Multi component programme providing support to schools and teachers to improve PA, FMS and healthy eating.	6 weeks	All skills sig improved ($p<0.001$) Junior children have bigger improvements
Piek et al (2012)	n=511 mean age 5.42 yrs low SES		Bruininks-Osteretsky Test of Motor Proficiency	Animal Fun programme. Teacher PD, 30min p/d, 4 x d/p/w, over 10 wks (I) 6 schools (C) 6 schools	(PI) 6 months (FU) 12 months	(I) condition x time interaction $F(2,1219)=3.35$, $p=.035$ (I) Sex(Boys)

						x time F(2,1219)=3.84 p=0.22
Salmon et al. (2008) Australia	n=311 Mean age 10.8yrs Co-ed	Group RCT (BM) behaviour modification x 66 (FMS) fundamental movement skills x 74 (BM/FMS) x 93	Established FMS measure	Switch Play intervention delivered in addition to PE. 3 classes each:- (BM)lessons taught by teacher to reduce TV time (FMS) 19 FMS PE sessions across 3 terms, 6 skills (BM/FMS) received both	(PI) 6 month (FU)12month	(BM) (PI) p=0.01 (FU) p=0.05 BMI decreased in the BM/FMS group. FMS group enjoyed PA more
Van Beurden et al. (2003) Australia	n= 1045 mean age NR (yrs 3&4) Co-ed	Quasi-experimental (I) intervention schools x 9 (C) control schools x 2	NSW DET resource on FMS: get skilled, get active	(I) Move it groove it (MIGI) intervention: whole school approach, pre-service and in-service teacher PD and buddy system, online lesson plans for PE and FMS, $ for PE equipment (C) Schools' regular PE curriculum	(PI) 18 months	Sig in all FMS recorded No sig decrease in VPA or MVPA

*ERE = Error reduced environment, ESE = Error strewn environment, FMS = fundamental movement skills, PD = professional development, PE = physical education, VPA = vigorous physical activity, MVPA = moderate to vigorous to physical activity, Sig = Significant difference, BM = behaviour modification, PI – post intervention, FU = follow up, RCT = randomised controlled trial, n = number of participants, yrs = years, co-ed = co-education, NR = not recorded, C = control group, I = intervention group, Dept = department, SCORES = scoring

Discussion

The following discussion will identify key factors of influence of FMS development identified through the current body of FMS literature. These factors will be discussed in relation to the findings of this review and the socio-ecological model.

1) Multi-level theoretical framework

As previously discussed (Chapter One) FMS development is a complex journey influenced by multiple factors at many different levels. This research has focused on a socio-ecological model as a framework for planning, implementation and discussion. By focusing on a socio-ecological model, factors of influence were considered at the individual, social, physical environment and policy environment level.

It has long been recorded that multi-component interventions are more effective at changing PA behaviours (Sallis, Prochaska et al. 2000) and recent research that included FMS interventions support that belief (Lai, Costigan et al. 2014). Lai et al. (2014) has suggested the utilisation of a theoretical model or framework is required for producing a sustained impact. PA and FMS interventions that deliver more than one component in the school setting are reported as more effective due to their potential to influence multiple factors at different levels (Dudley, Okely et al. 2011; Lai, Costigan et al. 2014). However, a review of interventions implemented throughout early childhood settings reports multi-component interventions do not significantly change PA behaviours or FMS (Mehtala, Saakslahti et al. 2014). This review focused on a socio-ecological model for planning implementation and discussion and concluded that study quality was low within interventions implemented throughout early childhood settings (Mehtala, Saakslahti et al. 2014).

Although study quality was poor, the NZ intervention reported significant increases in all FMS through a multicomponent approach (Mitchell, McLennan et al. 2013). Out of the eight studies included in this research, six included more than one component with all six observing improvements in FMS and PA behaviours. All of the components targeted the various levels of the socio-ecological model. To date, there are limited studies that have followed a socio-ecological framework to investigate factors associated with FMS. One study, with preschool children,

concluded that only factors at the individual level were associated with FMS development (Barnett, Hinkley et al. 2013). This finding may have been due to the young age of the children but further research with children aged five to eight years is warranted to investigate if the various levels are somehow weighted with significance impact. Questions posed include – 1) are greater results observed if all four levels are prioritised appropriately; 2) will prioritising the levels of the socio-ecological framework assist with the implementation, maintenance and evaluation of FMS interventions, and 3) can this lead to cost effective, sustainable interventions?

The findings from this review support the view that multicomponent, school based interventions appear to be more effective at increasing FMS and changing PA behaviours by influencing the multiple levels on a theoretical framework.

2) Environmental factors

One of the most consistent predictors of FMS mastery is reported as the school that a child attends (Davies 1999). Regardless of intervention, each school environment is a unique catalyst for FMS development and PA behaviours. Environmental factors that schools provide include: facilities, opportunities to practice and learn and social support which may determine if children reach their FMS capacity.

The school environment can have a significant impact on FMS and PA behaviours, as children have been found to be more active in school free play than at home (McKenzie, Sallis et al. 2002). Boys are influenced by the amount of space that they have to play in and studies carried out in schools report that the more space boys have to play at free play time, the more time they are physically active (Harten, Olds et al. 2008).

One of the studies (Breslin, Murphy et al. 2012) in this review did not include any form for delivery to children and was a follow up research intervention that assessed children whose teachers had attended a training course over a year prior to the assessments. The results from the assessments were compared to assessments conducted on children whose teachers had not attended the training course. The most significant predictor of FMS was not the attendance of the teachers to the training course but the individual schools themselves. The school culture is driven by the

principals, staff and parent involvement and schools that embrace a sporting or physically active culture score significantly higher in regards to FMS development.

The physical environment is one of the four levels of influence on the socio-ecological model and this review identifies that the environment has the potential to significantly impact FMS development in children aged five to eight years.

3) Teacher professional development

There is a belief that school-based FMS interventions empower the teacher to become better equipped to teach PE sessions that will increase FMS by increasing their knowledge base (Gatman, 2005). This is reflected in recent research (Callea, Spittle et al. 2008) investigating the confidence levels of generalist teachers to deliver PE sessions that increase FMS. Teachers have reported a lack of understanding of what and how to deliver efficacious PE lessons. Many teachers believe that any form of PA is PE and that the main purpose of PE is to get kids 'running around', 'burning off steam' and to 'get oxygen to the brain'. There is undoubtedly a knowledge gap among generalist teachers about teaching FMS through PE. What is evident throughout is the lack of pre-service and in-service teacher training provided to early childhood and primary school teachers (Deli, Bakle et al. 2006; Foweather, McWhannell et al. 2008; Robinson, Webster et al. 2012). Primary school teachers feel they have not received adequate training to plan and implement FMS interventions (Callea, Spittle et al. 2008) and in NZ, teachers struggle to interpret and implement the H&PE curriculum (Gatman 2005). Considering these teachers are influencing the development of FMS during the optimal development time these teachers arguably require adequate training to deliver effective FMS programmes. Professional development provided during pre-service training positively influences early childhood teacher's confidence and knowledge to teach FMS activity sessions (Hart 2005; Petrie 2010). Teachers can be instrumental in helping children to practice, master and enjoy learning FMS (Leppo, Davis et al. 2000). Children naturally enjoy moving which means PE lessons that are enriched with movement concepts and guided practice should be a success (Leppo, Davis et al. 2000).

This research has identified teacher PD a key component of effective school based FMS interventions. PD is just one of the key characteristics of an effective school based intervention so it

is recommended that future efforts into increasing teacher's knowledge base are focused on in-service and pre-service teachers.

4) Delivered in and through the curriculum time of physical education

The policy environment at a school is often reflected through the interpretation and implementation of the H&PE curriculum document in NZ. FMS development needs to be a key focus of any PE curriculum for children to develop these prerequisite motor skills required to participate and enjoy physical activity throughout the life stages (Pate, Pratt et al. 1995). Interventions that target FMS development have also been reported as effective strategies for increasing PA (McKenzie, Alcaraz et al. 1997; van Beurden, Barnett et al. 2003; Salmon, Ball et al. 2008). FMS activities in conjunction with PA participation and enjoyment and self-perception should be part of an effective H&PE curriculum.

Teachers are not confident teaching PE, let alone constructing meaningful lessons that allow children to explore and develop their FMS; yet PE plays an important role in the acquisition of these essential, movement skills. The NZ H&PE curriculum of teaching 'in, through and about movement' provides teachers with the parameters required for successful skill acquisition and is a platform that requires further development. Longitudinal research shows that education policy may be a key factor in increasing FMS on a public health scale (Hardy, Barnett et al. 2013). Hardy et al. (2013) conducted a large population study (n= 13,752) and completed secondary analysis of representative, cross-sectional school based surveys from 1997, 2004 and 2010. Although FMS was deemed to be low across all time points, there was a significant overall increase between 2004 and 2010. This is believed to be attributed to changes in practice and policy in teaching FMS in schools.

FMS development is a complex journey and findings from this study support the implementation of curricular FMS activities. It is important to mention the evidence (Foweather, McWhannell et al. 2008) to suggest however that co-curricular interventions have the potential to increase FMS. Research carried out in the UK and Australia (Cliff, Wilson et al. 2007) has shown promising results of increased FMS and a change in PA participation and associated health benefits. Future research is required to determine the impact of curricular compared to co-curricular FMS

interventions and if a combination of the two yields greater improvements in FMS development and PA behaviours.

5) Element of session delivery

Most young children are kinaesthetic learners; not only do they move to learn but they need to learn how to move. Chapter One identified the developmental nature of FMS and the fundamental requirement for children to have opportunities to practice along with an element of skill instruction. One study included in this review (Breslin, Murphy et al. 2012) did not include an element of delivery to the children and reported no significant improvement in FMS. All of the other studies included an element of session delivery and all reported improvements in FMS or associated benefits.

A meta-analysis of the effectiveness of FMS interventions reported (Logan, Robinson et al. 2012) a correlation between the amount of time spent participating in FMS activities during the intervention and improvement of FMS. Although there are no specific guidelines around how much activities need to be done, interventions that provide an element of session delivery are providing essential opportunities for practice and skill instruction.

6) Intervention duration

Four of the five studies included in the final analyses implemented interventions that ranged between six to twelve months. All four reported significant improvements in FMS development. Studies that were of low method quality or studies that did not report significant improvements in FMS implemented interventions less than six months.

Two studies were implemented for over a year but it was identified in both studies that a limitation to the intervention was the scale and the funding required to sustain such an intensive intervention. Key learnings and intervention characteristics from these studies have been cross referenced with interventions running over a much shorter time span and found to be similar. A serious consideration is the possibility of a cut-off point when too much intervention can become detrimental to teacher confidence and ability to plan, review and implement interventions. There is a real need for further research into the possibility of a disempowerment threshold that can be translated

through to field based interventions in the school environment. Any research investigating effective characteristics of time parameters should also consider minutes of instruction time, instructional approaches (Logan, Robinson et al. 2012) and time spent in skill specific instruction compared to game based activities.

Changes in FMS development can be dramatic; initial changes in FMS are rapid with results being observed after a single lesson (Adolph 2008; Lubans, Morgan et al. 2010; Capio, Poolton et al. 2013). These initial observed results however are not an indicator of mastery of FMS. In fact as previous research (Clark and Metcalfe 2002; Clark 2005) has shown, true mastery of certain skills, especially higher order skills that require complex motor development can take a long time to master. These higher order skills include jumping and overarm throw and can take years to become an automatic component of a child's repertoire of skills. Research suggests (Barnett, Morgan et al. 2008) object control development is dependent on learning experiences that are quality and repeated often. It has been shown that interventions must include a follow up assessment to conclude mastery of a fundamental movement skill (Smyth and Q'Keeffe 1998; Kovacs 2008). All of the studies in this review that were deemed to be of high methodological quality included a follow up assessment.

7) Focus on behaviour change throughout

Factors influencing children's PA behaviours are important to understand when designing efficacious FMS interventions. The PA behaviours of children have long been investigated (Sallis, Alcaraz et al. ; Luepker, Perry et al. 1996; Sallis, Prochaska et al. 2000) with the hope of finding the key to creating positive behaviour change. Behaviour change is predominantly targeted at the individual level but is influenced by social, environment and policy factors. There is evidence to suggest that positive PA behaviours are associated with FMS development. Without a change in behaviour, interventions are not going to be effective or sustainable.

The interventions (Beurden, Barnett et al. 2003) included in this review that were implemented for six months or longer reported the greatest results in FMS development. In part, this may have been a result of a greater change in PA behaviours. Social cognitive theory purports that behaviour change is determined by environmental, personal and behavioural elements, all of which can be

identified on a socio-ecological theoretical framework. Findings from this review suggest that behaviour change process should be considered when planning and implementing future interventions.

This review has a number of key strengths: Firstly, to the knowledge of the researcher it is the first review to narrow the focus to FMS interventions delivered during curriculum time to children aged five to ten years. Secondly all of the studies have been published within the last 11 years, providing current evidential knowledge around the efficacy of FMS interventions. Thirdly a sound methodological process has been followed (Liberati, Altman et al. 2009).

Limitations of this review are also acknowledged: Studies were only included in the review if they had been published in English language. Due to the nature and scope of the review a systematic approach was taken to carry out a critical review, rather than a systematic review being conducted.

There has been previous research into effective school based interventions that aim to increase PA, FMS, self-esteem, change TV viewing behaviours and reduce obesity (van Beurden, Barnett et al. 2003; Salmon, Ball et al. 2008). Although methods varied greatly characteristics of effective interventions were identified including, multicomponent, multi-level, teacher professional development, teaching FMS directly and explicitly through the PE curriculum, minimum delivery between 6-12 months and a follow up. Many of these characteristics' are in line with the key determinants defined in this study, apart from the lack of behaviour change. This would suggest that behaviour modification was not a key outcome of previous studies.

Conclusion

Research on effective FMS interventions is limited and what is available varies greatly with study quality. Studies that have high method quality showed clear characteristics of effective school based FMS interventions. Work is needed to be done to determine optimum time parameters of interventions, effective instructional approach, school policy and curriculum recommendations. Results to increase FMS were varied with best results seen when teacher professional development

was delivered alongside activity sessions to children. Where interventions were implemented across different schools, the school environment played a key role in the development of FMS.

Inferences made about effective school based FMS interventions suggest that the following determinants will lead to an increase in FMS mastery among primary school children aged 5-10 years: 1) Multicomponent and multi-level, 2) Environmental factors such as education, facilities, opportunities to practice and learn and social support, 3) Teacher professional development, 4) Delivered in and through the curriculum time of physical education, 5) Element of session delivery, 6) An intervention that runs for a minimum of 6-12 months, and 7) Focus on behaviour change throughout.

Early intervention is paramount for FMS development and the primary school setting offers an ideal location to target children, as well as teachers and parents who may provide further FMS learning opportunities. With this knowledge it is important to advocate to all teachers and policy makers the importance of delivering efficacious FMS programmes within the school environment. Due to the reported characteristics of Get Set Go (multi-component and multi-level, teacher professional development, delivered in and through the NZ curriculum, element of session delivery, runs for two years and focuses on behaviour change) this review concludes that theoretically Get Set Go will be an effective school based intervention to increase FMS.

CHAPTER THREE: RESEARCH METHODS

Protocol

This thesis comprises the following three lines of enquiry: (1) a critical review of FMS interventions for children (Chapter Two), (2) a quasi-experimental (pre-post) study of the effectiveness of a current FMS programme, Get Set Go, on improving children's FMS skills (Chapter Four), and (3) an evaluation of the Get Set Go programme using a framework that assesses intervention Reach, Efficacy, Adoption, Implementation, and Maintenance (RE:AIM; Chapter Five). The data collection was conducted in Auckland, New Zealand, between February 2013 and October 2013. Methods specific to each of the three investigations listed above are provided in their respective chapters. This chapter depicts the methods for school and participant recruitment, intervention delivery, and outcome measurement.

Ethics

Ethical approval to conduct the research was sought from the Auckland University of Technology Ethics committee on 10th September 2012. The application was considered in September 2012, and approval (Appendix A) to conduct the research was provided in November 2012 (AUTEC reference 12/249).

School Recruitment

All Auckland schools registered to participate in the Get Set Go programme (n = 28) were identified by the organisation responsible for coordinating Get Set Go into Auckland primary schools (Sport Auckland). For the purposes of this research, all schools registered to start participation in the Get Set Go programme in the Auckland region during the period of January to March 2013 were eligible to participate. Eligible schools (n = 7) were approached by the researcher to arrange a one-on-one

consultation with every school Principal. Each Principal was provided with a study-specific information sheet, a school consent form (to be signed by the Principal on behalf of the school), and an opportunity to discuss the research at the meeting. If Principal (school) consent was given, recruitment of participants commenced as soon as practically possible.

Participant Recruitment

All children aged 5-8 years, and their classroom teachers, from participating schools who were involved with the Get Set Go programme were eligible to participate in the research. For the purpose of this thesis teachers will be referred to as junior teachers. Junior teachers are classroom teachers of children aged 5-8 years. Parents of eligible children were sent parent information and parent consent forms and child information and assent forms via take home packs from the class teacher (provided by the researcher).

Parent information forms requested parents read through the child information and assent form with their child, discuss the research and answer any questions their child may have had. For a child to participate in the research, both parental consent and child assent was required.

The researcher provided each junior teacher from classes participating in the Get Set Go programme with an information sheet and consent form. These teachers were invited to complete a survey (Appendix B), post intervention and participate in an informal one-on-one interview at follow up.

Stamped addressed envelopes were provided to all parents of eligible children and eligible junior teachers to return consent forms to the researcher. Eliminating the cost of returning the consent forms was an attempt to increase response rate and reduce barriers to participating.

Consent and participation was obtained without coercion or inducement to participate, and participants were able to withdraw from the study at any time with no adverse consequences.

Inclusion/Exclusion Criteria

Quasi-experimental study (Chapter Four)

The motor proficiency test that was utilised to objectively assess FMS is focused on able bodied children to enable standardising. To establish a different test protocol would jeopardise the significant relevance of test results. Therefore all able-bodied children who provided assent to participate in the research and whose parents provided consent to the child's involvement in the study were included. Any temporarily or permanently disabled children were excluded from being objectively assessed for FMS as part of this research. Disabled children were not excluded from participating in the Get Set Go programme.

RE:AIM evaluation (Chapter Five)

All junior teachers who provided consent to being involved in the programme and complete the survey and informal interview were included in the research.

All children aged 5-8 years and junior teachers from participating schools were included in this research at a demographic/nominal level. Information at this level could not be used to identify individuals and is information that is available in the public domain.

Intervention Description

Get Set Go is a two year programme delivered in curricular time at school and aims to influence FMS factors at an environmental and individual level. The programme components are outlined in Table 3.1 and include ongoing teacher PD, resources and school based FMS training for teachers and students. Teacher PD is delivered over a full school day and covers a range of FMS related topics. A detailed list of content is at Appendix C. FMS training was delivered once a week for eight weeks to each class teacher and their students. The structure of the eight week FMS training is outlined in Appendix D.

Games played in class were often repeated by the junior teacher at another time in the week when the coach was not in attendance. This opportunity allowed children to remember the game and play again at playtime or at home with friends and family. The coaches specifically asked children to teach the game to someone at home and changes to the rules are encouraged throughout. Children learn through quality teaching experiences and the Get Set Go programme follows a pedagogical model of teaching games for understanding (TGFU). Children are involved in the creation of the game and play to the rules that they have created. The class is encouraged to work together to create games that are fair and inclusive. This also takes pressure off the teacher to create new activities or research activity ideas for session plans. After the games have been created and played (and sometimes modified) the children are asked to create, write, draw or make a video about the experience. This helps to create links between the eight learning areas of the curriculum and increase teachers' confidence.

The programme also encouraged PA homework tasks that involved teaching family members how to perform motor skills. This programme fits with recommended models (Gatman, 2005) of creating synergy between the two PA forums (curricular and co-curricular) in primary schools by creating a shared purpose and understanding of PA between parents/caregivers, other community members, and schools.

At the time of this research, the Get Set Go programme was being delivered into Auckland schools across a two year period (2013-2015). Due to the scope of this research and in consideration of the time constraints, intervention parameters were defined for the purposes of this study. Only the initial six months of the Get Set Go programme in participating schools was evaluated. The initial six month period was defined as the intervention for this current thesis. Schools were only eligible to participate if they were due to start the Get Set Go programme between February 2013 and March 2013. It was essential that participating schools in the Get Set Go programme all followed the same implementation model. This implementation model is displayed in Table 3.1. At no time did this research impact on the implementation model of the Get Set Go programme. Schools operate on a four term per year model, which are identified alphabetically. Implementation of the Get Set Go programme can start at any stage throughout the school year.

Baseline was considered to be all information collected in term a. The intervention was considered to be the delivery component of term b and the follow up was considered to be the effects after term c.

Table 3.1: Get Set Go implementation model

Year 1:	
Term a	School is visited and GSG is explained to Principal and teachers Schools decide whether to participate Initial PD for junior teachers is diarised, and if time allows delivered (1 day) 8 x weekly FMS training sessions for junior classes are timetabled for next term
Term b	1 full day (initial) PD for all junior teachers Resources provided to teachers 8 weekly FMS training sessions for each junior class Programme review and planning for Term c
Term c/d	School to continue implementing GSG
Year 2:	
Term a,b,c or d	1 x 2 hour refresher PD for junior teachers 1 x 2 hour practical games PD for junior teachers 8 x weekly FMS training sessions for each junior class PE curriculum planning with the whole school
Year 2:	Additional extras to be implemented (school dependent)
	After school club for 5-8 year olds Planning and implementation support of GSG into school athletics day

Notes: FMS = fundamental movement skills, GSG = Get Set Go, PD = professional development, PE = physical education

Measures

Quasi-experimental study (Chapter Four)

A modified version of the Test of Gross Motor Development- Edition 2 (TGMD-2) (Ulrich, 2000) was used to assess FMS in participating children (Appendix E). The full version of the TGMD-2 consists of twelve motor skills in total: six locomotor skills and six object control skills. Validity of the TGMD-2 has been tested previously and reported as reliable in three areas, including content description, criteria prediction, and construct identification (Ulrich 2000). A high degree of reliability (Ulrich 2000; Cools, Martelaer et al. 2009; Valentini 2012) and successful field based assessments (Lubans, Morgan et al. 2011; Fotrousi, Bagherly et al. 2012; Capio, Poolton et al. 2013; Mitchell, McLennan et al. 2013) have provided evidence for the utility of the TGMD-2 for objective assessment of children's FMS.

Due to time constraints and the scope of this current thesis the TGMD-2 was simplified to include two object control skills (overarm throw and catch) and two locomotor skills (running and skipping), totalling four skills. This modification cut each assessment time of individual children from 15-20 minutes to 5-7 minutes. The four skills assessed for this research deliberately coincided with the skills included in the eight weeks of FMS training the junior teachers and students received.

FMS assessments were conducted by a trained researcher and involved children being scored on the four FMS skills outlined above. Prior to data collection, training on the TGMD-2 took place in a school and early childhood settings, outside of the testing locations, and results were not included in the data analysis. Children aged 3-10 years from various educational settings were involved in researcher training to establish a true appreciation for the full scale of the TGMD-2 (which is designed for assessing 3-10 year olds). The researcher assessed five children from three classes at one primary school and fifteen preschool children from one early childhood centre, totalling 30 children. Inclusion criteria for assessment was determined through various factors including time restraints of researcher, accessibility to children and an attempt to assess ten percent of anticipated research participants. Children were included if they were able bodied and present on the day. Assessments were carried out following predetermined testing protocol.

All FMS assessments were conducted outside in the school playground or in the school hall or gymnasium in small groups of 4-6 children, depending on class size, school commitments and the weather. Repeat assessments were conducted under the same conditions at each school, for example if baseline was conducted in the gymnasium then post intervention and follow up assessments were conducted in the gymnasium. Activities that children were asked to perform were everyday activities that children participate in regularly such as running, skipping, throwing and catching activities. Every effort was made to reduce and 'test like' environment. A warm up game with the group that involved children using their bodies and pretending to be different types of beans (running beans, jumping beans, broad beans, string beans etc) was played beforehand for five minutes to introduce the children to activities to be tested. The TGMD-2 protocol was followed, which has been published in previous research (Ulrich, 2000). In brief, the researcher demonstrated each activity twice for the children and then asked the children to repeat the activity one at a time so that they could show the researcher how they performed the skill. Each child had two attempts at each of the four skills. Each of the four skills had three or four skill criteria that, when performed determine the maturity of the individual skill. Where a child performed a skill criterion a '1' was marked in the appropriate box. If a child failed to perform a skill criterion a '0' was marked in the appropriate box. The scores from the two attempts were added up to produce a total score for each of the four individual skills. Testing in each school was carried out over 2-3 days to facilitate data collection with all participating children.

Objective FMS assessments were implemented at baseline (start of Term b), at the end of the intervention (at the end of Term b) and at follow up, one term later (at the end of Term c, 2013).

RE:AIM evaluation (Chapter Five)

The reach of the intervention was determined through analysis of data provided by the principal at baseline. Along with school rolls the principals provided class and teacher information. A checklist that was discussed with the principal and includes information requested is displayed at Appendix F. A funding model was provided by Athletics NZ (Appendix G) and discussed with the school principal to demonstrate cost of the intervention provided to the school.

Efficacy of the intervention was determined using data from the objective FMS assessments (outlined above). Data were collected from junior teacher surveys and one-on-one interviews were considered in evaluating the intervention efficacy. One-on-one interviews were semi structured and included the same open ended questions that were used on the survey (Appendix G). Data collected from teachers that completed the survey and participated in the one-one-one interview were cross referenced and validated by comparing answers were similar. The open ended questions created opportunities for new topics to emerge during the interviews. Children's feedback was received throughout the delivery phase via interactions with the coach and post intervention through creative writing examples. Teachers worked with the children in their classes to create writing experiences that included letters to the coach, cards to family members pictures, class posters, stories, and postcards. These were thematically analysed and a small sample of these are provided in Appendix H.

Adoption of the intervention was measured by using data from the school rolls, principals provided information on number of classes participating compared to potential number of classes that were eligible to participate. In addition the junior teacher surveys that were implemented post intervention provided information to validate the adoption of the intervention.

Survey items assessed teachers' views on quality, impact and implementation of Get Set Go via a Likert scale and a series of open ended questions about confidence in teaching Get Set Go and strengths and weaknesses of the programme.

Maintenance of the intervention was determined via analysis of information provided by the principals and junior teachers at follow up. The number of teachers that continued to implement Get Set Go was identified along with school policies and H&PE plans.

Data Collection

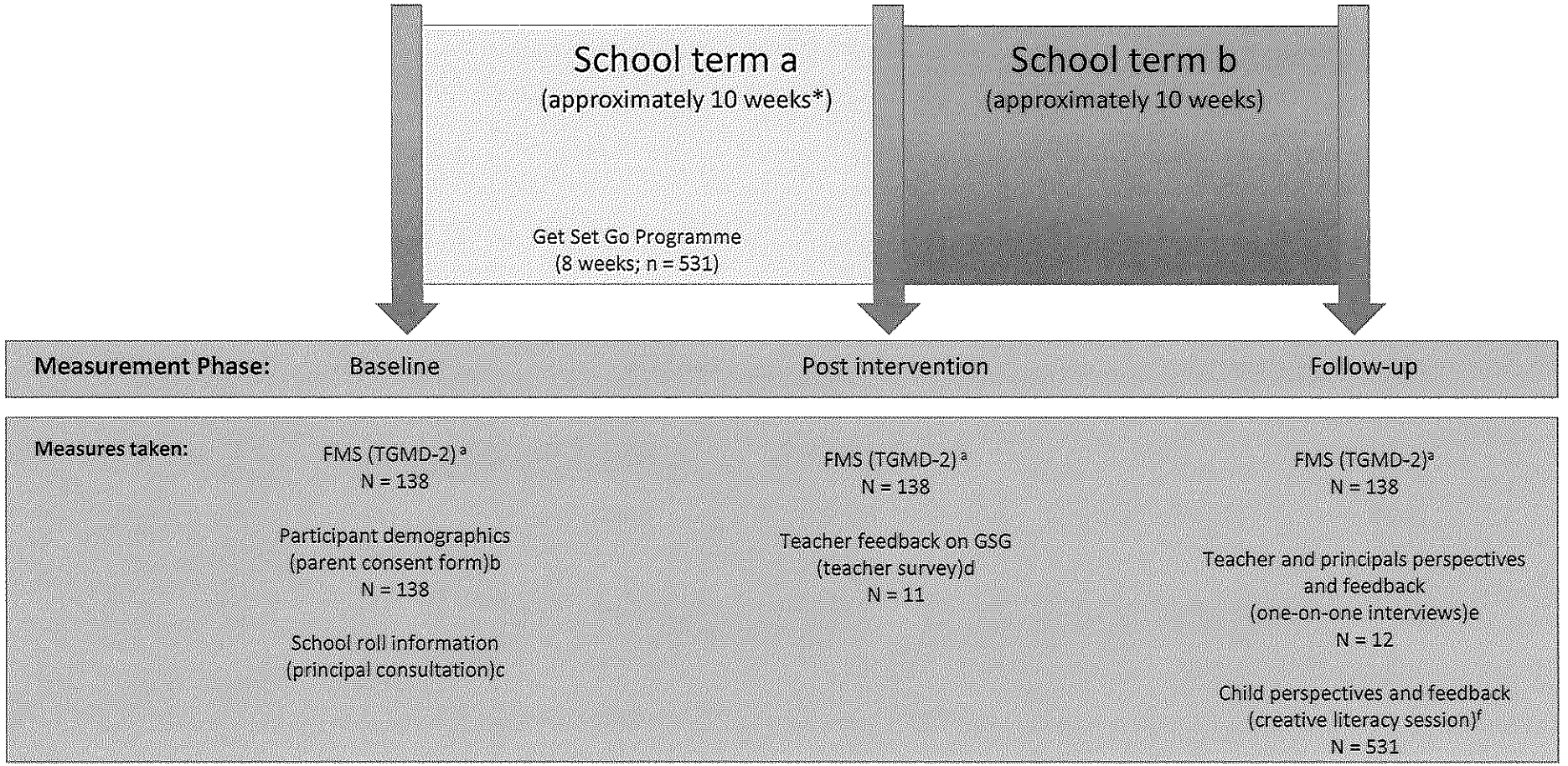
The data collection process is identified in Figure 3.1. In addition, as the researcher, I am identified as part of the research data collection process through the position I hold at Sport Auckland as Director of Youth Development. Subject knowledge as part of my role will play a part in the

discussion chapter by identifying discussion points and to bring a wider subject knowledge base. This will be clearly identified as researcher subject knowledge.

Data Analysis

SPSS.20 was utilised to create the data set and complete analysis of the objective FMS objective assessments. This process is explained in detail in Chapter Four.

Information collected from the teacher surveys and informal interviews was utilised as part of the RE:AIM evaluation framework. This analysis is explained in detail in Chapter Five.



*The school calendar year in NZ is delivered across four terms which are each approximately 10 weeks duration. Each year there are variations in term duration and schools have a week of flexibility when to start the term. In 2013 term 1 was approximately 9 weeks, term 2 approximately 10 weeks, term 3 approximately 11 weeks. For n= 60 children from 1 school, term 1 was school term a (above). For n= 78 children from across 3 schools, term 2 was school term a (above).

Notes: FMS = fundamental movement skills, N = number of participants, TGMD-2 = Test of Gross Motor Development-2, GSG = Get Set Go
Chapter Four: a Used to determine Efficacy, b Used to determine demographics for grouping – sex, ethnicity, age
Chapter Five: a Used to determine Efficacy, c Used to determine Reach and Adoption, d Used to determine Implementation, e Used to determine Maintenance and Efficacy, f Used to determine Efficacy.

CHAPTER FOUR: THE EFFECTS OF A SCHOOL BASED INTERVENTION ON FUNDAMENTAL MOVEMENT SKILLS

Introduction

FMS are prerequisite motor functions needed to effectively participate and enjoy a wide range of sporting, recreation and individual pursuits (Vandorpe et al., 2012; Hands, 2007; Harten et al., 2008). FMS mastery has been linked with positive health and educational benefits in primary school children. These benefits include increased PA, MVPA, self-esteem, perceived motor competence, academic achievement, social interactions, and decreased obesity, sedentary behaviours, and presence of cardiovascular risk factors (Okely, Booth et al. 2004; Hume, Okely et al. 2008; Singh, Mulder et al. 2008; Cliff, Okely et al. 2009; Lubans, Morgan et al. 2010; Dudley, Okely et al. 2011).

There is a growing body of evidence that suggests FMS mastery among groups of children aged 5-12 years is decreasing (Booth et al., 1999; Foweather, 2010; Sanders & Kidman, 1998; van Beurden et al., 2002) although recent data published in New Zealand (NZ) suggests that FMS mastery have stayed relatively constant between 2002 and 2006 (Sport NZ, 2012). A large longitudinal study of 13,752 children aged 9-15 years in Australia showed an increase in FMS mastery across the first survey periods: 1997-2004 (Hardy et al., 2013). There was not an increase between the second survey period, 2004 -2010 despite the increase observed in the previous survey period. Levels of FMS mastery were still below expected level for the age range and sample size, throughout the complete reporting period. FMS mastery ranged from as low as 20.8% for mastery of catching in 1997 to no higher than 55.5% for catching in 2010. Catching had the greatest increase in mastery and more children had mastered catching over any other skills.

Children do not naturally learn FMS; they have to be provided with appropriate skill training and opportunities for practice to allow for skill development and refinement. The acquisition of FMS is enhanced by training and education involving complex learning tasks that provide problem solving, compared to less difficult tasks (Carey, et al, 2005).

A number of individual FMS have been extensively explored (Gallahue 1989; Clark and Metcalfe 2002; Clark 2005) and it has been shown that true mastery can take years for more complex higher order skills, including jumping, over arm throw, and catching. Research suggests that children attain mastery sooner through the interaction of a trained teacher, coach or parent to bring context to learning situations and give purpose to play (Drost and Todorovich 2013).

Longitudinal studies (Hardy, Barnett et al. 2013; Lai, Costigan et al. 2014) suggest that FMS mastery can be enhanced through school-based interventions. Early intervention is paramount for FMS development (Stodden et al, 2008) and the primary school setting offers an ideal location as it allows access to all children, has facilities in place for evidence based curricular and co-curricular FMS programmes, and offers an established infrastructure and trained personnel for successful implementation. Changes in practice and policy and inclusion of FMS development in the curriculum have been reported as key factors of successful school based interventions (Hardy, Barnett et al., 2013; Lai, Costigan et al., 2013

The New Zealand (NZ) curriculum provides direction for student learning and provides guidance to schools so that they can design and review their practice (Ministry of Education, 2007). How this curriculum is interpreted and implemented varies greatly from school to school; reflective of the large cultural and environmental differences of schooling communities across the country. These variations of implementation can have substantial implications into a child's learning experience, especially in the domain of health and physical education (H&PE).

Of the four strands within the NZ H&PE curriculum, one includes the development of motor skills; teaching in, through, and about the movement (Ministry of Education, 2007). This strand alone is reported by teachers as difficult to interpret and implement with inadequate knowledge and training reported as contributing factors for not understanding or implementing (Gatland 2005). The ability to plan a FMS session that is at the correct complexity level for all participating children requires careful judgement. Such judgement may be one of the main distinguishing features of outstanding teachers and coaches (Carey, Bhatt & Nagpal, 2005).

In light of emerging research highlighting the benefits and possibilities that are available within the education setting, along with low and possibly declining FMS mastery, it is essential to implement

and appropriately evaluate school based FMS interventions. As previously discussed in Chapter Two school based FMS interventions are limited and methodologies vary greatly.

There is clearly evidence to suggest school based FMS interventions can be effective. Work now needs to be done to establish how best to incorporate those interventions into field based practice that is not detrimental to the learning and development of the child. This research intends to evaluate the effectiveness of a current FMS programme (Get Set Go) being delivered nationally throughout primary schools in NZ as an intervention that can be measured and quantified.
In light of the Get Set Go programme displaying characteristics of effective school-based FMS interventions that have been defined in Chapter Two it is hypothesised that children's FMS levels will significantly increase post intervention and at follow up.

Methods and Procedures

Study population

This was a quasi-experimental study to evaluate change in FMS mastery in children participating in the two year Get Set Go programme in Auckland, NZ between March – October 2013. Due to the time requirements of this research only schools that started participation in March were invited to participate. A detailed recruitment process can be viewed in the methods chapter (Chapter Three).

Deciles are a 10% grouping of socioeconomic status and are a means for which the NZ Ministry of Education allocates its funds. There are ten deciles with approximately 10% of schools in each decile ranking. Decile one schools have the highest proportion of students from low socioeconomic households. Decile ten schools have the lowest proportion of students from low socioeconomic households. All schools enrolled with the Get Set Go programme were invited to participate regadrless of decile. All children enrolled in junior classes (years 0-3, approximate ages 5-8 years) at the participating schools were invited to participate in the study

Intervention description

Get Set Go is a two year game-based multicomponent programme designed to increase children's FMS. The programme is theoretically based and comprises an ongoing interactive process based

on children's needs, following a Teaching as Inquiry Cycle that allows easy implementation within the NZ primary school curriculum.

The programme is delivered in curriculum time by accredited coaches and school teachers are required to participate in the delivery to their class. The activities delivered by the coaches can be repeated at home or in the playground and children are encouraged to teach family memebers how to play to create school-club links. Teachers participate in a one-day training course run by the Get Set Go Regional Coordinator, employed at Sport Auckland. Training covers FMS theory and development, needs analysis of students, assessment and planning strategies, and links to the school PE and curriculum plan. Trained Get Set Go coaches then work alongside teachers to deliver eight, weekly in-class training sessions to students, focused on FMS. The purpose of this eight week delivery component is to further develop the teachers' confidence and knowledge to implement Get Set Go. It is an opportunity for teachers to put theoretical knowledge gained at the one day training into practical application via modelling (coach delivery), mentoring (coach and teacher delivery) and objective feedback (teacher delivery). The eight sessions are structured in a manner that increases teacher participation and confidence over the eight sessions. This structure can be viewed at Appendix D. For the purposes of this study, FMS skills taught and assessed were skipping, running, catching, and overarm throw. Activities to be completed at home are discussed with the children at the end of each session. Throughout the eight week programme, teachers and children are encouraged to plan and develop games that are meaningful to them. Before the end of the eight week intervention, planning is carried out with each individual teacher to allow them to further develop their confidence in teaching FMS. The final session (session eight) is followed by a literacy lesson in class time which includes children writing about their skills and experiences. A further 18 months of support is provided through refresher training for teachers, after school clubs for children, assistance with appropriate integration of junior children (years 0-3) in school athletics days, annual PE curriculum planning, and an additional eight weeks of in-class FMS delivery to children.

Measurement

The assessment time points have been discussed in detail in Chapter Three and Figure 2.1. In summary, assessments were implemented at baseline, post intervention and again at follow up which was approximately one school term later. There are four school terms per year in NZ; each is approximately of 10 weeks duration.

FMS assessments were conducted by a trained researcher and involved children being scored on four fundamental skills (running, skipping, overarm throw, catch) on a modified version of the TGMD-2 (Ulrich 2000). The modified version can be viewed at Appendix E. The full version of the TGMD-2 includes 12 fundamental movement skills and was modified by reducing the number of skills due to time constraints. Both versions require the children to perform a skill that is broken down into three or four criterion. Each child is scored on each attempt of the skill, depending if they successfully perform the skill criterion.

This scoring allowed FMS skills to become quantifiable. Training on the TGMD-2 took place in a school and early childhood settings, outside of the testing locations, and results were not included in the data analysis.

All FMS assessments were conducted in small groups of 4-6 children, depending on class size and school commitments. A suitable warm up game was played beforehand to introduce the children to activities to be tested and reduce any reactivity to the testing procedure. Testing in each school was carried out over 2-3 days to ensure students that were absent on initial testing days could be assessed.

Procedure

This study was granted ethical approval from the Auckland University of Technology Ethics Committee (AUTEC 12/249). A list of schools due to participate in the Get Set Go programme was provided to the primary researcher by Sport Auckland, the Regional Sports Trust responsible for the coordination of the programme into schools. Principal and teacher consent was received before parental consent and child participant assent was obtained. All parties were provided a written

description of the purpose and procedures of the study, together with possible risks and benefits of participating.

Statistical Analysis

Statistical tests were used to determine group differences among selected variables using t-tests. The Generalised Linear Model (GLM) procedure on SPSS (version 20) was used to test for intervention effects in the context of a linear regression design in which time (baseline, post intervention, follow up), ethnicity (NZ European, Māori/Pacific, Other ethnicities), school decile (decile six, decile nine) and sex (male, female) were entered as predictors and the motor skills (total score; subscores for running, skipping, catching, overarm throw) were specified as the outcome variables. The analysis examined all 2-way and 3-way interactions. Model effects were tested through the chi-square test. Significance during model testing was set at $p < 0.10$ for inclusion into final GLM analyses.

Results

Sample characteristics

Seven schools were invited to participate in the study, of which four agreed to participate. The three that did not participate reported busy timetables or no interest as reasons for not participating. Schools were either decile six or nine, reflecting socio-economic status of high (decile nine) or medium (decile six).

All children from across the four schools that were participating in the Get Set Go programme (N=531) were invited to participate in the research. There was a 26% response rate at baseline, totalling 138 participants. Response rate from potential participants varied across schools. Variance was not significant: school 1) 31%, school 2) 24%, school 3) 24%, school 4) 21%. A total of 80 boys and 58 girls ranging from 5 years to 8 years 7 months of age (M = 6 years, 9 months, SD = 8.32 months). There was no statistical difference at baseline for sex $p = .495$ or ethnicity group p =

.843 of the child. All participants measured at baseline were measured post intervention and at follow up. Baseline characteristics are displayed in Table 4.1.

Table 4.1: Baseline sample characteristics

	Boys N = 80	Girls N = 58	p-value
Age, Mean (SD)	6.08 (0.86)	6.10 (0.81)	0.400
Ethnicity	NZ European N = 50 Māori/Pacific N = 10 Other N = 19 Not Recorded N = 1	NZ European N = 36 Māori/Pacific N = 9 Other N = 13	0.054 0 .118 0.088
School decile	Decile 6 N = 29 Decile 9 N = 51	Decile 6 N = 14 Decile 9 N = 44	0.072 0.051

Notes: N = number of participants, SD = standard deviation

Descriptive results

Table 4.2 displays the mean and standard deviation for the TGMD-2 scores for the total score and four motor skills across the three assessment times. Scores for boys and girls are provided separately.

Table 4.2: Individual motor skill results of the TGMD-2 assessment across the three time points.

FMS Assessment	Time	Boys Mean (SD)	Girls Mean (SD)
Total Score	B	19.71 (6.56)	20.60 (5.10)
	PI	23.05 (7.78)	23.24 (5.84)
	FU	27.41 (3.27)	27.17 (3.46)
Running	B	5.82 (1.99)	5.71 (1.76)
	PI	6.85 (2.14)	6.66 (1.61)
	FU	7.70 (.66)	7.52 (.84)
Skipping	B	3.86 (1.57)	4.22 (1.35)
	PI	4.36 (1.74)	4.90 (1.63)
	FU	5.41 (1.10)	5.71 (.88)
Catching	B	5.76 (2.03)	6.17 (1.70)
	PI	6.16 (2.48)	6.72 (1.94)
	FU	7.30 (1.14)	7.24 (1.22)
Overarm throw	B	4.83 (2.09)	4.47 (1.94)
	PI	5.63 (2.27)	4.98 (1.77)
	FU	6.95 (1.35)	6.71 (1.53)

Notes: B = Baseline assessment, FU = Follow up assessment, FMS = fundamental movement skill, PI = Post intervention assessment, SD = standard deviation, TGMD-2 = Test of gross motor development-2.

GLM analysis

Table 4.3: Results of the Generalised Linear Modelling for effects of the Get Set Go programme on children's fundamental movement skills.

FMS Assessment	Source	Df	p-value
Total score	Time	2	<0.001
	Age	33	<0.001
	Ethnicity	2	<0.001
	Time x School decile	3	0.003
	Sex x Age	22	<0.001
Running	Age	33	<0.001
	Time	2	<0.001
Skipping	Age	33	<0.001
	Ethnicity	2	0.001
	Time	2	<0.001
	School Decile	1	0.006
	Sex	1	0.015
Catching	Age	33	<0.001
	Time	2	<0.001
	Ethnicity	2	<0.001
	School Decile	1	<0.001

Over arm throw	Time	1	<0.001
	School decile	1	<0.001
	Sex	1	<0.001
	Age	33	<0.001
	Ethnicity	2	<0.001
	Time x School decile	2	<0.001
	Sex x Age	21	<0.001

Note: df = degrees of freedom,

The results of the GLM analysis are summarised in Table 4.3. Overall, there was a significant increase observed across all four FMS skills and total FMS score ($p < 0.001$ for all) over the assessment periods. Most notable changes were observed with younger children (mean age= 5.4 years - 6.3 years) who displayed greater incremental increases than children aged over (m) 7.2 years. Age and time were not the only factors that impacted FMS development significantly. Significant results from the GLM analysis are explored further and reported separately below for ethnicity, sex, and school decile.

Ethnicity effects

Māori/pacific ethnic group were significantly better ($p < 0.001$) at motor control (catch and overarm throw) skills than the Other or NZ European ethnic groups at baseline. In contrast children of NZ European ethnicity were significantly better ($p < 0.001$) at skipping than the other two ethnicity groups. Māori/Pacific group were significantly better ($p < 0.005$) at skipping than the Other ethnic group. The greatest improvements ($p< 0.004$) within the ethnic groups across time for total score was observed in ethnic group 2, Māori/Pacific.

Sex effects

Boys significantly attained greater over arm throw and total scores younger than girls when match with their age groups. Boys also scored significantly higher at overarm throw regardless of age ($p < 0.001$). When matched with their age groups girls did not attain any skills younger than boys.

School decile effects

A relationship was also observed between school decile and time. At baseline, decile six schools scored significantly higher for the total score and catching score than decile nine schools ($p = 0.002$ and $p < 0.001$ respectively). Over time, decile nine schools improved total scores significantly more than decile six, so that at follow up there was no statistical difference between the two groups.

At baseline and post intervention, throwing skills were significantly higher ($p < 0.005$ and $p < 0.001$ respectively) at decile six schools than decile nine schools. There was no significant differences between school decile at follow up. There was a significantly larger increase ($p < 0.001$) in over arm throw scores at decile nine schools. Skipping was also effected by school decile but total effect was not significant ($p= 0.006$), at baseline skipping at decile six schools was significantly higher than decile nine schools ($p <0.001$).

Summary

The aim of this research was to evaluate the effectiveness of a current FMS programme being delivered in Auckland, NZ in a sample of primary schools. This is the first quasi-experimental study to investigate the effects of a school based FMS intervention being delivered in NZ. Key findings from this research suggest that Get Set Go is an effective schol based FMS intervention. These key findings will be explored in the discussion paper in the broader context of the thesis.

CHAPTER FIVE: USING THE RE:AIM FRAMEWORK TO EVALUATE THE IMPACT OF GET SET GO: FUNDAMENTAL MOVEMENT SKILLS FOR KIWI KIDS

Background

RE:AIM is a theoretical framework offering a systematic approach to review the impact of public health interventions through five dimensions (Centre for Training and Research Translation, 2013). The model dimensions comprise: (a) Reach – The number of people affected by the intervention and whether they are representative of the general population, (b) Effectiveness – The impact of the intervention on intended outcomes, (c) Adoption – The number of settings that are involved and whether they are representative of settings overall, (d) Implementation – Whether the intervention was successfully implemented, and (e) Maintenance – Long term effects of the intervention and sustainability.

The RE:AIM approach has been used successfully with public health interventions (Glasgow, McKay et al. 2001), public health policy implementation (Jilcott et al., 2007), and more recently to evaluate a school based, lunchtime intervention to increase PA (Hyndman et al., 2014). The purpose of RE:AIM is to create a systematic model for examining research translation and dissemination (Austin et al., 2011). This process provides a much broader evaluation of an intervention's effectiveness in terms of its reach. A broader evaluation helps to assess potential bias that can be associated with quantitative evaluation only; allowing teachers, coaches and health professionals to confidently transfer findings from research interventions into field based practice.

The aim of this Chapter is to use the RE:AIM framework to evaluate current field based practice of FMS training with children aged five to eight years delivered through the Get Set Go programme in NZ primary schools. Get Set Go is an evidence based, multi-level, multi-component programme and has been quantitatively evaluated in Chapter Four. Quantitative analysis alone provided statistically significant results that suggested Get Set Go is an effective FMS intervention. Applying the RE:AIM framework to evaluate this programme will identify key strengths and weaknesses of

the Get Set Go programme across various levels of the socio-ecological model (individual level, social level, physical environment, policy environment).

Methods

Participants

All junior children (n=531) aged 5-8 years from four primary schools in the Auckland region participated in the Get Set Go programme. The schools were located in neighbourhoods with decile ranking of six and nine (two decile six schools and two decile nine schools). All schools consented to participate in the research along with all 26 junior teachers. The majority of the teachers were female with two male teachers.

There were no children excluded from the Get Set Go programme being delivered. Only children that provided parental and child consent and assent participated in the skill assessment (Chapter Four).

Procedure and data collection

Recruitment procedures for schools, teachers and children have been previously explained in Chapter Two. Demographic school data were discussed with the Principal and the lead sports teacher after the school had signed the principal consent form.

Data collection consisted of different methods to address each of the five dimensions of RE:AIM (Table 4.1). A detailed figure (3.1) in Chapter Three demonstrates the timing of data collection.

Observations of skill acquisition were conducted by a trained researcher on a modified version of the TGMD-2. Detailed reporting of the method procedures and of the findings have been discussed in-depth in Chapters Three and Four respectively.

At follow up, short informal interviews were carried out with a wide selection of teachers to provide answers to predetermined, standardised questions about their experience and views of Get Set Go, their confidence teaching PE and the three main highlights they would share with other teachers

about the programme. A copy of the questions can be viewed at Appendix I. For the purposes of the current investigation, aside from reporting findings from Chapter Four, measures taken at the post-intervention phase were not included.

Table 5.1: RE:AIM dimensions, level of impact, measurement, and methods of evaluation.

Dimension	Level	Measurement	Method of Evaluation
Reach (e.g. n of participants and are they representative)	Individual	n junior classes participating n children participating n teachers participating	School roll and feedback from principal. Funding model for programme
Efficacy (e.g. efficacy of the intervention in increasing FMS)	Individual	Children's FMS scores Teacher reported confidence teaching FMS Children's enjoyment and feedback	TGMD-2 used to objectively measure FMS of representative selection of children (n = 138) Teacher surveys post intervention and informal discussions at follow up which included predetermined standardised questions Session 8 is followed by a literacy session where children use creative writing to express their views on the programme
Adoption (e.g. how many classes are involved and are	School	n of participating classes compared to possible n. n of sessions delivered in	School roll and principal feedback at baseline

they representative)		addition to coach deliver	Teacher feedback post intervention, school policy, PE plans
Implementation (e.g. factors affecting implementation)	Individual School	Teacher's perceptions of the intervention Teachers attendance to PD Quality assurance of activity sessions delivered by coaches Delivery organisations perceptions of the intervention	Teacher surveys at baseline and interviews at follow up n provided by Sport Auckland Coach observation forms Feedback on implementation model for programme level (Athletics NZ) and local delivery level (Sport Auckland)
Maintenance (e.g. extent the school maintained Get Set Go)	Individual School	# of teachers continuing to implement Get Set Go School H&PE plan in place with focus on FMS development	Teacher and principal feedback at follow up Development of H&PE plan

Notes: FMS = fundamental movement skills, H&PE = health & physical education, n = number, NZ = New Zealand, PD = professional development, PE = physical education

Results

Of the 34 teachers that participated in the PD component of the Get Set Go programme, 16 (47%) completed and returned a teacher survey post intervention. This figure is lower than expected. A possible reason for the low survey completion may be due to eight of the 34 teachers that attended were not directly involved in the in class delivery part of the programme. These eight teachers were

support staff of the programme; teacher aides or principals that may or may not participate at some point. A total of 26 teachers, along with their classes participated in the Get Set Go delivery. All attended the PD component and 61% completed and returned a teacher survey post intervention. It is interesting as attendance of additional staff indicates a commitment from the school community to adopt the programme. This is not reflected in the surveys returned as none of the support staff completed one. This may have been a communication barrier between the researcher and the support staff or they may have attended because they had been directed to by the Principal or senior management.

The results throughout this next section will be presented according to the RE:AIM dimensions across the various levels of the socio-ecological model where appropriate. The various socio-ecological levels include the individual, the social, the physical environment and the policy environment.

Reach

The reach of the Get Set programme was reviewed at the individual level using information provided by the school principal during initial consultation and during the follow up interview. All junior (years 0-3) children on the school roll received the Get Set Go programme delivered during the curriculum time. This in school delivery model can be viewed at Appendix D and guarantees that all children are provided with appropriate skill instruction and opportunities to practice in addition to providing a learning experience for the whole class (including the teacher). Principals indicated in their feedback they were appreciative of receiving a specific junior programme that can be delivered to all of their classes. Schools are often faced with multiple sporting options but limited activities that are suitably modified to the younger age groups. Principals reported that often sports providers suggest their programmes are suitable for the younger age groups when in reality they do not meet the needs of their students or their teachers. Principals are very conscious of teacher time and involvement required when implementing new programmes, especially with the junior classes.

The Get Set Go programme is delivered by specialist coaches that have been accredited by Athletics NZ following a process that has been developed in consultation with Physical Education New Zealand (PENZ). (PENZ is the national advisory group on the NZ H&PE curriculum). This specialist delivery, along with PD and resources for the teachers does come with a cost to implement. A funding model for the programme can be viewed at Appendix G. Within the Auckland central region this cost is eliminated from schools through various organisation initiatives, partnerships and funding. By removing the cost to schools it has increased the reach of the programme, not just within the schools themselves but across the region. Principal feedback around programme costs suggested this was a considerable factor when planning and budgeting for the school. Get Set Go being fully funded and provided to the schools was viewed as extremely positive by Principals. If programme costs are too high and it is a programme that is deemed significant, schools will nominate classes and or teachers to receive the programme and share learnings with rest of the school. It was pointed out that schools have different priorities and in many cases PD for teachers around sport and PE or sport programmes for children were rarely funded outside of current sport funding received by the schools.

The full funding of the programme implementation was covered jointly by Sport Auckland, a regional sports trust as part of their organisation key performance indicators (KPI's) and Athletics NZ through KiwiSport funding. The funding model covered the cost of programme implementation (Chapter Four) for two years.

Efficacy

Efficacy of the programme was measured at the individual level and used results from direct observation of children's FMS, teacher feedback through survey and informal discussion and student feedback via creative writing classroom work.

Direct observation

Results for objective FMS assessment have been discussed in-depth in Chapter Four. In brief, improvements were seen in FMS of all children over the three time points. As to be expected, the

time points and age were a significant factor in FMS development. Other key determinants of FMS development were the school decile ranking, ethnicity, and sex of the child.

Teacher feedback

Of the 26 classroom teachers that participated in Get Set Go PD and in class delivery, 16 completed and returned post intervention surveys. Of those 16 teachers, six agreed to informal one-on-one interviews at follow up. A copy of the questions asked can be viewed at Appendix I.

Teachers reported increases in confidence delivering PE due to improved class management skills for outside the classroom, increased knowledge on planning a session, new game and activity ideas, increased knowledge on the importance of PA and PE for child health, and new ideas to integrate into the H&PE curriculum. Main highlights of the programme reported by the teachers were that it was the best PD they have ever had, the coaches were knowledgeable and professional and the "kids loved them", and "great resources".

Through thematic analyses of post intervention surveys and one on one interviews the following themes were identified: Increased (teacher) confidence in teaching PE and increased (teacher) understanding of importance of PE, PA and FMS.

Increased teacher confidence:

Feedback from teachers identified they were continually struggling for activity ideas that were challenging and enriching for their students. There were many concerns around "being that teacher, that can't teach PE" or "wasting time sending children for a run around". Many of these concerns stem back to a lack of confidence and understanding on how to interpret the H&PE curriculum and how to implement it.

During the PD sessions teachers were asked to identify their teaching strategies in the classroom in regards to literacy and numeracy. These strategies are then discussed in the context of PE and related to current topics focused on in class. Many teachers revert to a direct instruction teaching strategy when teaching PE outdoors. This may be in part due to a lack of knowledge around structure and content of sessions or low confidence in class management strategies. For teachers

that are less confident it is important they feel in control of the class outdoors and feel the structure of, direct instruction teaching offers a sense of control. More work is needed to fully understand which teaching strategies are more effective at increasing FMS, PA, student enjoyment and teacher confidence (Dudley et al, 2011).

The approach discussed through the Get Set Go PD is based around the pedagogical model of TGFU and helps to increase confidence as teachers realise "... not only have I realised I can teach PE but I'm enjoying taking my class out". Many teachers have teaching strategies that they are confident with in the classroom so it is interesting to note the lack of confidence in regards to teaching PE. During the one-on-one interviews when asked to expand on this topic teachers reported lack of training and PD to fully understand the H&PE curriculum, not enough time to plan or implement due to national standards and their own lack of understanding and enjoyment of PA and sport.

This is not the first time that lack of knowledge and understanding of the H&PE curriculum has been reported in NZ (Gatman 2005). In fact worldwide there is a decrease of time spent training pre service teachers on the benefits and effects of PA through the PE curriculum (Morgan and Bourke 2005; Sallis and McKenzie 1991; Callea et al, 2008) leading to decreased confidence. This research has demonstrated through teacher feedback that Get Set Go is effective at increasing teacher confidence at delivering PE to increase FMS.

Increased understanding:

The NZ curriculum has eight learning areas with H&PE being one of them. The curriculum provides a base of learning for all students that will enrich their lives and lead onto further learning and specialisation. All learning at schools should make use of the connections that naturally exist between the learning areas and link back to key competencies and values (Ministry of Education, 2007). This research tells us this is not the case; for some teachers PE was an inconvenience that distracted from "real learning" of literacy and numeracy, was something that they were forced to do and in one case refused to do the expected amount for that school. For other teachers it was an area of the curriculum therefore they did it, without really understanding the impact of it or how to link to other learning areas. In all of these reported cases there was no link between PE and other

learning areas. PE was viewed as a very distinctly isolated area of learning. Unfortunately these reported cases were not in the minority, in fact of the 16 classroom teachers that completed a survey 12 reported themselves as not fully understanding the importance of PE, PA or FMS.

"PE has always been this thing that we have to do and to be honest if I could get away without doing it then I would".

This lack of understanding can be linked back to the lack of training previously discussed. Previous research has demonstrated that teacher training not only increases teacher understanding and confidence (Morgan and Bourke 2005; Sallis and McKenzie 1991; Callea et al, 2008) but also children's self-perceptions and motor skills (Breslin et al, 2012). This research fully supports these findings as teacher feedback post intervention provided conclusive evidence that their confidence had increased and they all understood the value of PE to increase FMS.

Children's feedback:

Two common trends were seen throughout all of the examples which included the games played and the coach that worked with them. Most children made reference to the specific skills that they learnt and many made mention of their favourite game(s).

The content of the feedback about games was all very positive as children found the games "fun... exciting... the best games ever.....so cool". Some of the more interesting and revealing feedback suggested that children "enjoyed sharing (their) our games with you" "loved learning new things" "thank you for letting us make up our own games" "we played a game of.....and I was good at it". Comments like these are evident that children themselves prefer to be involved with their learning and benefit from the TGFU approach that Get Set Go is based on.

All children made reference to the particular coach that they had working with their class and it is clear that Get Set Go coaches are impacting on children's lives:

"thank you for listening to us" "I like the way you are so calm to us. Thank you for teaching us so many things" "we miss you.... We love you..... you are the best teacher ever" "I have never been so happy.....thank you for teaching us" "you are amazing, thank you for teaching us how to....."

"thank you for helping us and being so nice.....in my heart I will keep you" " I admire your experience with sports. You have so much 'can do' and understand everything we explain. I extremely like you" "Thank you for your kindness".

Such positive experiences are critical for developing a lifelong love of learning and to develop positive PA behaviours that track through childhood and into adulthood (Malina 2001). Get Set Go coaches are fully accredited by Athletics NZ before they can deliver the programme into schools. On top of the training provided by the programme authority, Sport Auckland provides mentoring, training and quality assurance within the school setting. All coaches receive regular coach observations to ensure a high standard of service delivery. This is reflected in the children's feedback. Feedback from Sport Auckland recognises that trained and skilled coaches are instrumental in the successful delivery of the programme.

The efficacy of the Get Set Go programme has been assessed through direct observation of FMS, teacher feedback through surveys and one-on-one interviews and child feedback through creative writing experiences. This assessment demonstrates that Get Set Go is an effective school based intervention to increase FMS in children aged 5-8 years and increase teachers confidence and understanding of the importance of PE (to increase FMS). In addition it is undeniably enjoyed and valued by the children that participated. Games were inclusive to all and children played a role in creating and adapting rules. It was through playing these games that children's skills were significantly increased so that by follow up there were no significant differences between sub groups (ethnicity, sex, school decile). These findings suggest that Get Set Go is effective and enjoyable.

Adoption

All 26 junior classes from across the four participating schools and all 531 children aged 5-8 years in attendance at the four schools participated in the Get Set Go programme being delivered. Eight additional teachers, including teacher aides were provided with PD to allow continual implementation and support within the school setting. This resulted in 34 teachers participating in

the Get Set PD. This extra support allowed for teacher release in the cases of additional teacher PD, cover for sickness, and assistance in planning and delivery.

The number of additional sessions delivered varied widely across all classes at each school. Interestingly there were also differences observed between schools. Schools with clearly documented PE plans, or a designated 'sports coordinator', on average delivered more additional sessions than schools without. None of the schools had PE plans that included Get Set Go or FMS as specific components of their PE plans. Additional Get Set Go sessions were more likely to be delivered during the eight week intervention with an average of 103 additional sessions being delivered. This figure dropped to an average of 87 at follow up for the following eight week period.

Although there was a decrease in Get Set Go sessions being delivered there was no account of other PE sessions that were being delivered. It has already been discussed that Get Set Go increased teachers' confidence of implementing PE. In addition FMS is only a small component of the H&PE curriculum. It cannot be expected that teachers deliver only Get Set Go to students. To deliver a meaningful PE curriculum within a school a wide range of movement experiences must be offered to children within the formative, five to eight years of age. Future research should take into account all PE sessions that are being delivered in the school setting. The difficulty with assessing the adoption of Get Set Go is that it is very much based around PD of the teacher. Theoretically if Get Set Go is effective at increasing teacher understanding and confidence, which this research has suggested it is, they will be confident to deliver age appropriate, meaningful PE sessions that help to develop FMS. Teachers may have been delivering sessions that they have planned either by themselves, within their junior syndicate or with their classes. These classes would have been independent from activities delivered during Get Set Go. These sessions may not have been reported during post intervention surveys or follow up.

Assessing the adoption of Get Set Go could be improved through the development of a PE plan with a specific unit of Get Set Go or FMS. By introducing a policy document into the school setting there will be increased awareness of the language used around FMS development and will make it easier to assess the adoption of the intervention. That being said Get Set Go was adopted on a weekly basis by 14 of the 16 teachers that completed a post intervention survey. PD and resources

provided to the teachers were reported as important factors in adopting the programme. It is recommended that schools are required to commit to developing a specific Get Set Go or FMS unit plan to be delivered through PE to receive the programme.

Implementation

There were a number of barriers and enablers to implementing Get Set Go that were reported by the teachers and principals. These issues need to be considered when implementing Get Set Go to further schools in the future. Specific barriers and enablers are discussed at the individual level, school setting level, and organisation level for programme model and local delivery model.

Individual level

Some teachers reported negative initial feelings towards the programme as there was a perception that it would increase workload. The post intervention survey revealed that all 16 teachers who completed the survey reported there was value to the programme and that they were excited to start implementing Get Set Go. Nearly all (n = 15) of the teachers reported PD as excellent while one of the teachers reported the PD as good.

The 8-week activity sessions involve an element of teacher delivery and this was not managed by all of the teachers. Teachers that did not attempt any planning or delivery of activity sessions reported "not enough time for PE planning", "too many other commitments" and "the introduction of national standards has seen a huge shift in our focus and PE is not a focus for us". In contrast there was more positive feedback about the ease of implementation, for example: "the games ideas were fantastic and we (the class) play them all the time" , "I am much more confident at doing PE with my class now", "We have lots of snacktivities throughout the day and I have noticed a huge difference in their behaviour..... If they (children) get restless we pop outside for a quick game and it helps to settle them down", and "we have found it easy to link PE in with our other curriculum activities and the children have loved creating their own games, making props and creatively writing about their experiences".

School setting level

There were 26 classes participating in the programme, however PD was provided to 34 teachers to ensure sustainability of the programme in cases of sickness or absence. Principals reported sustainability and impact of the programme as important factors when sending teachers and teacher aides on professional development. There was also a belief that it would ease the burden of responsibility if all teachers received the same training and help to develop a positive culture for implementation. Principals perceived teacher involvement and engagement as a factor in the teacher implementation element of Get Set Go (and any programme) and reported it was the culture rather than policy that influenced most. Considering all four schools had signed up to Get Set Go prior to research recruitment it is possible that these four schools had a positive PA and PE culture. A notable difference in the Principals perception of implementation was reported; a dedicated lead teacher for sports and PE planning gave principals the perception implementation was easy. The one principal with no dedicated sport teacher perceived the implementation to be more difficult. The same school did not send any additional support teachers or teacher aides to the professional development. Further research to define what constitutes a positive PA and PE culture within NZ primary schools would be beneficial not only for Get Set Go implementation but for all school based PA and FMS interventions.

Organisation level

Feedback received from Athletics NZ was positive around the implementation model reporting that "out of everywhere in the country, the delivery model used in the Auckland region is a best match to the Get Set Go implementation model supported by Athletics NZ". Get Set Go implementation, programme evaluation, and development is dependent on one key member of staff within Athletics NZ. This is a significant potential limitation to the programme unless an appropriate and achievable succession plan is implemented to ensure continuity of Get Set Go.

Local delivery is coordinated and in the case of PD delivered by Sport Auckland. The following is feedback received from Sport Auckland about local delivery:

> "The implementation model follows a learning and assessment cycle to ensure continual evaluation of programme processes and outcomes. We recognise that multi-level, multi-component programmes involving children's PA and development require constant monitoring and evaluation for programme efficacy. The aim is to deliver a high quality programme across various levels of influence. Implementation of Get Set Go is heavily dependent on key personnel within the organisation".

Like many other sporting and education programmes and activities, Get Set Go is driven by key personnel in organisations. This research did not officially investigate legacy or succession plans but it is known to the researcher that these have been raised by both organisations (Athletics NZ and Sport Auckland) in regards to Get Set Go. There are currently staff training and development processes in place to ensure intellectual property (IP) is not restricted to one person. There are also training manuals, resources and online processes that can be utilised if new personnel need training.

Quality assurance of activity sessions being delivered is evaluated by Sport Auckland as the organisation responsible for programme coordination throughout the Auckland region. The Get Set Go Regional Coordinator (Sport Auckland employee) conducts regular coach observations during the programme following a monitoring and evaluation framework (Appendix J). Get Set Go coaches have to be fully accredited (Appendix K) by Athletics NZ before they can deliver the programme into the school environment. Get Set Go has been delivered to almost 60 schools in the Auckland Region in total and there are over 20 coaches that have become accredited by Athletics NZ to deliver into these schools.

Using the RE:AIM criteria, the implementation of Get Set Go could be considered successful. Not all of the teachers achieved the desired amount of delivery independent of the Get Set Go coach but it was the minority that did not undertake this additional work. Nothing was asked of the teachers that was outside of normal PE planning and implementing expectations. Teachers reported how easy, fun and refreshing it was to implement Get Set Go and these ideas were reinforced when teachers observed the positive impacts on the students in their class. The

implementation model used by Sport Auckland to deliver Get Set Go into primary schools in NZ seems to be an effective model that is practical and achievable.

Maintenance

Maintenance was the area that scored the weakest out of all domains due to a number of barriers. Barriers and enablers are discussed at the individual and school setting level.

Individual level of maintenance

Overall, 12 of the 16 teachers that completed a survey reported still using the Get Set Go games, activities and knowledge learnt at least once a week to implement PE with their class 12 weeks after programme completion. At the same time, nine of the 16 teachers reported increased levels of PE and PA in their students. Teachers that were not continuing to implement Get Set Go activities reported time constraints and delivery of different activities as the main contributing factors.

All teachers involved in the one-on-one interviews reported they valued the programme and thought it was very important for the children in their class to participate in Get Set Go. Teachers that were also parents reported they "....wish I knew this information and these activities when I had my own children" "every parent and every teacher should do this course" "it explains so much of my child's behaviour when they were growing up".

School setting level of maintenance

Although two of the four participating schools had specific PE plans in place, none had a unit with a focus on FMS development. It has previously been discussed in Chapter One and Two that the policy environment is a critical component of the socio-ecological model. It would be interesting to further explore the impact of policy environment on FMS development as previous research indicates that it is a key factor (Hardy, Barnett et al. 2013). In contrast during this research principals reported that culture and not policy was the contributing factor. It could be argued that the NZ curriculum in it's true form is policy that relates to each individual schools culture and values.

Work may be needed to assist schools to write school PE and sport policies that develop cultures and respect their values.

Summary

The aim of this study was to demonstrate the use of the RE:AIM framework to evaluate current field based practice of FMS training with children aged five to eight years delivered through the Get Set Go programme in NZ primary schools. To the knowledge of the researcher this study is a world first to apply RE:AIM to a school based FMS intervention. Recent research (Hyndman et al, 2014) has demonstrated the ability of the framework to review a lunch time based PA programme at a school in the UK. In both instances RE:AIM has proven to be an effective framework that is easy to implement in the school environment. Findings from this study will be explored in the discussion chapter (Chapter Six) in the context of the entire thesis.

CHAPTER SIX: DISCUSSION

The importance of FMS development and intervention in children is a growing area of research within the domains of public health, child development, education, and social and health sciences. There are indications that FMS mastery among children plays an important role in child health and development, physical activity behaviours and outcomes, and academic related benefits (Strong, Malina et al. 2005; Dudley, Okely et al. 2011; Lopes, Santos et al. 2013; Lai, Costigan et al. 2014).

School settings have been identified as key influencers of FMS development due to their ability to influence the various levels of activities that are effective at increasing FMS mastery (Martin and Hands 2003; Ericsson 2011). Policy, trained staff, access to all children and their parents, facilities, resources, and equipment allow for the implementation of effective age appropriate multi-level, multi-component FMS interventions.

At the time of commencement of this thesis, a number of knowledge gaps in this field remained. In particular there were no NZ based quasi-experimental studies of school based FMS interventions, and no defined characteristics of effective school based FMS interventions delivered to young school-aged children. The foundations of this thesis were drawn from these knowledge gaps and based on evidence that: the optimal time for FMS development is between the ages of 4-7 years; NZ children are entering school with inadequate proficiency of FMS mastery; children are more active at school; and teachers are struggling to plan and implement appropriate PE lessons due to lack of training and confidence.

Research Question

The main research question for this body of work was identified as:

Is the Get Set Go programme delivered in Auckland schools an effective FMS intervention for children aged 5-8 years?

A number of pertinent sub-questions were also identified and addressed in the thesis chapters as below.

Chapter Two: Can peer reviewed research articles that are of high quality identify characteristics of effective school-based FMS interventions for 5-8 year olds

Chapter Four: Does the impact of the Get Set Go FMS programme on children's FMS skills differ by children's ethnic group?

Chapter Five: Can the RE:AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) assessment framework be applied to evaluate a school based FMS intervention, and if so, how does the Get Set Go programme perform when evaluated using the RE:AIM framework.

The overall aims of this body of work were to:

1. Reviewing method quality of existing school based FMS interventions.
2. Identifying determining characteristics of effective school-based FMS interventions.
3. Objectively measuring the impact of a school based intervention delivered across four schools, on the FMS of 138 children aged 5 – 8 years.
4. Evaluating the effects of a school based FMS intervention at the different levels of the socio-ecological model using the RE:AIM model framework.
5. Identifying recommendations for future implementation of the FMS intervention.

These aims were addressed via a series of chapters that included a literature review (Chapter Two), an assessment of the effectiveness of a school-based FMS intervention (Chapter Four) and an evaluation of a school based FMS intervention using an assessment framework (Chapter Five).

Chapter Two comprised a critical review the quality of existing school based FMS interventions for 5-8 year olds and identification of effective study characteristics. A systematic approach (Liberati,

Altman et al. 2009) of identifying and reviewing the literature was undertaken, including robust critique of the method quality of studies using a criteria checklist tool (Tooth, Ware et al. 2005; Singh, Mulder et al. 2008). While there have been school based FMS interventions focusing on primary school children (5-12 year olds), no previous research has critically reviewed interventions aimed at 5-8 year olds (Dudley, Okely et al. 2011; Lai, Costigan et al. 2013). As previously discussed (Chapters One and Two) this stage of childhood is the optimal time frame to develop FMS in accordance with developmental models (Gallahue 1989; Clark and Metcalfe 2002; Clark 2005).

Overall, findings suggested that school based FMS interventions delivered throughout the PE curriculum could have a significant impact on FMS mastery of children aged 5-8 years. This finding is supported by previous research investigating FMS interventions delivered through the PE curriculum (Ericsson 2008; Salmon, Ball et al. 2008; Dudley, Okely et al. 2011; Ericsson 2011; Breslin, Murphy et al. 2012; Logan, Robinson et al. 2012; Capio, Poolton et al. 2013; Mitchell, McLennan et al. 2013). There are many school-based FMS interventions delivered around the world and throughout NZ ranging from peer reviewed to self-defined best practice. Identification of characteristics of effective FMS interventions are important for programme planners and funders, policy makers, researchers, teachers and coaches, to inform decision-making about FMS intervention design and implementation.

Identification of the key determining characteristics of effective interventions were defined in Chapter Two and include: 1) Multicomponent and multi-level, 2) Environmental factors such as education, facilities, opportunities to practice and learn and social support allow children to reach their FMS capacity, 3) Teacher professional development, 4) Delivered in and through the curriculum time of physical education, 5) Element of session delivery, 6) An intervention that runs for a minimum of 6-12 months, 7) Focus of behaviour change throughout. These key determinants demonstrated through previous, methodologically sound interventions (van Beurden, Barnett et al. 2003; Ericsson 2008; Salmon, Ball et al. 2008; Piek, McLaren et al. 2013) were identified in the Get Set Go programme which was utilised as the intervention for this current thesis.

The remainder of this chapter will provide discussion around key study findings from Chapters Four and Five that will assist in answering the research question. Study limitations and implications will be documented followed by recommendations for further research and intervention implementation. Finally this thesis will draw conclusions and answer the research question.

Chapters One and Two clearly defined that the socio-ecological model was an important factor during the planning and implementation of this study. This will now be considered during the discussion component of the thesis as each socio-ecological level is discussed in relation to this research.

Policy Environment

The RE:AIM evaluation of Get Set Go programme identified the policy environment as the socio-ecological level that requires further investigation in regards to FMS development. Previous research (Hardy, Barnett et al. 2013) has identified that policy is important for FMS development, however this research reported (Chapter Five) that Principals believe it is an active school culture, rather than policy, that is important. Further research with NZ principals would be needed to establish if this is a true representation throughout the country. There is evidence (Hargreaves 1999; Darling-Hammond and McLaughlin 2011) to argue that school culture is created through effective implementation of strategic policy and documentation. None of the participating primary schools had PE or sport plans in place with specific FMS units and only one had a school strategic plan that identified sport and physical activity as important outcomes for their school. If school culture is created through policy, schools need to create strategic and curriculum policies that support positive sporting and physical activity activities that recognise FMS as an important component. There is research that identifies school culture as an important factor in children and teachers' participation in physical activities. (Strong, Malina et al. 2005)Full funding of this programme allowed school Principals to provide PD for all teachers at the school if they thought it

was relevant to the teachers learning, for sustainability of the programme or to create a positive PA culture.

A minimum intervention delivery of six to twelve months has been identified as optimal to increase FMS but it is not clear what this may look like in the context of the school PE curriculum. In NZ the acquisition of motor skills is one of the learning strands of the H&PE curriculum. Little is known as to what effect FMS interventions have, detrimental or otherwise, to the other key strands of the H&PE curriculum. The strands include: Strand A – Personal Health and Physical Development, Strand B - Movement Concepts and Motor Skills, Strand C - Relationships With Other People, Strand D - Healthy Communities and Environments. Within each strand there are three or four achievement outcomes and across the whole curriculum there are eight different levels that the strands cover. An effective and appropriate unit of work within H&PE is considered to cross at least two strands of the curriculum (PENZ, 2014). Teachers report low confidence in interpreting and implementing all strands of the NZ H&PE (Gatman 2005); raising the question around quality and quantity of pre-service and in-service teacher training and support provided. When surveyed (Chapter Five) many teachers reported negative personal PE experiences when they were at school which contributed to their lack of desire to teach PE. This is reflective of previous research (Callea, Spittle et al. 2008) that also identify a necessity for increased in-service and post-service training to increase knowledge around PE and FMS delivery.

H&PE is taught in, through and about movement as it recognises the different levels of a child's physical, social and emotional development. As discussed in Chapter One, FMS are prerequisite motor functions that are required to participate in and enjoy sport, recreation and individual physical pursuits. FMS are also interrelated to a child's cognitive, emotional and social development which the Get Set Go programme recognises and reinforces in, through and about delivery. Get Set Go is aligned with the H&PE curriculum and is recognised by teachers when participating in the teacher professional development: "I had never thought about PE in that way before..... I just focus on the skill or the game we are trying to play.....I now know how to assess the needs of my class,

it's awesome" "I remember learning this stuff at uni but just never have time to plan anything exciting".

Get Set Go is a programme that coexists harmoniously alongside the NZ H&PE and it is evident that Athletics NZ consulted with PENZ during the creation of the resources and teacher PD component.

Physical Environment

This research did not comprehensively investigate the effects individual schools may have on FMS interventions due to the scope of the design; it was never identified as a variable to be investigated due to the population size required for statistical significance of that magnitude. It was however, interesting to observe the impact an individual school appeared to have on FMS development. Through the recruitment process the four schools (out of seven) that agreed to participate resulted in one of two decile rankings. This was not intentional but it did allow for additional analysis of any relationships between school decile and FMS mastery. Information provided in Chapter Five from teachers at decile nine schools (higher socio-economic status) indicated that these schools are located in the inner city. Feedback from these schools suggested that many of their students did not have access to gardens, or if they did the size was inadequate to encourage FMS and PA activities. This may have been a factor in the significant differences observed at baseline. Children at the decile nine schools had significantly lower FMS scores than children from the decile six schools. Interestingly, at follow up there was no significant difference between any of the schools, highlighting that school based FMS interventions can make a difference across a range of schools.

As discussed there were significant differences observed between the four schools at baseline and post intervention. Unfortunately this study did not have the scope to investigate this in depth but previous research has suggested there may be a number of reasons for this, as discussed below.

NZ research (Mitchell et al, 2013) has indicated that school decile ranking is of significance to children's FMS levels. The study suggests that children from lower decile schools have lower FMS abilities than children higher decile schools. This is in contrast to this research. Children from the higher decile nine schools were significantly performed significantly worse at FMS than children

attending the decile six schools. One theory for the difference observed between these two NZ studies is the suburban location of the schools. There is evidence (Brustad 1996) to suggest that children who live in highly populated urban communities spend less time in MVPA when compared to children who live in rural locations. It has already been identified (Chapter One) that there is a link between time spent in MVPA and FMS of children (Fisher, Reilly et al. 2005; Cliff, Okely et al. 2009). In support of this the high decile schools in this research were located in the inner city compared to the decile six schools that were located in semi urban locations. The schools participating in the other NZ study (Mitchell et al, 2013) were located in the Waikato region of NZ and were often rurally located.

A key finding of this research was how school decile was an important factor over time and also for all skills apart from running. Previous research indicates that children from higher decile schools perform better at FMS assessments than children from lower decile schools (Mitchell et al.2013). Findings from this study are in contrast, as children from the two participating schools with the lower decile performed better at FMS assessments. The two higher decile schools were located in a central city location. Field and playground space at the schools was limited and principals reported that for many children school was their main source of physical activity. An increase in high density urban living, busy streets and an increase in safety concerns have led to a dramatic decrease in space available at home to play and children actively transporting to school. In comparison the two decile six schools were located around the city fringe in semi-urban communities. Both of these schools had large green playing spaces and it was reported that many children actively transported to school.

In addition to the differences between high density living and semi-urban communities, other key findings included one of the decile nine schools had significantly greater percentage of Māori/Pacific children. Although this ethnicity group had significantly lower skipping scores, scores for over-arm throw were significantly higher, there was no difference between the run scores, and the catch scores were marginally higher than in other ethnic groups. Considering the large percentage of Māori/Pacific participants, there must have been other factors at play for all skills to be low at the decile nine schools at baseline. Previous research (Breslin, Murphy et al. 2012) and findings from

Chapter Two indicates that the individual schools themselves are an important factor in FMS interventions due to environment factors and policy influences. There were only four schools in this research, with very distinct Principals, values and play spaces. Differences observed between school deciles could have been coincidental due to the individual and environmental factors involved.

Individual and Social Level

It is the diversity of NZ culture that makes us unique to many other countries in the world. Auckland is home to over 200 ethnicities, making it one of the most culturally diverse cities internationally. With only 17 different ethnic groups identified through participant consent forms this study provided comparatively low ethnic representation. There are no experimental interventions that investigate ethnic differences in FMS but there are cross sectional studies (Mitchell, McLennan et al. 2013; Sport NZ 2012). Recoding of ethnic groups was required to complete the statistical analysis of FMS assessments.

At baseline Māori /Pacific children scored significantly higher at overarm throw than any other ethnic group and had lower skipping scores than the NZ European group. This finding is in line with previous cross sectional studies carried out in NZ (Mitchell et al, 2012; Sport NZ 2012) and is a reflection of the cultural differences between the ethnic groups. Māori and Pacific populations are very family/whanau oriented and generally have larger families than NZ European and Other ethnicities (Statistics NZ 2006). Larger families may create increased FMS development opportunities as Pacific children have been reported as more likely to be active than NZ European children (Ministry of Health 2003). These increased opportunities could be factors in increased manipulative skills such as overarm throw. The greater improvements demonstrated throughout the Māori/Pacific group at post-intervention and follow up reinforce the need for an element of skill instruction to master a range of FMS. The fact that there was no significant difference between groups at follow up indicates that all children are able to master FMS.

Interestingly ethnic group was not significantly related to running skills. This may be due to the difficulty in accurately assessing running. As previously discussed in Chapter One, gait

development occurs in two stages with the second stage taking five years from the onset of walking. This second stage of gait development is when children develop the flight phase of running and occurs generally around the age of six years. It is natural to want children to succeed at what is viewed as a simple locomotor action but is actually a complex biomechanical and physiological task.

Children from the Other ethnicity group had significantly lower improvements in FMS skills than the improvements found for the NZ European group. Unfortunately the participant numbers in this research were not large enough to facilitate analysing ethnic groups more dynamically. Cross sectional studies report that ethnic groups that are included in the Other ethnic groups category in this research (including Asian, Indian and Middle eastern) score significantly lower in FMS skills compared to other ethnic groups (Mitchell, McLennan et al. 2013; Sport NZ 2012).

Differences were observed between the sexes with boys demonstrating mastery across a greater range of skills than girls and performing them better (van Beurden, Barnett et al. 2003; Okely, Booth et al. 2004; Hume, Okely et al. 2008). It is universally accepted by developmental theorists (Gallahue 1989; Clark and Metcalfe 2002) that FMS differences observed are likely to be caused by environmental factors and are not biological. Theoretically if boys and girls are given the same opportunities of instruction, practice, feedback and encouragement (Nelson, Thomas et al. 1986; Thomas and French 1987) then assessment of FMS would be similar. An important factor in determining adolescent PA and fitness is a child's perception of their object control skill development (Barnett, Morgan et al. 2008). It has been frequently reported that boys perceive themselves as performing FMS more proficiently than girls (Barnett, Morgan et al. 2008; Kalaja, Jaakkola et al. 2010). Sex differences have also been observed in preschool children, suggesting specific FMS skills may influence the physical activity behaviours of preschool children (Cliff, Okely et al. 2009).

In contrast, Saakslahti et al. (1999) reported notable sex differences in intensity of PA but not in FMS which may be due to the child's immature skill acquisition at the preschool age. The study suggested that boys benefit from parental involvement while the girls benefit from more independent play; a finding that may be a reflection of parents' role behaviour. Parents may favour

more vigorous activities demanding gross motor skills from boys and more stationary activities for girls. The prevalence of skill mastery is directly associated with socioeconomic status more consistently with girls than boys (Sääkslahti, Numminen et al. 1999; Mehtala, Saakslahti et al. 2014). As developing movement patterns are refined, the quality of performance is improved, leading to more complex movement patterns. These complex movement patterns are required for specific games and sports, however a large sample of six, seven and eight year olds (n = 5518) from proportionately stratified randomly selected schools in New South Wales displayed insufficient motor control to accomplish fundamental movement skills (Booth, Okely et al. 1999).

Age is often taken as a natural predictor for FMS development as children progress through maturation (Clark 2005). However maturation does not necessarily lead to FMS mastery, in fact it is well documented that children do not naturally learn FMS; they need to be taught, have an opportunity to practice and receive feedback, place learning into context through their own thought processes and continue to practice (Gallahue 1989; Gallahue 1993; Clark 2007). This complex developmental process can take a varying degree of time dependent on the individual and is intertwined with physiological, genealogical, socio-emotional, environmental and experiential factors (Shumway-Cook and Woollacot 2003).

While children develop skills as they mature, their ability, confidence and understanding of those skills are dependent on childhood experiences. This study found that, predictably, age and time were important factors to FMS development for overall total score and all four individual skills. Interestingly younger children (mean age = 5.4 years-6.3 years) gained greater benefits across all skills and for their total FMS scores than children aged over 7.2 years. This fits with previous developmental (Gallahue 1989; Gallahue 1993) and motor competency (Stodden, Goodway et al. 2008) theories that FMS are most efficaciously developed between 4-7 years due to physiological and cognitive abilities.

Small variances in FMS abilities of children entering school are magnified as children embark on their learning journey. Such an enriched learning environment provides a platform for FMS

development due to the various levels of PA influence in the school setting. These levels and influences have been previously discussed (Chapter One).

Locomotor skills are often linked to frontal lobe brain activity which is linked with short term memory, problem solving, rationalisation, and planning and motivation. There is a belief that children naturally develop locomotor skills more so than manipulative skills as all children walk, run and skip. This study reinforces that no FMS are natural and require an element of teaching and opportunities to practice and develop. A key example of this were the Māori and Pacific children who scored highly at catching and overarm throw but scored the lowest for skipping. Skipping is a key skill that has been linked to academic readiness and achievement. The skill of skipping requires a large amount of information to pass across the corpus collosum between the two hemispheres of the brain. If children have not laid the foundation of this skill through lots of crawling, walking and marching activities which are known as cross patterning activities, they will struggle to perform a smooth, rhythmical skip that coordinates both sides of the body.

This research has demonstrated that Get Set Go is an effective intervention at increasing FMS, and in particular skipping. Get Set Go is a programme that has the potential and capacity to impact many children and teachers on an individual level. When delivered into Auckland schools all junior teachers and junior children participated in the programme. Research indicates that school based FMS interventions can significantly impact FMS mastery in children aged 5-8 years (Dudley, Okely et al. 2011; Lai, Costigan et al. 2014). According to the key determinants defined in Chapter Two, theoretically Get Set Go would be an effective FMS intervention.

Internationally, although methodologies vary greatly, success at increasing FMS through school based interventions has been observed (Salmon, Ball et al. 2008; Ericsson 2011; Piek, McLaren et al. 2013). Previous NZ research is limited and lacks robustness. Mitchell et al. (2013) reported results of a current FMS intervention but time collection points were only five weeks apart. This thesis has already identified (Chapter Two) that length of intervention is an important factor. To effectively demonstrate an increase in FMS, participants were required to demonstrate abilities over an extended period of time, considered an indicator of FMS being 'learned' or 'mastered'. Like

previous research (Salmon, Ball et al. 2008; Piek, McLaren et al. 2013) investigating school based interventions, a follow up assessment was implemented to demonstrate intervention effectiveness of increasing FMS mastery. This research showed significant improvements in FMS post intervention and at follow up for individual skills and total score, suggesting that Get Set Go was effective at increasing FMS mastery among children.

Statistical analyses of the FMS assessments provided valuable data on FMS of NZ children, adding to the limited data currently available. This is the first time FMS data has been reported for Auckland children specifically, and the first school based quasi-experimental FMS study in NZ. Findings from this study supported previous research (Mitchell, McLennan et al. 2013; Sport NZ 2012) that identifies significant variances between specific skills, ethnic groups, the sexes and schools. Like previous NZ cross sectional studies (Mitchell, McLennan et al. 2013; Sport NZ 2012), Māori and Pacific children had better motor control (overarm throw) skills and lower skipping ability than other ethnic groups. Boys also demonstrated greater overarm throw and total score at an earlier age than girls and scored significantly higher for the overarm throw only, when matched with girls their age. This key finding from the research suggests that Get Set Go is an effective intervention at reducing variances observed among children. At follow up the only significant difference observed between the sexes was overarm throw. This was the only significant difference observed in any subgroup at follow up indicating that Get Set Go improves FMS over and above normal development and maturity.

The critical evaluation of the Get Set Go intervention through the use of a public health intervention, theoretical evaluation framework (RE:AIM) identified recommendations for future implementation. The framework provides a combination of quantitative and qualitative feedback to evaluate the impact of the programme and the perceived value to the participants. RE:AIM is a valid and effective process of evaluating a school based FMS intervention. Learnings from this can be easily transferred to form implementation recommendations for schools and organisations looking to implement similar programmes. This process also identified objective limitations and implications of the Get Set Go programme that can be reviewed as part of ongoing programme monitoring and evaluation.

This research is a world first to apply RE:AIM to a school based FMS intervention. Recent research (Hyndman et al, 2014) has demonstrated the ability of the framework to review a lunch time based physical activity programme at a school in the UK. In both instances RE:AIM has proven to be an effective framework that is easy to implement in the school environment. The main benefit from applying the RE:AIM framework was the ability to add context to the quantitative analysis of the directly observed FMS assessments. With no control group it could have been argued that any observed improvements were a result of normal maturation of children. The FMS improvements were significant across all skills and between all subgroups. The RE:AIM framework allowed these learnings to be evaluated at face value within a school setting. In real terms it means that this research has identified why Get Set Go was successful and where improvements can be made to ensure sustainability and continual development to meet the needs of the schools. The application of the framework in Auckland schools demonstrated that: not only is Get Set Go effective at increasing children's FMS, teacher confidence and teacher understanding to implement PE but it is easy to implement, caters to all junior children and teachers in the school and has a high rate of adoption.

This research is an important first step to assessing a school-based FMS programme for informing future implementation. Ongoing monitoring and evaluation of the programme would be worthwhile to ensure continual development to meet the needs of the teachers and the children in the school environment. Additional longitudinal research is needed to gauge how long teachers remain confident and how much continual intervention and support is needed to maintain effective PE sessions in the school environment that develop FMS and encourage positive PA behaviours. Previous international research (Barnett, van Beurden et al. 2009; Ericsson 2011) indicates that gains in FMS can be sustained but to what level and for how long requires further investigation.

Using RE:AIM allowed for evaluation at the personal (intra and inter) level above the objectively assessed FMS. Although objectively assessed FMS is considered the gold standard of assessments it does not offer much room for interpretation. By combining the TGMD-2 and RE:AIM, for the first time this study was able to explore reasons behind FMS improvements. There may be many interventions implemented in schools around the world that are effective at increasing

FMS. Objective data alone cannot distinguish if the interventions are enjoyable, appropriate, easy to implement, valued by the participants or align with national, local and school policy, and this research has contributed relevant insights for the international research field.

Strengths and Limitations

This body of work was limited by a number of factors as discussed below. Original ethics approval was granted for the inclusion of a control group in this research, however due to time constraints and scope of the study this did not occur. Recruitment of schools, assessment tool training and data collection were more time consuming than anticipated. This study could be viewed as a limitation of the thesis as any significant increase in FMS over time could be attributed to normal development and maturation. Mitigating data in respect of this are the significant improvements observed for total scores among Māori and Pacific and higher decile schools. At follow up the only significant difference observed was for the overarm throw between the sexes. Boys scored significantly higher than the girls when matched with their age. There were no other observed differences between any ethnic group, the sexes or schools.

The main strength of this research is the use of direct observation to assess FMS of children alongside the RE:AIM framework to add context and to transfer learnings from research into practical delivery terms. Both the assessment tool used for the direct observation (TGMD-2) and the RE:AIM framework are validated research tools. This is the first time the RE:AIM has been used in the school setting during curriculum time and to the knowledge of the researcher this is the first time RE:AIM has been used to add depth to a quasi-experimental study that had previously identified a validated direct observation tool to assess children's FMS.

There were insufficient participant numbers to statistically analyse impacts of school based FMS intervention on range of ethnic groups. This is due to the ethnic diversity within Auckland schools. Although numbers were too low to identify impact on all of the identified ethnic groups (n=19) two of the ethnic groups were defined: NZ European numbers were large enough to be on their own group and Māori /Pacific were grouped together. These two ethnic groups provide data that can be

compared to previous research and statistics. Although Māori and Pacific ethnic groups are two distinct population groups, they share many PA factors (Rush, Plank et al. 2003)

Get Set Go is a two year programme, yet the time constraints and scope of this thesis did not allow for the evaluation of the complete programme. Intervention boundaries were set to the initial six months of a two year period. Baseline assessments were true figures of children who had not previously experienced Get Set Go or any other specific FMS intervention delivered by trained coaches. Get Set Go offers additional extras in the year two delivery period. These additional extras, which are school dependent, may significantly influence the development of FMS outside of this study. Future research is warranted across the full two year programme.

Other limitations were elements of the recruitment process. Relationships throughout the education and sport sector played a key role in recruiting the schools. Schools recruited had previously expressed an interest or were signed up to start the Get Set Go programme regardless of the research. Ideally schools would be recruited to participate in research which would involve delivery of Get Set Go intervention and assessment of children. This would create more input from the school Principals and teachers and may have impacted on participant response rates. Selecting schools to participate would allow additional quantitative research into determinants of FMS development.

Only four of the 12 skills on the TGMD-2 were used. Although TGMD-2 is a validated tool it is designed to portrait an overall picture of a child's FMS development. This study was limited by only assessing four schools however they are well reported skills and data analysis allowed for discussion and comparison with previous studies.

Implications

Get Set Go has been identified as an effective school based FMS intervention that meets the needs of teachers and children in Auckland schools. The key implication of this study is that there is justification for continued funding and implementation.

Some schools had higher FMS scores than others. Identification of reasons for this could be used to inform development of programmes that may generate greater increases in FMS. It is possible that each school may have a set of defining characteristics that could determine if they are a school that fosters FMS development and PA. This also relates to the issue of school culture that was raised by Principals in that culture and policy are key determinants of successful interventions.

The individual impact individual schools have on FMS can be successfully explored with the RE:AIM framework as it is possible to identify which level has the most impact on intervention. RE:AIM application for this current thesis was used in the intervention context (across all four schools). If this was modified and applied to individual schools along with baseline assessments of FMS, valuable data on the characteristics of schools with high performing children could be reviewed.

RE:AIM can be utilised as a monitoring and evaluation tool for any school based interventions delivered in curricular (Chapter Five) and co-curricular (Hyndman et al. 2014) time. Future research is required to determine the impact of curricular compared to co-curricular FMS interventions. Further research is also recommended to determine the effectiveness of other Get Set Go programmes around the country that follow a different implementation model.

The funding model is a large contributing factor to the successful implementation of programmes. If investment priorities are to change in the future this may cause a risk to the continuation of delivery of Get Set Go. A programme legacy plan to detail local and national objectives and strategies to achieve growth, development and sustainability is needed. This needs to include succession planning and development of key personnel in organisations.

Recommendations

Future research evaluating the complete two year Get Set Go programme will establish full impact of the intervention. Mixed method analysis provided learnings that could be transferred directly into field based practice by teachers, parents and coaches. The researcher recommends future

postgraduate studies that are looking to implement findings into practice utilise the RE:AIM framework for analyses.

It would be of interest to investigate the possibility of FMS interventions to be detrimental through over dependency of teachers on intervention deliverers or the neglect of other areas of child learning and development.

This body of work provided sufficient evidence and discussion to form rationalised theories and answers to the research question and sub questions. Further questions have been developed as a result of this research and are posed for future research:

1) Are greater results observed if all four levels of the socio-ecological model are prioritised appropriately?
2) Will prioritising the levels of the socio-ecological framework assist with the implementation, maintenance and evaluation of FMS interventions, and
3) Can this lead to cost effective, sustainable interventions?
4) Is there a cut-off point where teachers or the school institution becomes dependent on FMS interventions delivered into schools?
5) Is there potential for disempowerment logic modelling to theorise future research areas?
6) Can further research identify a maximum implementation timeframe?

Considering the results observed in this study and that, in Auckland Get Set Go is 1) Multicomponent and multi-level, 2) considers environmental factors such as education, facilities, opportunities to practice and learn and social support for children, 3) includes teacher professional development, 4) is delivered in and through the curriculum time of physical education, 5) includes an element of session delivery, 6) runs for longer than six months and 7) focuses on behaviour change, this programme is recommended for future school based implementation.

Conclusion

This work captured the story of the student's learning and thought processes allowing for this critical discussion and conclusions to be made. As a whole it allowed the student to form a theoretical model around best practice school based FMS interventions.

The research presented in this thesis provides a significant evaluation of a school based FMS intervention in NZ (Get Set Go). Within the scope of this research it has been identified that the Get Set Go programme displays key determining characteristics of an effective FMS intervention. FMS skills improved and there were positive impacts throughout various levels of influence. The Get Set Go programme was effective at increasing teacher confidence and their understanding of the importance to implement appropriate PE sessions for children aged 5-8 years.
Limitations of the programme include the dependency on key personnel to facilitate funding and implementation. Policy and commitment from government, funding and service providers will have a substantial impact on the programme creating sustainability. Multi-level interventions are required to increase FMS and that in this respect the policy environment is the one level of the socio-ecological model that requires further development. This higher level commitment will be critical in achieving optimal benefits from interventions.

In conclusion, Get Set Go is an effective school based FMS intervention for children aged five to eight years; continued implementation within Auckland schools is recommended.

REFERENCES

(2012). "Physical Education; New Physical Education Research from Queen's University Discussed." Education Business Weekly: 120.

Adolph, K. E. (2008). "Learning to Move." Current Directions in Psychological Science **17**(3): 213-218.

Ainsworth, B. E. (2000). "Compendium of physical activities : an update of activity codes and MET intensities." Med Sci Sports Exerc **32**: S498-S504.

Austin., Bell., Caperchione, Mummery. (2011) Using the RE-AIM Framework to Examine an Evidence-Based Physical Activity Intervention in Primary School Settings. Health Promotion Practitioner. 12:6 932-941.

Barnett, L., P. Morgan, et al. (2008). "Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment." Int J Behav Nutr Phys Act **5**(40).

Barnett, L., E. van Beurden, et al. (2009). "Six year follow-up of students who participated in a school-based physical activity intervention: a longitudinal cohort study." International Journal of Behavioral Nutrition and Physical Activity **6**(1): 48.

Barnett, L. L. Hardy, D. R. Lubans, D. P. Cliff, A. D. Okely, A. P. Hills and P. J. Morgan (2013). Australian children lack the basic movement skills to be active and healthy. *Health Promotion Journal of Australia* 24(2) 82-84 http://dx.doi.org/10.1071/HE12920

Bond, C. (2011). "Supporting children with motor skills difficulties: an initial evaluation of the Manchester Motor Skills Programme." Educational Psychology in Practice **27**(2): 143-153.

Booth, M. L., T. Okely, et al. (1999). "Mastery of fundamental motor skills among new south wales school students: Prevalence and sociodemographic distribution." Journal of Science and Medicine in Sport **2**(2): 93-105.

Bouchard, C., & Shephard, R.J. (1994). Physical activity, fitness and health: The model and key concepts. In C. Bouchard, R.J. Shephard, & T. Stephens (eds.), *Physical activity, fitness and health: International proceedings andconsensus statement* (pp. 11-20). Champaign, IL: Human Kinetics

Breslin, G., M. Murphy, et al. (2012). "The effect of teachers trained in a fundamental movement skills programme on children's self-perceptions and motor competence." European Physical Education Review **18**(1): 114-126.

Callea, M., M. Spittle, et al. (2008). "Primary school teacher perceived self-efficacy to teach fundamental motor skills." Research in Education **79**(-1): 67-75.

Capio, C. M., J. M. Poolton, et al. (2013). "Reducing errors benefits the field-based learning of a fundamental movement skill in children." Scandinavian Journal of Medicine & Science in Sports **23**(2): 181-188.

Carey, J.R. Bhatt, E. Nagpal, A (2005). Neuroplasticity Promoted by Task Complexity. Exercise & Sport Sciences Reviews: 33(1)

Clark, J. (2005). "From the beginning: a developmental perspective on movement and mobility." Quest **57**: 37 - 45.

Clark, J. and J. Metcalfe (2002). "The mountain of motor development." Motor development: Research and reviews. Volume 2: 163 - 190.

Clark, J. and J. Metcalfe (2002). "The mountain of motor development: A metaphor." Motor development. Research and reviews **2**: 163 - 190.

Clark, J. E. (2007). "On the Problem of Motor Skill Development." Journal of Physical Education, Recreation & Dance **78**(5): 39-44.

Clarke, W. R. and R. M. Lauer (1993). "Does childhood obesity track into adulthood?" Critical Reviews in Food Science and Nutrition **33**(4-5): 423-430.

Cliff, D. P., A. D. Okely, et al. (2012). "Proficiency Deficiency: Mastery of Fundamental Movement Skills and Skill Components in Overweight and Obese Children." Obesity **20**(5): 1024-1033.

Cliff, D. P., A. D. Okely, et al. (2009). "Relationships between fundamental movement skills and objectively measured physical activity in preschool children." Pediatric Exercise Science **21**(4): 436-449.

Cliff, D. P., A. Wilson, et al. (2007). "Feasibility of SHARK: A physical activity skill-development program for overweight and obese children." Journal of Science and Medicine in Sport **10**(4): 263-267.

Cools, W., K. D. Martelaer, et al. (2009). "Movement Skill Assessment of Typically Developing Preschool Children: A Review of Seven Movement Skill Assessment Tools." Journal of sports science & medicine **8**(2): 154-168.

Deli, E., I. Bakle, et al. (2006). "implementing intervention movement programs for kindergarten children." Journal of Early Childhood Research **4**(1): 5-18.

D'Hondt, Deforche, De Bourdeaudhuij, Lenoir (2009). Relationship between motor skill and body mass index in 5- to 10-Year-old children. *Adapted Physical Activity Quarterly,* 2009, 26, 21-37.

Drost, D. K. and J. R. Todorovich (2013). "Enhancing COGNITIVE UNDERSTANDING TO IMPROVE FUNDAMENTAL MOVEMENT SKILLS." Journal of Physical Education, Recreation & Dance **84**(4): 54-59.

Dudley, D., A. Okely, et al. (2011). "Effective physical education and school sport: A systematic review of physical education and school sport interventions targeting physical activity, movement skills and enjoyment of physical activity." Journal of Science and Medicine in Sport **14, Supplement 1**(0): e50.

Dudley, D., A. Okely, et al. (2011). "A systematic review of the effectiveness of physical education and school sport interventions targeting physical activity, movement skills and enjoyment of physical activity." European Physical Education Review **17**(3): 353-378.

Duncan, S., Schofield, G., Duncan, E. (2006) " Pedometer-determined physical activity and body composition in New Zealand children" Medicine and Science in Sports and Exercise [2006, 38(8):1402-1409]

Dwyer, G. M., L. A. Baur, et al. (2008). "The challenege of understanding and assessing physical activity in pre-school age children: Thinking beyond the framework of intensity, duration and frequency of activity." Journal of Science and Medicine in Sport **391**: 3.

Eather, N., P. J. Morgan, et al. (2013). "Improving the fitness and physical activity levels of primary school children: Results of the Fit-4-Fun group randomized controlled trial." Preventive Medicine **56**(1): 12-19.

Eccles JS. (1999). The development of children ages 6 to 14. Future Child. 9(2):30-44.

Ericsson, I. (2008). "Motor skills, attention and academic achievements. An intervention study in school years 1–3." British Educational Research Journal **34**(3): 301-313.

Ericsson, I. (2011). "Effects of increased physical activity on motor skills and marks in physical education: an intervention study in school years 1 through 9 in Sweden." Physical Education and Sport Pedagogy **16**(3): 313-329.

Fisher, A., J. J. Reilly, et al. (2005). "Fundamental movement skills and habitual physical activity in young children." Medicine & Science in Sports & Exercise **37**(4): 684-688.

Fotrousi, F., J. Bagherly, et al. (2012). "The Compensatory Impact of Mini-Basketball Skills on the Progress of Fundamental Movements in Children." Procedia - Social and Behavioral Sciences **46**(0): 5206-5210.

Foweather, L. (2010). Fundamental movement skill competence among 10-11 year old children: Year 2 PEPASS Physical Activity Project. Liverpool, Liverpool John Moores University**:** 11.

Foweather, L., N. McWhannell, et al. (2008). "Effect of a 9-wk. after-school multiskills club on fundamental movement skill proficiency in 8- to 9-yr.-old children: An exploratory trial." Percept Mot Skills **106**: 745 - 754.

Gagen, L., & Getchell, N. (2006). Using 'Constraints' to Design Developmentally Appropriate Movement Activities for Early Childhood Education. Early Childhood Education Journal 34:3, pp 227-232

Gallahue, D. (1989). Understanding motor development; infants, children, adolescents. Brisbane, John Wiley.

Gallahue, D. (1993). Developmental physical education for today's children. Dubuque, WCB Brown & Benchmark.

Gallahue, D. and J. Ozmun (2006). Boston: McGraw-Hill.

Gatman, V. (2005, December). *Physical activity and physical education within health and physical education in the New Zealand curriculum: A primary school teacher's perspective.* Auckland: University of Auckland

Gesell Institute of Child Development Annual Report (2012). Accessed online: http://www.gesellinstitute.org/wp-content/uploads/2013/11/web-file-AR-FY11-12.pdf

Gimenez, R., E. De J. Manoel, et al. (2012). "INTEGRATING FUNDAMENTAL MOVEMENT SKILLS IN LATE CHILDHOOD." Perceptual and Motor Skills **114**(2): 563-583.

Ginsburg, K. R. (2007). "The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds." Pediatrics **119**(1): 182-191.

Glasgow, R. E., H. G. McKay, et al. (2001). "The RE-AIM framework for evaluating interventions: what can it tell us about approaches to chronic illness management?" Patient Education and Counseling **44**(2): 119-127.

Goodway, J. D. and C. F. Branta (2003). "Influence of a Motor Skill Intervention on Fundamental Motor Skill Development of Disadvantaged Preschool Children." Research Quarterly for Exercise and Sport **74**(1): 36-46.

Hamlin, Mike J and Ross, Jenny J. Barriers to Physical Activity in Young New Zealanders [online]. Youth Studies Australia, Vol. 24, No. 1, Mar 2005: 31-37. Availability: < http://search.informit.com.au/documentSummary;dn=903499236276498;res=IELFSC> ISSN: 1038-2569. [cited 10 Jul 14].

Hands, B. and M. Martin (2003). "Fundamental movement skills: Children's perspectives." Australian Journal of Early Childhood **28**(4): 47-52.

Hardy, L. L., L. Barnett, et al. (2013). "Thirteen-year trends in child and adolescent fundamental movement skills: 1997-2010." Medicine and Science in Sports and Exercise **45**(10): 1965-1970.

Hardy, L. L., L. King, et al. (2010). "Fundamental movement skills among Australian preschool children." Journal of science and medicine in sport / Sports Medicine Australia **13**(5): 503-508.

Hardy, L. L., L. King, et al. (2010). "Fundamental movement skills among Australian preschool children." Journal of Science and Medicine in Sport **13**(5): 503-508.

Harris, S. R. and C. B. Heriza (1987). "Measuring Infant Movement: Clinical and Technological Assessment Techniques." Physical Therapy **67**(12): 1877-1880.

Hart, M. (2005). "Influence of a Physical Education Methods Course on Elementary Education Majors' Knowledge of Fundamental Movement Skills." Physical Educator **62**(4): 198-204.

Harten, N., T. Olds, et al. (2008). "The effects of gender, motor skills and play area on the free play activities of 8–11 year old school children." Health & Place **14**(3): 386-393.

Hume, C., A. Okely, et al. (2008). "Does weight status influence associations between children's fundamental movement skills and physical activity?" Research Quarterly for Exercise and Sport **79**(2): 158-165.

Hyndman, B., Benson, B., Telford, A. (2014). A Guide for Educators to Move Beyond Conventional School Playgrounds: The RE-AIM Evaluation of the Lunchtime Enjoyment Activity and Play (LEAP) Intervention. Australian Journal of Teacher Education. 39(1).

Iivonen, S., A. Sääkslahti, et al. (2009). "The development of fundamental motor skills of four- to five-year-old preschool children and the effects of a preschool physical education curriculum." Early Child Development and Care **181**(3): 335-343.

Jollcott, S., Ammerman, A., Sommers, J., Glasgow, R.E. (2007). Applying the RE-AIM framework to assess the public health impact of policy change. Annals of Behavioral Medicine. 34:105-114. doi:10.1007/BF02872666.

Kalaja, S., T. Jaakkola, et al. (2010). "The role of gender, enjoyment, perceived physical activity competence, and fundamental movement skills as correlates of the physical activity engagement of Finnish physical education students." Scandinavian Sport Studies Forum **1**: 69-87.

Kirk, M. A. and R. E. Rhodes (2011). "Motor Skill Interventions to Improve Fundamental Movement Skills of Preschoolers With Developmental Delay." Adapted Physical Activity Quarterly **28**(3): 210-232.

Kovacs, C. R. (2008). "Measuring Motor Skill Learning—A Practical Application." Strategies **22**(2): 25-29.

Lai, S., S. Costigan, et al. (2013). "Do School-Based Interventions Focusing on Physical Activity, Fitness, or Fundamental Movement Skill Competency Produce a Sustained Impact in These Outcomes in Children and Adolescents? A Systematic Review of Follow-Up Studies." Sports Medicine: 1-13.

Leppo, M. L., D. Davis, et al. (2000). "The basics of exercising the mind and body." Childhood Education **76**(3): 142-147.

Liberati, A., D. G. Altman, et al. (2009). "The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration." Annals of Internal Medicine **151**(4): W-65.

Logan, S. W., L. E. Robinson, et al. (2012). "Getting the fundamentals of movement: a meta-analysis of the effectiveness of motor skill interventions in children." Child: Care, Health and Development **38**(3): 305-315.

Lopes, L., R. Santos, et al. (2013). "Associations between gross motor coordination and academic achievement in elementary school children." Human Movement Science **32**(1): 9-20.

Lopes, V., L. Rodrigues, et al. (2011). "Motor coordination as predictor of physical activity in childhood." Scand J Med Sci Sports **21**(5): 663 - 669.

Lubans, D., P. Morgan, et al. (2011). "Randomized controlled trial of the Physical Activity Leaders (PALs) program for low-active adolescent boys from disadvantaged secondary schools." Prev Med **52**: 239 - 246.

Lubans, D., P. Morgan, et al. (2010). "Fundamental movement skills in children and adolescents: review of associated health benefits." Sports Medicine **40**(12): 1019 - 1035.

Luepker, R. V., C. L. Perry, et al. (1996). "Outcomes of a field trial to improve children's dietary patterns and physical activity: The child and adolescent trial for cardiovascular health (catch)." JAMA 275(10): 768-776.

Maddison, R., et al. (2014). "Effects of active video games on body composition: a randomized controlled trial"

Malina, R. (1996). "Tracking of physical activity and physical fitness across the lifespan." Res Q Exerc Sport **67**: 48 - 57.

Malina, R. M. (2001). "Physical activity and fitness: Pathways from childhood to adulthood." American Journal of Human Biology **13**(2): 162-172.

Malina, R. M. (2004). "Motor development during infancy and early childhood: Overview and suggested directions for research." International Journal of Sport and Health Science **2**: 50-66.

Martin, M. and B. Hands (2003). "Fundamental movement skills: Teachers' perspectives." Australian Journal of Early Childhood **28**(4): 40-46.

McKenzie, T., J. Alcaraz, et al. (1997). "Effects of physical education program on children's manipulative skills." J Teach Phys Educ **17**: 327 - 341.

McKenzie, T., J. Sallis, et al. (2002). "Childhood movement skills: Predictors of physical activity in Anglo American and Mexican American adolescents?" Res Q Exerc Sport **73**: 238 - 244.

Mehtala, M. A., A. Saakslahti, et al. (2014). "A socio-ecological approach to physical activity interventions in childcare: a systematic review." International Journal of Behavioral Nutrition and Physical Activity **11**(1): 22.

Milo Team. (2012). The New Zealand State of Play Report.

Ministry of Education (2007). *Health and Physical Education in the New Zealand Curriculum.* Wellington, New Zealand

Ministry of Health (2000). *The New Zealand Health Strategy.* Wellington, New Zealand

Ministry of Health (2008). *The B4 School Check: A Handbook for Practitioners.* Wellington, New Zealand

Ministry of Health (2013). The New Zealand Health Survey. Annual update. Wellington, New Zealand. Accessed online: http://www.health.govt.nz/publication/new-zealand-health-survey-annual-update-key-findings-2012-13

Mitchell, B., S. McLennan, et al. (2013). "Improvement of fundamental movement skills through support and mentorship of class room teachers." Obesity Research & Clinical Practice **7**(3): e230-e234.

Morgan, P. and V. Hansen (2008). "Physical education in primary schools: Classroom teachers' perceptions of benefits and outcomes." Health Educ J **67**: 196 - 207.

Morgan, Philip J.; Bourke, Sid. (2005). An investigation of pre-service and primary school teachers' perspectives of PE teaching confidence and PE teacher education. Australian Council for Health, Physical Education and Recreation Inc. Accessed online: http://www.achper.org.au/publications/asia-pacific-journal-of-health-sport-and-physical-education

Nelson, J. K., J. R. Thomas, et al. (1986). "Gender Differences in Children's Throwing Performance: Biology and Environment." Research Quarterly for Exercise and Sport **57**(4): 280-287.

Newell, K.M. (1985). Differing Perspectives in Motor Learning, Memory, and Control. Advances in Psychology, Volume 27, 1985, Pages 295–317.

Okely, A. and M. Booth (2000). "Relationship of enjoyment of physical activity and preferred activities to fundamental movement skill proficiency in young children." Int J Behav Med **7**: 151.

Okely, A., M. Booth, et al. (2001). "Relationship of physical activity to fundamental movement skills among adolescents." Med Sci Sports Exerc **33**: 1899 - 1904.

Okely, A. D. and M. L. Booth (2004). "Mastery of fundamental movement skills among children in New South Wales: prevalence and sociodemographic distribution." Journal of Science and Medicine in Sport **7**(3): 358-372.

Okely, A.D., Booth, M.L., & Chey, T. (2004). Relationships between body composition and fundamental movement skills among children and adolescents. *Research Quarterly for Exercise and Sport, 75*(3), 238-247.

Pate, R. R., M. Pratt, et al. (1995). "Physical activity and public health: A recommendation from the centers for disease control and prevention and the american college of sports medicine." JAMA **273**(5): 402-407.

Pellegrini, A. D. and P. K. Smith (1998). "Physical Activity Play: The Nature and Function of a Neglected Aspect of Play." Child Development **69**(3): 577-598.

Petrie, K. (2010). "Creating confident, motivated teachers of physical education in primary schools." European Physical Education Review **16**(1): 47-64.

Petrunoff N, Lloyd B, Watson N, Morrisey D. (2009). Suitability of a structured Fundamental Movement Skills program for long day care centres: a process evaluation. Health Promotion Journal of Australia. Apr;20(1):65-8

Piek, J. P., S. McLaren, et al. (2013). "Does the Animal Fun program improve motor performance in children aged 4–6 years?" Human Movement Science **32**(5): 1086-1096.

Reilly, J. J., L. Kelly, et al. (2006). "Physical activity to prevent obesity in young children: Cluster randomised controlled trial." British Medical Journal **333**(7577): 1041.

Robert, D. L. and B. Yongue (2004). "Developing quality preschool movement programs: CHAOS and KinderPlay." Teaching Elementary Physical Education **March 2004**: 9-12.

Robinson, L., E. K. Webster, et al. (2012). "Teaching Practices that Promote Motor Skills in Early Childhood Settings." Early Childhood Education Journal **40**(2): 79-86.

Saakslahti, A., P. Numminen, et al. (1999). "Is physical activity related to body size, fundamental motor skills, and CHD risk factors in early childhood? / L'activite physique est-elle en rapport avec la taille corporelle, les capacites motrices fondamentales et les facteurs de risques de maladies cardiovasculaires chez les jeunes enfants ?" Pediatric Exercise Science **11**(4): 327-340.

Sääkslahti, A., P. Numminen, et al. (1999). "Is physical activity related to body size, fundamental motor skills, and CHD risk factors in early childhood?" Pediatric Exercise Science **11**(4): 327-340.

Sallis, J., J. Prochaska, et al. (2000). "A review of correlates of physical activity of children and adolescents." Med Sci Sports Exerc **32**: 963 - 975.

Sallis, J. F., J. E. Alcaraz, et al. "Predictors of change in children's physical activity over 20 months." American Journal of Preventive Medicine **16**(3): 222-229.

Sallis, J. F., & McKenzie, T. L. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport,62,* 124–137.

Salmon, J., K. Ball, et al. (2008). "Outcomes of a group-randomized trial to prevent excess weight gain, reduce screen behaviours and promote physical activity in 10-year-old children: Switch-Play." Int J Obes **32**: 601 - 612.

Salmon, J., K. Ball, et al. (2008). "Outcomes of a group-randomized trial to prevent excess weight gain, reduce screen behaviours and promote physical activity in 10-year-old children: Switch-Play." Int J Obes **32**(4): 601-612.

Salvy, S., Roemmich, J., et al. (2008). The effect of peers and friends on Youth Physical Activity and Motivation to be Physically Active. Journal of Pediatric Psychology 34(2).

Sanders, L. and L. Kidman (1998). "Can primary school children perform fundamental motor skills?" Journal of Physical Education New Zealand **31**(4): 11-13.

Serdula, M. K., D. Ivery, et al. (1993). "Do Obese Children Become Obese Adults? A Review of the Literature." Preventive Medicine **22**(2): 167-177.

Shumway-Cook, A., & Woollacott, M.H. (2001). *Motor control: Theory and practical applications - 2nd edition.* Pennsylvania, United States of America: Lippincott Williams & Wilkins.

Singh, A., L. Uijtdewilligen, et al. (2012). "Physical activity and performance at school: A systematic review of the literature including a methodological quality assessment." Archives of Pediatrics & Adolescent Medicine **166**(1): 49-55.

Singh, A. S., C. Mulder, et al. (2008). "Tracking of childhood overweight into adulthood: a systematic review of the literature." Obesity Reviews **9**(5): 474-488.

Smyth, P. J. and S. n. L. Q'Keeffe (1998). "Fundamental motor skills: The effects of teaching intervention programmes." The Irish Journal of Psychology **19**(4): 532-539.

Sport and Recreation New Zealand. *Developing Fundamental Movement Skills Manual.* Wellington, New Zealand: Author; 2010

Sport and Recreation New Zealand (2012). "Fundamental Movement Skills in New Zealand Children". Wellington, New Zealand.

Statistics New Zealand (2006). Accessed online: http://www.stats.govt.nz/browse_for_stats/people_and_communities/Households.aspx

Stodden, D., J. Goodway, et al. (2008). "A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship." Quest **60**: 290 - 306.

Strong, W., R. Malina, et al. (2005). "Evidence based physical activity for school-age youth." J Pediatr **146**(6): 732 - 737.

Sturgess, J. (2003). "A model describing play as a child-chosen activity — is this still valid in contemporary Australia?" Australian Occupational Therapy Journal **50**(2): 104-108.

Sturgess, J. (2003). "A model describing play as a child-chosen activity: is this still valid in contemporary Australia?" Australian Occupational Therapy Journal **50**: 104-108.

Thomas, J. R. and K. E. French (1987). "REFERENCES FOR MOTOR TASKSâ€"GENDER DIFFERENCES ACROSS AGE IN MOTOR PERFORMANCE: A META-ANALYSIS." Perceptual and Motor Skills **64**(2): 503-506.

Tooth, L., R. Ware, et al. (2005). "Quality of Reporting of Observational Longitudinal Research." American Journal of Epidemiology **161**(3): 280-288.

Trudeau, F., R. Espindola, et al. (2000). "Follow-up of participants in the Trois-Rivières Growth and Development Study: Examining their health-related fitness and risk factors as adults." American Journal of Human Biology **12**(2): 207-213.

Tsao, L.-L. (2002). "How much do we know about the importance of play in child development?" Childhood Education: 230-234.

Ulrich, D. (2000). Austin, Texas: Pro.Ed.

Valentini, N. C. (2012). "Validity and Reliability of the TGMD-2 for Brazilian Children." Journal of Motor Behavior **44**(4): 275-280.

Vameghi, R., Shams, A., et al (2013). The effect of age, sex and obesity on fundamental motor skills among 4-6 year old children. Pakistan Journal of Medical Sciences 29(2).

van Beurden, E., L. M. Barnett, et al. (2003). "Can we skill and activate children through primary school physical education lessons? "move it groove it"—a collaborative health promotion intervention " Preventive Medicine **36**(4): 493-501.

Vandorpe, B., J. Vandendriessche, et al. (2012). "Relationship between sports participation and the level of motor coordination in childhood: A longitudinal approach." Journal of science and medicine in sport / Sports Medicine Australia **15**(3): 220-225.

Veitch, et al (2009). Children's Right to Play: An examination of the importance of play in the lives of children worldwide. Accessed online: http://ipaworld.org/main/wp-content/uploads/2010/02/IPAconceptPaper.pdf

Westendorp, M., E. Hartman, et al. (2011). "The relationship between gross motor skills and academic achievement in children with learning disabilities." Research in Developmental Disabilities **32**(6): 2773-2779.

Who Multicentre Growth Reference Study, G. and M. de Onis (2006). "WHO Motor Development Study: Windows of achievement for six gross motor development milestones." Acta Pædiatrica **95**: 86-95.

Wiepert, S. L. and V. S. Mercer (2002). "Effects of an increased number of practice trials on Peabody Developmental Gross Motor Scale scores in children of preschool age with typical development." Pediatric Physical Therapy **14**: 22-28.

Williams, G.H., Pfeiffer, K.A., O'Neill, J.R., Dowda, M., McIver, K.L., Brown, W.H., & Pate, R. (2008). Motor skill performance and physical activity in preschool children. *Obesity, 16,* 1421-1426. doi: 10.1038/oby.2008.214

Woollacott, M. and A. Shumway-Cook (2002). "Attention and the control of posture and gait: a review of an emerging area of research." Gait & Posture **16**(1): 1-14.

World Health Organisation (2012). Prioritizing areas for action in the field of population-based prevention of childhood obesity, Geneva, Switzerland. Accessed online 30th March 2024.

Wrotniak, B.H., Epstein, L.H., Dorn, J.M., Jones, K.E., & Kondilis, V.A. (2006). The relationship between motor proficiency and physical activity in children. *Pediatrics, 118,* e1758-e1765. doi: 10.1542/peds.2006-0742.

AUT UNIVERSITY
TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

AUTEC SECRETARIAT

1 March 2013

Melody Oliver
Faculty of Health and Environmental Sciences

Dear Melody

Re Ethics Application: **12/249 Controlled trial of a school based intervention on actual and perceived motor skill proficiency.**

Thank you for providing evidence as requested, which satisfies the points raised by the AUT University Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 1 March 2016.

As part of the ethics approval process, you are required to submit the following to AUTEC:

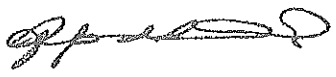
- A brief annual progress report using form EA2, which is available online throughhttp://www.aut.ac.nz/researchethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 1 March 2016;
- A brief report on the status of the project using form EA3, which is available online throughhttp://www.aut.ac.nz/researchethics. This report is to be submitted either when the approval expires on 1 March 2016 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this. If your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply there.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at ethics@aut.ac.nz.

All the very best with your research,



Dr Rosemary Godbold
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Victoria Barton victoria.barton@hotmail.co.nz

Get Set Go
Fundamental Movement Skills for Kiwi kids

Active Post
New Zealand Post

Appendix B

Get Set Go: Auckland Schools Programme Evaluation

Name of School:	Get Set Go Coach:	Class / Year Level:
Teacher:	Email:	

(Please include email contact if you would like to be a part of the Get Set Go Teachers data base to receive additional information, activity ideas and on-going training and event opportunities)

Please circle the appropriate rating for each question. We also welcome and appreciate your comments

One Day Teacher PD prior to in school support

How useful was this training day, did this prepare you well for the follow on sessions?

Poor	*Average*	*Good*	*Excellent*

Quality of Programme Content and Resources

Games, activities and skill development ideas utilised, Quality of resources used.

Poor	*Average*	*Good*	*Excellent*

Quality of Coach

Classroom management, Children engaged and active, Supportive & inclusive environment, Children enjoying participating, Questioning, reflection and feedback used

Poor	*Average*	*Good*	*Excellent*

Programme Outcome

How effective was this programme in helping your children have become more competent and confident in using fundamental movement skills?

Poor	*Average*	*Good*	*Excellent*

Professional Development Level

How effective was Get Set Go in helping you to be more confident in your ability to deliver quality outcomes around Fundamental Movement Skills for your students?

Poor	*Average*	*Good*	*Excellent*

CONTINUE...

What has been the most beneficial part of the Get Set Go programme?

What are 3 key messages you would share with somebody about this programme?

Are there any areas that could be improved?

What is the most challenging part of the programme?

General Comments:

Thank you so much for your feedback!

The feedback that you provide will greatly help with our planning process to ensure that we provide you with a valuable service. We appreciate all of your hard work and commitment. Thank you to all those who have supported this programme.

Could you please forward these completed forms on to Stephanie Cunningham at stephaniec@sportauckland.co.nz or Victoria Barton at victoriab@sportauckland.co.nz

Appendix B

Teacher Survey

Thank you for agreeing to fill out this survey.

The following questions have no 'right' or 'wrong' answers they are only intended to provide general demographic and physical activity information. Your name and personal details will not be used when analysing data; I have only included it so that I can keep track of who is participating in the study. The information you provide will help us to build an understanding of how best to support the children in your school.

** Optional Questions

**Name:	Male/Female:
School:	Ethnicity:
Year group teaching:	
Number of children in the class:	
Have you heard of fundamental movement skills before the programme?	**YES / NO**
**Do you personally participate in regular physical activity (three or more times a week for 30minutes of huff and puff activity)?	**YES / NO**
On average how many hours a week does your class spend being active?	
How often does your class participate in PE?	
How often does your class participate in organised sport?	
Does your class generally enjoy being physically active?	
Do you have any children that openly do not enjoy physical activity?	**YES / NO**
Do you have any children that struggle with certain physical activities?	**YES / NO**
Do you feel confident identifying children that are struggling and planning appropriate activities?	**YES / NO**
Is physical activity a priority for you personally?	

If you were to rate your children on their motor proficiency which statement would you choose: *(you may tick more than 1 if appropriate)*	
All of the children in my class are at an acceptable standard for their age	
The children are very competent for their age	
Many children are struggling with simple activities	
All children would benefit from specialised instruction	
Some of the children need extra time and instruction	
There are lots of children who need help with their basic motor skills	
There are a few children that seem to struggle with certain activities	
All of the children love being active	
A handful of children do not enjoy being active	
When we do classroom physical activities the children get very excited and hard to control	
Approximately how many children have motor skills that are acceptable for their age?	
Approximately how many children require further development of their motor skills?	

Thank you for taking the time to complete this survey!

If you have any queries please contact Victoria Barton, victoriab@sportauckland.co.nz, (09) 623 7925 or 021 850912

Appendix C

Get Set Go
Fundamental Movement Skills for Kiwi kids

ActivePost
New Zealand Post

SPORT AUCKLAND

Professional Development Overview

1. Principles and Practices

What is Get Set Go

What is the underlying philosophy and rationale

What are key understandings

Where does it fit in with Child development

2. Skill Themes

Fundamental Movement Skill Themes

What are they How do they develop and interrelate

3. Methodology

Methodology, Learning Teaching and Assessing Cycle

How do you develop a child's FMS?

Lots of Practical Activities to use

4. Curriculum Links

Key competencies

Classroom topics and themes

5. Planning

Resources, how to use this PD

Get Set Go
8 Week Session Plan

Session	Session Content	End Task
Session 1	**Introduction** (3 minutes) - Introduce yourself, explain purpose of session. - What skills do they want to focus on (choose 2) might have choosen prior. - What subject they are learning about in class **Skill 1** BALANCE 1 – COACH (40 min)	- Children to practice at home - Encourage teacher to repeat games during the week
Session 2	**Skill 1** BALANCE 2 - COACH (40min)	- Make sure 2 skills have been finalized for the next session
Session 3	**Skill 2 (teachers choice)** session by COACH (40min)	- 'Homework' for the teacher create a game. Does not need to be complicated game
Session 4	**Skill 2** session by TEACHER and COACH Teacher delivers the game they created (10min) Coach observes/helps where needed. Provide some positive feedback. Then the coach delivers the rest of the session (30min)	
Session 5	**Skill 2** session by COACH (40min) Teacher starts to observe/assess the children (global check, identify children that are struggling)	- Move onto third skill - Continue to observe children in different forums
Session 6	**Skill 3 (teachers choice)** Session by COACH (40min)	'Homework' for the teacher – create game again
Session 7	**Skill 3** Session by TEACHER (10min) and Coach (30min) Coach to observe/ help where needed.	- Getting the children to continue writing and drawing about the skills they have learned
Session 8	**Skill 3 (out and in class session)** taken by COACH (40min) One or two games by coach (20min)	- Review and where to from here

	In class self-assessment done by children (writing activity)	

RUNNING

Equipment / Conditions: A minimum of 50 feet of clear space and a marking device (tape)
Directions: Mark off two lines 50 feet apart. Instruct child to 'run fast' from one cone to the other.

Performance Criteria	Test 1			Test 2			Test 3		
	T1	T2	T	T1	T2	T	T1	T2	T
1. Brief period where both feet are off the ground									
2. Arms in opposition to legs, elbows bent									
3. Foot placement near or on the line (not flat footed)									
4. Non-support leg bent approx. 90 degrees (close to buttocks)									

SKIPPING

Equipment / Conditions: A minimum of 30 feet of clear space and a marking device (tape)
Directions: Mark off two lines 30 feet apart. Instruct student to 'skip' from one cone to the other.

Performance Criteria	Test 1			Test 2			Test 3		
	T1	T2	T	T1	T2	T	T1	T2	T
1. A rhythmical repetition of the skip-hop on alternate feet									
2. Foot of non-support leg carried near surface during the hop-phase									
3. Arms alternately moving in opposition to legs at about waist level									

CATCHING

Equipment / Conditions: A 6-8 inch sponge ball, 15 feet of clear space, and a marking device
Directions: Mark off two lines 15 feet apart. Researcher tosses ball under arm to the student with a slight arc. Only counting tosses which are between child's shoulders and waist.

Performance Criteria	Test 1			Test 2			Test 3		
	T1	T2	T	T1	T2	T	T1	T2	T
1. Preparation phase - elbows are flexed and hands are in front of body									
2. Arms extend in preparation for ball contact									
3. Ball is caught and controlled by hands only									
4. Elbows bend to absorb force									

OVER-ARM THROW

Equipment / Conditions: A tennis ball (or beanbag) and 25 feet of clear space
Directions: Tell the students to throw the ball as far as they can

Performance Criteria	Test 1			Test 2			Test 3		
	T1	T2	T	T1	T2	T	T1	T2	T
1. A downward arc of the throwing arm initiates the windup									
2. Rotation of hip and shoulder (non-dominant side faces 'target')									
3. Weight transferred by stepping with the foot opposite throwing hand									
4. follow-through beyond ball release diagonally across body									

Principal Checklist **Appendix F**

n junior classes participating n children participating n teachers participating	School roll and feedback from principal.	
n of participating classes compared to possible n.	School roll and principal feedback at baseline	
# of teachers continuing to implement Get Set Go School H&PE plan in place with focus on FMS development	Teacher and principal feedback at follow up Development of H&PE plan	

Delivery Costs to Schools

Student Delivery Yrs 1-3

Targeting:	Primary School students years 1-3	
Sessions:	10	
Hours:	1 hour	planning delivery content with teacher (delivered by GSGRC)
	8 hours	delivery to students (delivered by GSG Coach or GSGRC)
	1 hour	review delivery content with teacher (delivered by GSGRC)
Ratio:	24:1	with teacher involvement in delivery sessions
	12:1	without teacher involvement in delivery sessions
Students receive:	Fundamentals Passport Certificate	
Teacher receives:	GSG module unit plan and session plans	
Delivered by:	GSG Regional Coordinators or GSG Coach	
Delivery Rate:	$35 per session (up to one hour)*	
Cost:	$742 + GST	
	Breakdown of Costs	
	Coach Costs	$350 ($35 per session)
	Travel	$150 ($15 per session)
	Certificates	$50
	GSG Resources	$192

GSG Teacher 1 day Professional Development

Targeting:	Primary School years 1-3 Teachers
Hours:	6 hours
Topics Covered:	• GSG principles and practices • GSG Categories and skill themes, • Planning, teaching and assessing GSG development, • Practical ideas and strategies
Ratio:	Max 15:1 Min 7:1
Teachers receive:	• Fundamentals Passport Certificate, • Electronic copies of GSG assessment sheets • Ready to use practical resource pack
Capability:	able to assist a GSG Coach/ Regional Coordinator to programme and deliver GSG programme
Delivery Contract:	negotiated with ANZ
Delivered by:	GSG Regional Coordinators
Delivery Rate:	$50 per hour
Cost per attendee:	$175 + GST

Confirmation of costs for the Athletics New Zealand Get Set Go programme.

Training Costs

GSG Regional Coordinator Training

Targeting: Competent people able to facilitate programme development regionally

Hours: 24 hours

Two 2 day workshops (6 hours per day)

Topics covered:

- GSG principles and practices: Key Understandings
  - Whole Child Approach
  - Developmental Principles
  - Learning to Move & Learning through Movement
- GSG Categories and skill themes:
  - Stability, Locomotor and Manipulative Skills
  - Linking skills delivery to TGFU and Coach Approach
- Planning, teaching and assessing GSG: Learning, Teaching and Assessment cycle
  - GSG within Whole School planning
- Practical ideas and strategies Role of GSG in NZ Curriculum
  - Links to Key Competencies
  - Cross curricular ideas
  - Planning for success
  - Activities, Lesson Plans and Implementation
- Facilitator Development:
  - Presentation Skills
  - Adult Learning principles
  - Strategies and Organisational elements

Regional Coordinators receive: GSG Regional Coordinators resources

Capability: Selected delivery capability identified by ANZ

Delivery contract: Yes

Delivered by: GSG manager

Cost per person: $2500 + GST

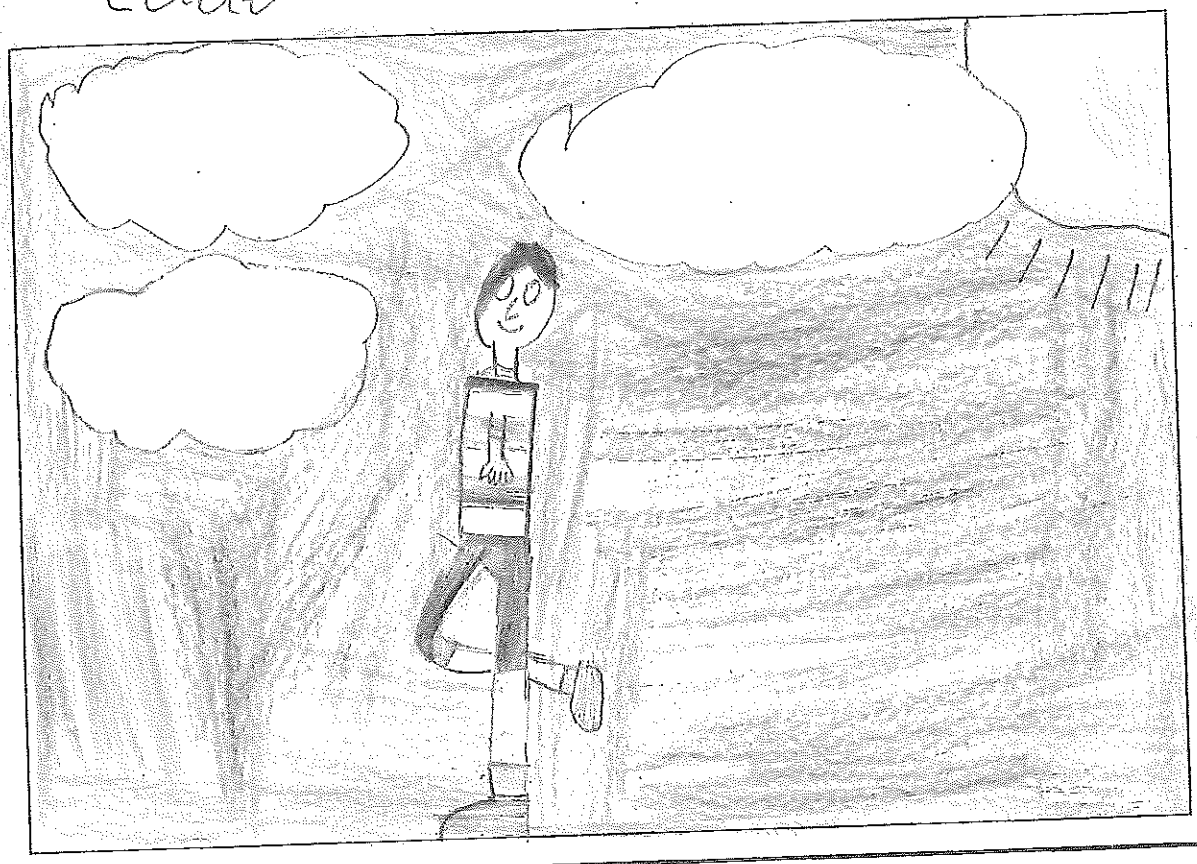
GSG Coach Training

Targeting:	Competent people able to deliver GSG programme to children aged 3-12
Hours:	12 hours – one 2 day period
Topics covered:	

- GSG coaching principles:
  - Key Understandings
  - Whole Child Approach
  - TGFU / Coach Approach
- GSG Categories and skill themes:
  - Stability, Locomotor and Manipulative
- Planning, teaching and assessing:
  - Learning, Teaching and Assessment cycle
- Practical ideas and strategies:
  - Role of GSG in NZ Curriculum Activities
  - Lesson Plans and Implementation ideas

Coaches receive:	Fundamentals Passport Certificate, electronic copies of GSG assessment sheets, Ready to use practical resource pack
Role capability:	Selected delivery capability identified by ANZ
Delivery contract:	Yes
Delivered by:	GSG Manager, selected GSG Regional Coordinators
Cost per person:	$1500 + GST

cade



Dear Stephanie

Thank you for being such a great

teacher on our class trip. I like

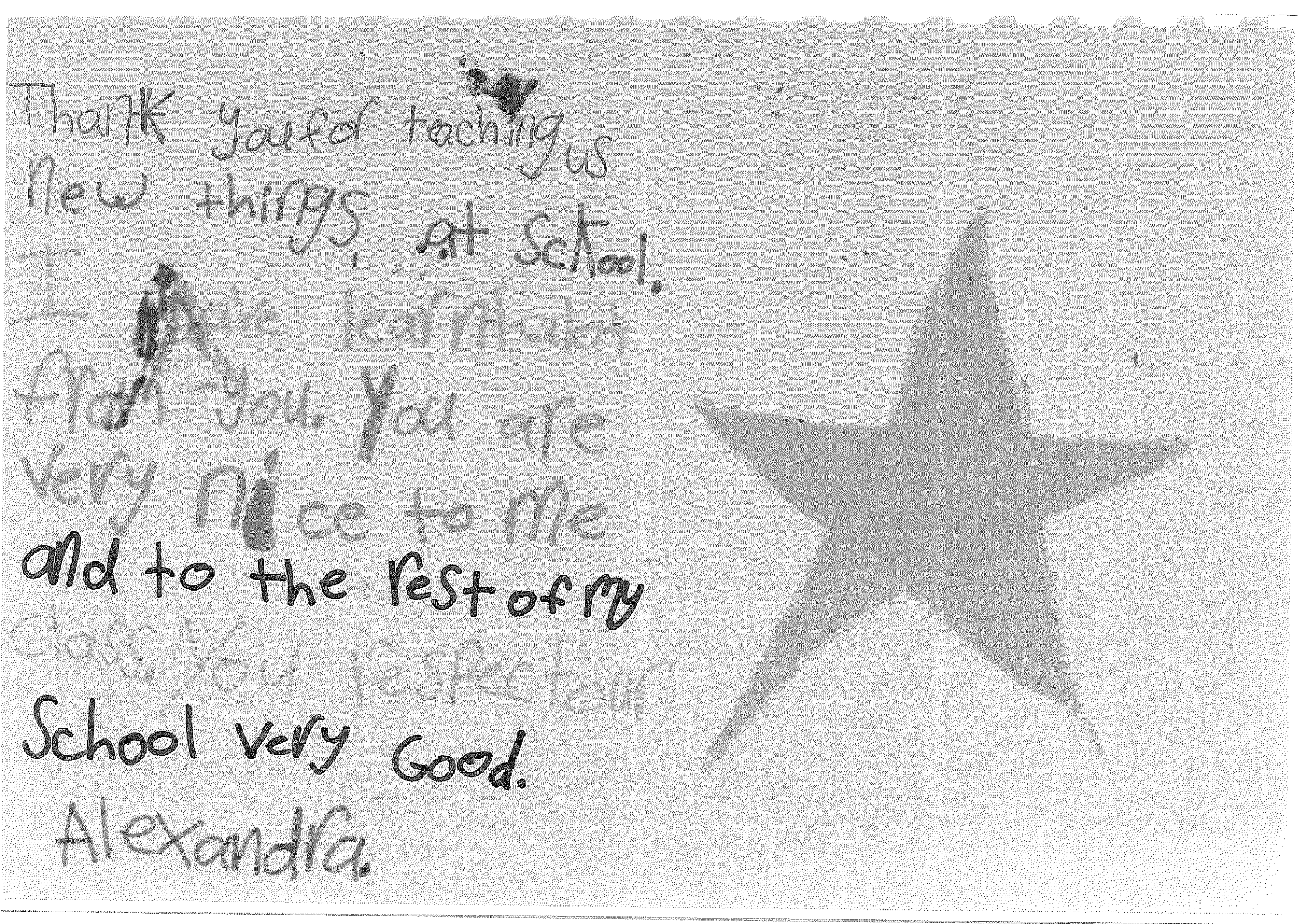
the way you did with us today

to. And thank you for teaching

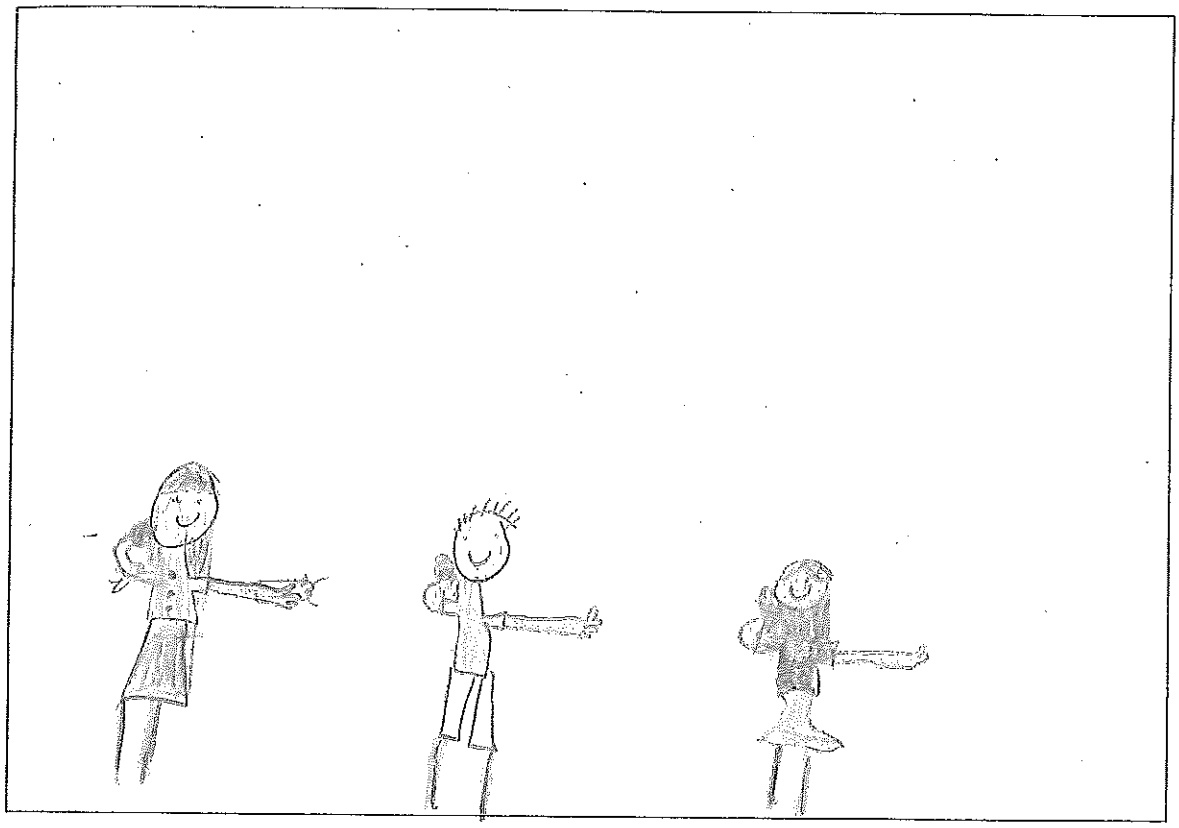
us things. Merry Christmas

and happy new year

Thank you for teaching us
new things at school.
I love learning at
school. You are
very nice to me
and to the rest of my
school very good.
Alexandra.



Hannah



Dear Stephanie.

Thank you for doing G.S.G with us. You are the best G.S.G teacher ever. My favourite out of over arm throwing. Sprint running and balancing is over arm throwing. Have a great Christmas.

from Hannah

Dear Stephanie

By Ashlin

I greatly appreciate that you choos
Our class room instead of room
Seven, nine and Ten.
Thank-you for giving
us this opertunecity of letingus
Play and Strike, roll and run
because those three things
are the bestest things in
Sports and that's mostly
wh[illegible]
for p.e. [illegible]
We really love about you is
that you come to school
and taught us how to do p.e
and [illegible]

Dear Stephanie

I admire your experience

with sports, you have so

much "can do" and understand

everything we explain. I

extremely like scarf tag

From Miro and room A

MIRO

Appendix I

One-on-One Interviews

Name: _____ School: _____

What has been the most beneficial part of the Get Set Go programme?

What are 3 key messages you would share with somebody about this programme?

Are there any areas that could be improved?

What is the most challenging part of the programme?

Get Set Go
Fundamental Movement Skills for Kiwi kids

Athletics New Zealand
Coach Development
Get Set Go Coach - Practical Assessment

Active Post
New Zealand Post

Coach Name		Location	
Date		No. of children	
Assessors Name		Session Focus	

Competence	Assess 1	Assess 2	Final Assess	Comments
Coaching approach – Did the coach:				
1 make the session enjoyable				
2 optimise involvement				
3 demonstrate an child-centred approach				
4 cater for all abilities				
5 show high standards of dress and behaviour?				
6 inclusively involve the Teacher				
Safety – Did the coach:				
1 check the environment				
2 check any specific needs of children				
3 check equipment				
4 re-check these during the session (- of those shown)				
5 ensure children maintain involvement?				
Organisation – Did the coach:				
1 manage children effectively				
2 manage equipment effectively				
3 manage space effectively				
4 group children according to number / ability / activity				
Developing skill – Did the coach:				
1 use coaching points - identified in Programme				
2 identify the children's developmental stage				
3 use skills appropriate to stage of learning				
4 discuss next steps				
5 adapt their coaching to skill level of children?				
The basic skills of coaching – Did the coach:				
1 build and develop relationships				
2 provide instruction and explanation				
3 use effective questioning techniques				
4 provide demonstration effectively & accurately				
5 show evidence of observation & analysis				
6 provide appropriate and effective feedback?				

Additional comments: _____

Assessor (PRINT NAME): _____ Signature: _____